

**A HYDROPOLITICAL HISTORY OF
SOUTH AFRICA'S
INTERNATIONAL RIVER BASINS**

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O Seremo**

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A HYDROPOLITICAL HISTORY OF SOUTH AFRICA'S INTERNATIONAL RIVER BASINS

Report to the
Water Research Commission

by

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EXECUTIVE SUMMARY

The hydropolitical histories of South Africa's four international river basins – the Orange, Limpopo, Incomati, and Maputo – are complex and fascinating. They show similarities as well as disparities in their development trajectories. Where the hydropolitical histories are similar, is where the rivers' development follows the general socio-economic and political progression of South African society.

These international rivers have been developed over time to such a degree that they are now interconnected through a multifaceted system of inter-basin transfers (IBTs). To varying degrees these rivers are now considered to be closed (Orange and Limpopo) or closing (Incomati and Maputo). Not only are the four rivers linked to each other, they are also linked to other national river basins, like the Fish and Sundays Rivers in the Eastern Cape. In fact, the first of these IBTs was the Orange River Project (ORP), one of the largest on the African continent, connecting the Orange with the Fish and Sundays. In January 2003, Phase 1b of the latest inter-basin transfer was completed. This is of the massive Lesotho Highlands Water Project (LHWP), which reverses the flow of Orange/Senqu into the Vaal River for use in Rand Water's (RW) supply area and for generating electricity for Lesotho. It is through RW's distribution system that the Orange and Limpopo Rivers are connected.

Thus, the rivers' development has come a long way since the first humans found their way to the southern tip of Africa, about 2 000 years ago. These were the hunters (San) and hunter/gatherers (Khoi-Khoi). The Bantu-speaking peoples who migrated later followed them from central Africa into the south-eastern parts of Southern Africa. This heralded a new era in the history of South Africa, one that differed fundamentally from the pre-historic. During this era, hominoids like *Homo erectus* were the dominant species. It was most probably *Homo erectus* that was responsible for the shaping of the present relatively tree-less Highveld savannah. However, these hominoids are no longer part of the landscape; only their fossil remains can be found at places such as Sterkfontein Caves, suggesting that they are part of the human evolutionary tree.

The San, Khoi-Khoi, and Bantu-speaking people's relatives are still today part of the rich diversity of South African society. Later colonisers of South Africa were the Europeans. They formally settled at the Cape of Good Hope on 6 April 1652, when Jan van Riebeeck established a trading post for the Dutch East India Company's (VOC) ships voyaging to India and beyond. The Europeans imported Roman-Dutch law practices regarding the management of the water resources of the streams flowing from Table Mountain. These practices evolved and were codified into the water laws of modern South Africa. This is not to suggest that the "indigenous" peoples of South Africa had no codification of water resource management practices. It is just that these traditional laws were not codified in writing, but were verbally passed from generation to generation.

The arrival of Europeans heralded the first phase (1652 to 1700) of the colonial frontier. Three other phases would follow. The frontier is defined by Thompson and Lamar (1981a:7-8) not as "a boundary or line, but as a territory or zone of interpretation between two previously distinct societies. Usually, one of the societies is indigenous to the region, or at least has occupied it for many generations; the other is intrusive. The frontier "opens" in a given zone when the first representatives of the intrusive society arrive; it "closes" when a

single political authority has established hegemony over the zone." During the first phase, there was the amalgamation of a stronghold and bridgehead on Table Bay by Europeans. They gained control of arable land 30 or 40 kilometres inland from there. The second phase was during the eighteenth and early nineteenth centuries. During this period many *trekboers* occupied land in the semi-arid and arid hinterland eastward towards the Fish River and northward toward the Orange. The third phase began in 1835, with the advent of the Great Trek, and lasted until about 1869. The final phase of the frontier lasted from 1870 to 1900. During this time, whites controlled the land south of the Limpopo and into Namibia, Zimbabwe, and Mozambique.

It was during the final phase of the frontier that the hydraulic mission took off. In its initial phases it was small and was sparked by events like the discovery of minerals – diamonds in 1867 and gold in 1886. This led to the establishment of towns and markets. Agriculturalists started to farm more intensively, as their land area shrank, which necessitated practising irrigation to ensure that the market was supplied and a surplus produced. The government was constantly petitioned by farmers to implement irrigation projects. Thus, strong vested interests were already starting to rear their heads in the South African water sector. The final phase of the frontier ended in 1902, when the Treaty of Vereeniging was signed. This meant that the British had established their dominance over the two Boer Republics of the Orange Free State (OFS) and South African Republic (ZAR).

South African society therefore entered the twentieth century at war. Throughout this century, a number of political and natural events had a dramatic impact on the development of the four international river basins. The first was the establishment of the Union of South Africa in 1910. This consolidated the four colonies of the Cape Colony, OFS, ZAR, and Natal under British rule. By then the hydraulic mission was already well under way, but was given new energy when the Department of Irrigation was established shortly after the establishment of the Union. This meant that a unified water law had to be codified – the 1912 Irrigation Act.

Nonetheless, irrigation and other water resource development projects would be implemented with seriousness after the great depression and drought of the early 1930s. Lewis, the then Director of the Irrigation Department, previously cautioned against large projects on the Orange and Vaal Rivers. Many large projects, like the Vaal Dam, were implemented on the Orange, Vaal, and the Limpopo Rivers. Many of the works were implemented to create employment among so-called "poor whites". Although this practice had been implemented nearly fifty years before, it was the first time that a concerted effort of this kind was made. Politics therefore played a major role in the hydraulic mission in South Africa, as it does everywhere in the world.

This became strikingly clear when project after project was implemented in all four river basins for the benefit of a minority white electorate, especially after 1948, when the National Party (NP) came to power. In the Tomlinson Report of 1956, water played a central role in the establishment of Bantu homelands, especially when irrigation projects were set up to supply water to these territories' agrarian economies. Thus, water was not only an economic resource, but also one with which the government could advance its ideological and political agendas, meaning that water was utilised as an economic and social resource. This was exemplified in the early 1960s, when South Africa embarked upon the construction of the ORP, and P.M.K. Le Roux (then Minister of Water Affairs) said that: "In the history of all

young civilised countries the time arrives when big and imaginative water development projects must be launched to promote growth of areas of development, the formation of industries and the generation of electric power, and to create the means of coping with the future population increase, so as to maintain the rate of progress for the country as a whole. That is the principal aim of the Orange River Project". This was also the case with numerous other water development projects to be implemented before the 1960s onwards.

Even so, between the 1960s and the 1980s, South Africa found itself isolated and ostracised within the world community as a direct consequence of its apartheid policy. The policy had international and national policy dimensions and reactions: the Bantustans, international mandatory and punitive sanctions, the armed struggle of the African National Congress (ANC) and other black resistance organisations, the South African armed forces' fight against communism in Angola, the state's search for security and status, the widening disparities of the haves and have-nots (not only in terms of money but water resources as well), and the implementation of the LHWP.

When the political transformation in South Africa was started on 2 February 1990 by the then President F.W. De Klerk, South Africa was a divided society, both politically and economically. The disparity between rich and poor was stark: nearly 18 million people, most of them rural blacks, had no access to running water or sanitation facilities.

In 1994, the ANC was elected the ruling party, and Nelson Mandela became the country's first democratically elected president. The new government immediately set out to correct the consequences of the past. Through the Reconstruction and Development Programme (RDP) it implemented policies to address the disparity between the racial groups. The rural and urban poor were targeted as the main beneficiaries to receive adequate water and sanitation facilities.

Notwithstanding this, the newly elected government is not without its critics. For instance, criticism was levelled against it, project authorities, the World Bank, and contractors regarding the impact of the LHWP on the environment and people living in the Project area in the Lesotho Highlands. Whereas farmers were lobbying for the implementation of irrigation projects in the arid parts of the country in the nineteenth century, environmental and human rights interest groups were lobbying against the implementation of the LHWP, or at least better compensation for those affected.

History, although highly contentious, has, therefore, a tendency to repeat itself. This study indicates this, and the fact that water is an all-encompassing resource, permeating all spheres of society. Water is not only a life-giver, but also a powerful political tool. It is, therefore, the elixir of all life, and the resource that will sustain future South African generations.

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ABBREVIATIONS AND UNITS OF MEASURE

Abbreviations

ANC: African National Congress.

CAAA: Comprehensive Anti-Apartheid Act.

CODESA: Convention for a Democratic South Africa.

COSAS: Constellation of Southern African States.

COSATU: Confederation of South African Trade Unions.

DBSA: Development Bank of Southern Africa.

DEA: Department of Environment Affairs.

DP: Democratic Party.

DWA: Department of Water Affairs.

DWAF: Department of Water Affairs and Forestry.

DWAFEC: Department of Water Affairs, Forestry, and Environmental Conservation.

EC: European Community.

EMG: Environmental Monitoring Group.

ESA: Early Stone Age.

ESCOM: Electricity Supply Commission.

FNLA: National Front for the Liberation of Angola.

GDP: Gross Domestic Product.

GEAR: Growth, Employment and Redistribution.

GEM: Group for Environmental Monitoring.

HCST: Hydrosocial Contract Theory.

HP: Horse Power.

HPH: Hydropolitical History.

IBT: Inter-basin Transfer.

- ITEM: Integrated environmental management.
- IFP: Inkatha Freedom Party.
- IIBTS: International Inter-basin Transfer Scheme.
- IRN: International Rivers Network.
- ISCOR: Iron and Steel Corporation Ltd.
- JCI: Johannesburg Consolidated Investment Company.
- JPC: Joint Permanent Commission.
- JPTC: Joint Permanent Technical Commission.
- JTC: Joint Technical Commission.
- JTC: Joint Technical Committee.
- JULBS: Joint Upper Limpopo Basin Study.
- JWC: Joint Water Commission.
- JWEEC: Johannesburg Waterworks, Estate, and Exploration Company.
- KOBWA: Komati Basin Water Authority.
- LBPTC: Limpopo Basin Permanent Technical Committee.
- LHDA: Lesotho Highlands Development Authority.
- LHWC: Lesotho Highlands Water Commission.
- LHWP: Lesotho Highlands Water Project.
- LMS: London Missionary Society.
- LNLA: Lesotho National Liberation Army.
- LSA: Later Stone Age.
- MAR: Mean Annual Run-off.
- MPLA: Popular Movement for the liberation of Angola.
- MSA: Middle Stone Age.

NP: National Party.

NSC: North-South Carrier.

NYSE: New York Stock Exchange.

OAU: Organisation of African Unity.

OB: Ossewa-Brandwag (Ox-Wagon Sentinels).

OFS: Orange Free State.

OPEC: Organisation of Petroleum Exporting Countries.

ORC: Orange River Colony.

ORDP: Orange River Development Project.

PAC: Pan-Africanist Congress.

PEMS: Paris Evangelical Missionary Society.

PM: Prime Minister.

PWC: Permanent Water Commission.

PWV: Pretoria-Witwatersrand-Vereeniging area.

RDP: Reconstruction and Development Programme.

RWB: Rand Water Board.

RW: Rand Water.

SACU: Southern African Customs Union.

SADCC: Southern African Development Coordination Conference.

SADC: Southern African Development Community.

SADF: South African Defence Force.

SACP: South African Communist Party.

SAFTO: South African Foreign Trade Organisation.

SAMC: South African Mining Company.

SAMWU: South African Municipal Workers Union.

SANNC: South African Native National Congress.

SAR: South African Railways.

SWAPO: South West African People's Organisation.

TCTA: Trans Caledon Tunnel Authority.

TPTC: Permanent Technical Committee.

TWP: Thukela Water Project.

UDI: Unilateral Declaration of Independence.

UNITA: National Union for the Total Independence of Angola.

UN: United Nations.

UNDP: United Nations Development Programme.

UNEP: United Nations Environment Programme.

UP: United South African Nationalist Party.

USA: United States of America.

VAPS: Vaal Augmentation Planning Study.

VHP: Vaal-Harts Project.

WCD: World Commission on Dams.

WDM: Water demand management.

WRC: Water Research Commission.

WSM: Water supply management.

ZANU: Zimbabwe African National Union.

ZAR: South African Republic (*Zuid-Afrikaanse Republiek*).

Units of Measure

BC: Before Christ.

c: *Circa*.

cm: Centimetre.

c/m³: Cent per cubic metre.

cusecs: Cubic metres per second.

ft: Feet

ha: Hectare.

in: Inches.

km: Kilometre.

km²: Square kilometre.

m³: Cubic metre.

m³/d: Cubic metre per day.

m³/s: Cubic metre per second.

m: Metre.

mcm: Million cubic metres.

mm: Millimetre.

mm/yr: Millimetre per year.

MW: Megawatt.

R: Rand.

s: Shilling.

t/ha: Tonne per hectare.

£: Pound.

1. INTRODUCTION

1.1. Motivation

Much has been written about Middle Eastern River basins. In these studies, the hydropolitical history of these rivers formed only part of the analysis, for instance Lowi (1993), Hillel (1994), Kliot (1994), Wolf (1995) and Allan (1996). There is a paucity of information on the hydropolitical history of South African rivers. Teclaff (1967), however, gave an analysis of international rivers, outside South Africa, from a historical and international law perspective.

Wilcox (1986) conducted a study on the history of the Orange River from an archaeological and historical outlook. The time-span of his study is limited, though. It does not cover the history of the river basin to the present. Meissner (1999, 2000a) also conducted studies on the hydropolitics of international river basins (Kunene, Okavango, and Orange), with a hydropolitical history element contained in these studies. Yet the focus of these studies was on the international relations between the actors involved in the river basins over time. There is a need for the studies of Wilcox (1986), Turtton (1998), and Meissner (1999, 2000a) to be broadened. The focus should be solely on the hydropolitical history of the Orange, Limpopo, Incomati, and Maputo Rivers until the present.

Analysing the hydropolitical history of these international river basins will help in the contextualisation of the current patterns of conflict and cooperation between the riparian countries. From the beginning of South Africa's history, water has played an important role in the shaping of the country, not only demographically but also politically. Water availability helped to determine where and how humans lived, and influenced the way in which they related to each other (Wolf, 1995:12). In other words, water is one of the moving forces in shaping a country's political destiny.

In addition, nothing happens in a political vacuum. Studying the hydropolitical history of the respective river basins can tell us how phenomena, operating in the past, may behave in the future. This history can also suggest how such phenomena may affect the hydropolitical dynamics of the rivers at present. This is particularly relevant when the requirements of the Southern African Development Community's (SADC) Protocol on Shared River Systems and elements of the National Water Act are considered.

Meehan (1988:88) gives a more scientific motivation for the study. He states that the importance of being able to control events in the environment comes down to the survival of the human race. Control over the course of events depends on the availability of knowledge. This, in turn, will require an organisation of experience that will both formulate and fulfil specific human purposes like water resources management.

Such a gap in knowledge is present in South African hydropolitical history. This gap needs to be filled if water resources planners, hydropolitical specialists, catchment management agencies and government officials want to make reasoned justifications of their actions regarding the management of international rivers. The analysis of the hydropolitical history of South Africa's major international river basins will help to broaden our knowledge system, and will fill the gaps in our knowledge of the respective international river basins.

1.2. Objectives

The project has the following objectives:

- To document the hydropolitical history of the major international river systems (Orange, Limpopo, Incomati, and Maputo) in South Africa in one coherent document; and related to this
- To produce a comprehensive hydropolitical history of the major international river basins in South Africa;
- To place all the relevant historical events into one coherent document. Furthermore, to establish a linkage between specific turning-points in historical decisions and the subsequent development of hydraulic installations like dams, irrigation systems, canals, *etc.* and the institutional arrangements managing these systems.
- To discover what the past experience of water management in these river systems was;
- To establish a framework and/or backdrop which project planners, water service utilities, government departments and catchment management agencies (CMAs) can use for the effective management of these international river systems;
- To contribute to a multi-disciplinary understanding of the dynamics of South Africa's major international river basins; and
- To build capacity by incorporating research assistants from previously disadvantaged communities into the research team.

1.3. Structure

The report is structured as follows:

Chapter 2 deals with the literature survey, general approach, and the methodology. In this chapter the literature is summarised and evaluated. The general approach and methodology according to which the research had been conducted are also outlined. Chapter 3 deals with the collection of information on research material and methods adopted during the research.

Chapter 4 offers a concise history of South Africa. The purpose of this chapter is to outline the history of South Africa, going back about 3 million to 1.5 million years. The chapter is not comprehensive, because space and time will not allow a comprehensive discussion of South Africa's history. Chapters five, six, seven, and eight discuss the hydropolitical history of the Orange, Limpopo, Incomati, and Maputo River basins respectively. These chapters are written comprehensively. The research team felt that it was important to include as much information on these river basins as possible.

Chapter 9 deals with the history of legal and institutional developments regarding the management of South Africa's international river basins. This chapter contains a history of the development of the water law of South Africa, and the role and function of the current Department of Water Affairs and Forestry (DWAF). In the chapter a number of international agreements or treaties pertaining to the four international river basins are also summarised. In the last chapter (Chapter 10) there is a discussion, recommendations, and conclusion. This chapter will indicate to what extent the project's objectives were achieved, the contribution

made to current water management practices, and recommendations for future research. A reference list and a number of appendices follow this.

2. LITERATURE SURVEY AND METHODOLOGY

2.1. Literature Survey

The following literature was surveyed during the project:

1. Government reports;
2. Academic literature; and
3. Newspaper and magazine articles.

The government reports used date back to the nineteenth century. These were mainly reports from geological surveys on the Orange River, the Reports from Select Committees, debates in the Cape Colony's Parliament (contained in Cape Hansard publications), petitions from private individuals sent to the Cape Parliament, reports (White Papers) of individual water projects, and reports from the Department of Irrigation, the Department of Water Affairs, the Department of Environment Affairs, and the Department of Water Affairs and Forestry.

The following insights were gained from these literature sources:

1. The different reports offer indications as to when the international rivers were first seen as potential sources of socio-economic development.
2. This allowed the researchers to ascertain how far back water resources development projects go. In many of the reports, the exact date could be established. In many other cases, only the year of implementation could be discerned.
3. The literature indicated the type of actors involved in the planning and execution of individual projects and how much these projects cost.
4. The circumstances under which these projects were implemented are indicated by the literature.
5. The reasons for the construction of many of the projects are suggested. From this the hydropolitical dynamics of the international river basins could be deduced. Notwithstanding this, some the "real reasons" for the construction of some of the projects are not contained in these reports. For instance, it is possible that a Member of Parliament for a specific constituency advanced arguments for the implementation of a project in his constituency. These reasons are not indicated in the government reports.

Some of the academic literature also dates back to the nineteenth century. In this case, much of the attention of this literature fell on the history of South Africa. This indicated the domestic and international political conditions at the time of the implementation of the water resources development projects. Some of the literature dating back to the nineteenth century also referred to the development of the international river basins, particularly the Orange River.

The newspaper and magazine articles were used as a secondary source of literature. These literature sources were used because they were in many cases the only source of information available on certain aspects of the hydropolitical history of the river basins. This was especially the case when the history of the Lesotho Highlands Water Project was written. Newspaper articles were also used when currently planned schemes were researched. These articles from particular newspapers and/or magazines are sometimes written in a biased,

ideological fashion. Such information was not included or commented on in the report. What are of importance are events, dates, the actors involved, where, and how the project was implemented.

2.2. Methodology

The methodology used in this report is of a descriptive-chronological nature. A description is provided of the history of South Africa, as well as the hydropolitical history of the four river basins concerned. The history of South Africa is arranged in a chronological order, starting at 3 to 1.5 million years ago, and is described up to the present. The hydropolitical history of the rivers is described in the same manner.

No attempt is made to analyse the data contained in this report. The reason for this is the large volume of data collected. The large volume of data to be surveyed and collated influenced the time spent on the analytical aspects of the report. What was done was to link political events in South Africa's history with events taking place in the four international river basins under consideration.

3. MATERIALS AND METHODS

3.1. Materials

The research assistants, receiving instructions from Tony Turton and Richard Meissner, were used to search for relevant material. This material was found in the archives and Africana and Rare Book Collection sections of the library (Academic Information Centre (AIC)) of the University of Pretoria (UP). Searches were done by using current electronic catalogues and "old" card catalogues, with the assistance of some of the library personnel working in each of these sections of UP's library. Current and old systems were used because much of the research material relevant to the topic of the project dates back to the nineteenth century and was not to be found on the electronic catalogue.

Another method used to find the relevant research material was "by hand". "By hand" literally means that the research assistants, and Richard Meissner, had to go through government documents, kept in the archives of the library, by hand. These documents are not on the electronic catalogue or the old card catalogue system. The help of some of the library personnel, especially Ms. Marietta Buys, was solicited to find out where exactly these documents are kept. Some of the documents were eventually found in the archives of the AIC and the Hans Merensky library at UP.

The services of Ria Groenewald at the AIC were also used to scan a map, dating back to 1886, of the Orange River. This map was drawn by the late Thomas Bain and showed a proposal for some of the components of the Orange River Project (ORP).

In the first progress report mention was made of the production of a number of maps (Bain's map and sketches) by Ms Oteng Seremo, one of the research assistants. She was supposed to do this by using a geographic information system (GIS) because she is a GIS specialist. Yet after the handing in of the first progress report, it became clear that it would be much easier to scan the map and to include it in the report as an appendix. The reason for this is that the map is difficult to digitise because the book containing the map was not to be removed from the Rare Book Collection of the AIC. The process of digitising the map would also be time-consuming. Financial resources would also have to be taken from the budget to pay the Department of Geography at the UP for the use of its GIS system. The research team therefore opted for the scanning of the map. This is less time-consuming and is also free of charge because a service by the AIC is rendered to the research team members who are also currently enrolled at the UP.

The research assistants also visited the library of the Africa Institute. However, not much information was retrieved from this source. Officials from the Department of Water Affairs and Forestry (DWAF) and the Department of Foreign Affairs (DFA) were also asked to assist in the location and copying of signed international agreements regarding the four international river basins.

Another source from which data was collected was the archives of the Parliament of South Africa in Cape Town. Richard Meissner established contact with the relevant personnel at the library of Parliament, which also runs Parliament's archives. Meissner subsequently undertook three research trips to these archives over a combined period of three weeks. The first research trip was in March 2002, the second in August 2002 and the third in January

2003. A research trip was also undertaken to the National Archives in Windhoek, Namibia, to collect data on the Fish River, a tributary of the Orange River. This trip took place in October 2002. The necessity for this trip was to find material on the Fish River for the period when Namibia was still under South African control.

The methods used during these research trips to find information, mainly previous government documentation, was "by hand" and to some extent by using the electronic catalogue of the relevant information centres. This led to huge volumes of photocopies being made.

Extensive use was also made of the library at the Rand Afrikaans University (RAU) and especially the Rare Book Collection of the library. Some valuable documents were also found here which were not available at the University of Pretoria's AIC, the archives of Parliament and the National Archives in Windhoek. These visits to RAU's library had no major financial implications, except for photocopying of documents, because Meissner has a visitor's card to gain access to the services of the library. On these visits to RAU's library use was also made of the Internet to find relevant and more recent documentation pertaining to the river basins in question. In these cases, documents were downloaded from DWAF's website and printed on the library's printers.

The most important aspect of the data-gathering process was the discovery of old material dating back to the nineteenth century. All other important aspects regarding the project are linked to this one. This was especially relevant to the Orange River basin. The closing of the South African frontier and other historical aspects like debates in the House of Assembly of the Parliament of the Cape Colony on whether irrigation projects should be built or not occurred in the period from about 1858 to 1900. The White Papers from the Department of Water Affairs from 1960 onwards and reports from the old Department of Irrigation before 1956 also gave valuable insight into the hydropolitical history of the four river basins.

3.2. Method

The data collected from the above-mentioned sources was arranged chronologically for each river basin. After this, the data was incorporated into the report. The procedure used was to summarise the relevant material for each river basin. For instance, in the case of a White Paper on a specific water development project, the relevant aspects of the project were identified and summarised in the report. The same was done for information pertaining to the broader management of the rivers' water resources and the historical events and circumstances in South Africa's history.

4. A CONCISE HISTORY OF SOUTH AFRICA

4.1. Introduction

The hydropolitical history of South Africa's international rivers is closely connected to the settlement of humans in South Africa. The reason for this is that humans use the water resources of a river differently from other creatures on earth. The hydropolitical history of the international river is best understood in the context of the settlement of the land, for various reasons. These aims mainly concern agriculture, the opening and closing of the frontier, and the subsequent urbanisation and industrialisation of South African society closely coupled with political occurrences. The settlement of land and the opening and closing of the frontier coincided with each other. This was the case after the arrival of Europeans in the middle of the 17th century. Before this, indigenous peoples used land, but no formal border existed.

The purpose of this chapter is to explain the history of South Africa in a concise manner. The reader will miss many facts in this rendition of South Africa's history, but there is no room and time for detail. The purpose is to illustrate the meaning of certain developments and related events and to link these with the hydropolitical history of South Africa's international rivers. This chapter is therefore only an introduction to South African history. It is arranged chronologically and its basis is the origin and interaction of South Africa's different population groups over time.

The chapter is divided into a number of parts. In the first part, the frontier is defined. The second looks at South Africa's pre-colonial history. The third part discusses the first phase of the colonial frontier. This is followed by a discussion of the second phase of the frontier. This phase involved the Great Trek, the establishment of the Boer Republics and the discovery of minerals in South Africa. In the fourth part, the third phase of the frontier is outlined. In the fifth part the closing of the frontier and the rise of Afrikaner nationalism is considered. This is followed by a discussion of the establishment of the Union of South Africa and the history of South Africa from this time up to 1948. The seventh section of the chapter looks at South Africa's apartheid policy and international isolation up to 1990. In the eighth part of the chapter the period 1990 to the present is discussed. In this period, South Africa witnessed radical political reforms and the first democratically elected government in its history. Lastly, a conclusion is drawn.

4.2. The Frontier Defined

A frontier is defined by Thompson and Lamar (1981a:7-8) as follows: "We regard a frontier not as a boundary or line, but as a territory or zone of interpretation between two previously distinct societies. Usually, one of the societies is indigenous to the region, or at least has occupied it for many generations; the other is intrusive. The frontier "opens" in a given zone when the first representatives of the intrusive society arrive; it "closes" when a single political authority has established hegemony over the zone. When the frontier has closed in a given zone, the intruders may have exterminated the indigenous people . . . they may have expelled them . . . they may have subjected them and incorporated them into their own political and economic system (as in South Africa); the intruders may themselves have been incorporated by the indigenous people . . .; or they may have reached a stalemate . . . The frontier also has a number of characteristics. There are three very important aspects in any frontier experience

or situation; territory; two or more primarily particular peoples; and the process by which the relations among the peoples in the territory originate, develop, and eventually solidify" (Thompson & Lamar, 1981a:8).

In any event, before Europeans arrived in South Africa, a pre-colonial frontier already existed. This happened when Bantu-speaking agro-pastoralists moved into Southern Africa. Before this, the country was settled only by San and Khoi-Khoi hunter-gatherers and pastoralists (Thompson & Lamar, 1981a:11).

After the arrival of Europeans, the frontier in South Africa advanced in four phases. The first stage, between 1652 and 1700, saw the amalgamation of a stronghold and bridgehead on Table Bay by Europeans. Europeans gained control of arable land 30 or 40 kilometres (km) inland from there. The second phase was during the eighteenth and early nineteenth centuries. During this period, many whites became *trekboers* or extensive stockfarmers. They occupied land in the semi-arid and arid hinterland eastward toward the Fish River and northward toward the Orange River. The third phase began in 1835. Around this time, organised bands of *trekboers* immigrated into the wetter eastern two-fifths of South Africa. By 1870 much of the fertile land east of the 200 mm rainfall barrier was settled. This migration was later known as the Great Trek and its participants the *Voortrekkers*. The final phase occurred in the last 30 years of the nineteenth century (1870-1900). During this period, whites controlled the land south of the Limpopo and into Namibia, Zimbabwe, and Mozambique (Thompson & Lamar, 1981b:23).

Thus, the geography of a certain frontier area provides the possibilities and limits for human activity. The physical geographical variables include the following aspects:

- Temperature and precipitation;
- Contours and river catchment areas;
- Soils (quantity and quality thereof);
- Flora;
- Minerals;
- Animal life (abundance and scarcity thereof); and
- The spatial relationship between the frontier area and the territory from which the "intruders" come (Thompson & Lamar, 1981a:8).

There is therefore a relationship between the settling of the land, the geographical features thereof, and the abundance and scarcity of natural resources. These factors would play a role throughout the hydropolitical history of South Africa's international rivers, from the pre-colonial frontier to the end of the twentieth century.

4.3. Pre-Colonial South Africa: Hominoids, Hunter-gatherers, and Agro-pastoralists

4.3.1. The Hominoids

Regarding human settlement of land in South Africa, the hydropolitical history of South Africa's international rivers started at around three to 1.5 million years ago. During this period, *Australopithecus africanus* settled in the Harts River Valley. *Homo habilis* also came

to live in the valley. During the Early Stone Age (ESA) (1.5 million to 100 000 years ago) *Homo erectus* wandered in the Orange River basin (Wilcox, 1986:10-11).

This hominid lived during the same era as *Australopithecus*, or about 500 000 years ago (Wilcox, 1986:11). *Australopithecus* became extinct in Africa around one million years ago. A number of possible reasons for this have been given:

- The physical environment deteriorated to such an extent that food became scarce for *Australopithecus*.
- *Australopithecus* and *Homo habilis* competed for food with *Homo erectus*, which had a more advanced survival strategy¹ and better implements, hence out-competing *Australopithecus*.
- *Homo erectus*' abilities to use, control, and sustain fire meant that it was more advanced, culturally, than *Australopithecus* and therefore contributed to the latter's extinction.
- *Homo erectus* had a more advanced survival strategy. For example, it built shelters as protection against predators. This led to a population increase that had a debilitating impact on *Australopithecus*'s survival (Tobias, 1986a:20, Wilcox, 1986:11).

Whatever the reason, at around one million years ago, the only hominid species in Africa was *Homo erectus* (Tobias, 1986a:20). Therefore, the food security of *Australopithecus* became precarious, and it was outnumbered by a more advanced hominid species that led to its demise. In other words, the advanced utilisation of natural resources by *Homo erectus* was the main factor that led to its survival and the demise of *Australopithecus*. Yet the Orange River's water resources were only used on a limited scale and by small groups of hunter-gatherer communities for personal drinking purposes.

It is important to note the settlement of early humans in the Orange River basin. The reason for this is that they were the forerunners of modern humans that would not only "conquer earth" but also the rivers that sustain our modern life support systems. For instance, *Homo habilis* fashioned hard material, produced rock implements, and built rock shelters, just like *Homo erectus* (Tobias, 1986b:11, 19). This illustrates a very early example of the utilisation of natural resources to create a better living standard for early humans.

Early humans lived by collecting roots, nuts, and other plant food, and by fishing, hunting, and gathering shellfish on the coast. They also may have had an impact on the landscape. This concerned the use of fire: the early settlers of South Africa may have created the grasslands of the Highveld in this manner. They did not degrade the environment in a serious way but had an impact nonetheless (Ross, 1999:6).

The transition between *Homo erectus* and *Homo sapiens* was between 500 000 and 100 000 years ago. After the *Homo sapiens* of the Middle Stone Age (MSA) (700 000 to 125 000 years ago), humans of the Later Stone Age (LSA) came to settle in the Orange River basin. Their last representatives were the San people and they were still producing stone implements as late as the 1870s (Wilcox, 1986:11). The Khoi-Khoi and the San peoples are the direct

¹ *Homo erectus* had a brain capacity of 940 cubic centimetres (cm³) compared to that of *Australopithecus africanus* 442 cm³ and 46% larger than *Homo habilis* 645 cm³, but 70% smaller than modern humans (Tobias, 1986a:21).

descendants of those prehistoric humans that lived in South Africa during the ESA (Attwell, 1986:1; Tobias, 1986a:22).

4.3.2. The San People

The San people were hunters, gatherers, and fishers. The low density of their population allowed them to live a comfortable life off the natural resources in their immediate surroundings and along the banks of the Orange River. Vegetable food occurred in abundance and during the dry season they would hunt those animals that came down to the river to drink. This game included large numbers of antelope, wildebeest, zebra, elephant, buffalo, rhino and giraffe. Hippos were also hunted. This was done by using staked traps dug in riverbanks, or hauled from the river below the Augrabies Falls after a flood. During a flood, hippos would fall to their death over the falls (Wilcox, 1986:11).

The San also used various types of methods to catch the fish that were also plentiful in the river. Among these were:

- Fish weirs,
- Wood harpoons, and
- Rod and line (Wilcox, 1986:11).

Timber, used for fuel and shelter material, was also in abundance along the banks of the rivers and was used by these people (Wilcox, 1986:11). Even so, a rough indication of the population base the river basins supported during the MSA and LSA would be the area needed per person for hunting and gathering purposes. Under favourable conditions, a community of San people needed around five square kilometres (km²) per capita in which to gather food and hunt. Before construction of the Gariep Dam started in the 1960s, the archaeologist Garth Sampson and his spouse Mary uncovered the remains of a number of shelters in the area to be flooded by the dam. Some of these remains were estimated to be more than 70 000 years old. Other remains of shelters of the MSA and LSA were also found in their hundreds, with a few from the ESA as well (Wilcox, 1986:11). These discoveries give some indication of the population base of humans in the Orange River basin. An exact figure cannot be given other than that it was small during the MSA, LSA, and ESA.

4.3.3. The Khoi-Khoi

After the San, the Khoi-Khoi (men of men) arrived on the scene in the Orange River basin. This was about 2 500 to 2 000 years ago. They were hunters as well as pastoralists. Hence, the agriculturist had arrived in the Orange River basin and other parts of South Africa (Wilcox, 1986:12; Bredekamp, 1986:28; Ross, 1999:7, 6).

The Khoi-Khoi came from an area where modern Botswana, Zambia and Angola meet. While still living in this region, they acquired sheep and later also cattle and start to move south into central Namibia, the Highveld of South Africa, and the Cape (Ross, 1999:7).

It is not certain how the Khoi-Khoi acquired their cattle. Two possibilities have been advanced. They could either have received cattle peacefully from agriculturists, most probably the Bantu people of the region, or by raiding their cattle. Apart from this, population pressure or the need for better pasture may have prompted the southern and western migration of the Khoi-Khoi into South Africa and Namibia respectively (Bredekamp, 1986:29).

Either way, the existence of the Khoi-Khoi centred on the ownership of cattle. However, they were also hunters and gatherers. They practised a semi-nomadic lifestyle, dictated by seasonal variations. Some Khoi-Khoi spent the summer in Cape Peninsula, and moved to the interior during the cold and wet winters. Their sheep and cattle gave them an independent pastoral existence. During times of need, such as drought, they could rely on their cattle and sheep for a livelihood. Cattle were used also for ritualistic purposes, protection of warriors during battles and transport. The number of cattle and sheep an individual owned gave him a certain status relative to other members of the community. Some families that had a surplus of cattle were considered wealthier than others (Bredekamp, 1986:29).

The Khoi-Khoi did not have a centralised political system because of their pastoral existence. Nonetheless, because of their dependence on cattle and sheep as an economic resource, calamities such as drought, disease, and theft could lead to the destitution of some families or communities. When this happened they could fall back on their hunter-gatherer existence. Some even went into the employment of other wealthier Khoi-Khoi families by selling their labour as herders and servants and by doing this building up their stock. Be that as it may, it was the arrival of Europeans that brought an end to this economic "repair" system of the poorer Khoi-Khoi. The reason for this is that they were no longer geographically isolated (Bredekamp, 1986:29-30).

Because of their pastoral and semi-nomadic existence, the water resources of the rivers were used only as long as a Khoi-Khoi community lived near a tributary or the main stem of such a river. Yet it was not a grand utilisation of a river's water in the sense of the water being consumed in bulk. What can be assumed, though, is that the Khoi-Khoi used more water per community than the San because of the cattle and sheep owned.

4.3.4. The Bantu People

After the Khoi-Khoi had settled in South Africa and parts of the Orange River basin, the Bantu peoples started to arrive. Unlike the Khoi-Khoi and the San, with their more nomadic lifestyles, the Bantu practised agro-pastoralism.

The development of agro-pastoralism by people of the Iron Age (Bantu people) meant that a more established rather than nomadic lifestyle could be practised. This established lifestyle was in contrast to the Khoi-Khoi and San because the planting and harvesting of foodstuffs fixed a community to a certain geographical area. Agricultural produce included the growing of grains like sorghum, babala, manna and rapoko, pulses like black beans and peanuts and members of the pumpkin family like calabash and sweet melon (Maggs, 1986:38).

Where did the Bantu people come from and when did they settle in South Africa? The agro-pastoralism of the Bantu people was more successful than the lifestyles of the Khoi-Khoi and San peoples. This practice prevailed in large parts of Africa. However, environmental extremities like the rain forests of central Africa and the dry regions of northeastern Africa were avoided. Communities, therefore, started to drift southwards. The first of these movements went down the east coast of Africa and reached modern-day Mpumalanga and KwaZulu-Natal about 1 700 years ago (Maggs, 1986:38).

Around 1 500 years ago, a second distribution of Bantu people took place from the north. This one occurred through Zimbabwe. The Bantu people did not spread over large parts of Southern Africa. They confined themselves, at first, to the bushveld and savannah regions of South Africa. These were the areas inside the summer rainfall region, which have an average rainfall of 600 millimetres per year (mm/yr). Enough rain fell in the area east of the 200-millimetre (mm) rainfall barrier, which was necessary for the successful cultivation of foodstuffs, pasture for cattle and sheep and wood for the production of charcoal and building material (Maggs, 1986:39).

During the Late Iron Age, the Bantu peoples started to move out of the bushveld regions and into the savannah areas of South Africa north and south of the Vaal River. This took place at around 1300 and by 1600; new areas were settled in the northern and southern parts of the Orange and Limpopo River basins. The largest settlements were those found in the Northwest Province and northwestern parts of the Free State. These settlements were large towns and were spread over a few square kilometres (Maggs, 1986:41). The agro-pastoralists therefore arrived in the Orange and Limpopo River basins around 700 to 400 years ago.

The 200 mm summer rainfall barrier was the main reason why the Bantu people did not move more westwards into the drier parts of the Orange River basin. Rainfall west of the barrier was too erratic for the cultivation of foodstuffs. The carrying capacity and attractiveness of land also vary from region to region. People are not likely to settle in deserts; they would rather establish communities in well-watered and fertile zones where agriculture is more likely to succeed (Thompson & Lamar, 1981a:8).

Rain played a more important role than rivers within the Bantu communities' economy. For instance, the ruler of each community had to assure the prosperity of every society. This meant that he had to guarantee that enough rain fell. This was a matter of utmost importance, especially west of the 200 mm rainfall barrier. Here rain was less abundant and reliable than to the east of the boundary. Within Batswana society, every speech ended with the motto *Pula!* (Let it rain). This was significant since the Batswana lived on the fringes of the Kalahari Desert and rain was necessary for the successful rearing of cattle and the planting of foodstuffs. Moshoeshe, ruler of the Sotho people in the nineteenth century, once stated that "peace is like the rain that makes the grass grow, while war is like the wind that dries it up. The ruler could make it rain for longer by preserving peace" (Ross, 1999:18).

The 200 mm summer rainfall barrier also formed a natural and ecological boundary between the Khoi-Khoi and Bantu peoples. Notwithstanding this division, interaction occurred between the two groups. Iron Age communities used the land to the west of the border for hunting and pasture. The Khoi-Khoi and San on the other hand hunted for the Bantu and herded their cattle and sheep for food, tobacco, and ironware (Maggs, 1986:43; Wilcox, 1986:15).

In economic terms, this division was also not clear. All groups hunted and collected foodstuffs found in the veld. However, not many Bantu fished or collected shellfish. All Bantu groups had cattle. Certain Khoi-Khoi, on the other hand, grew a variety of crops, most notably dagga (Ross, 1999:8).

Thus, during the second millennium a tripartite division of the population in South Africa took place although this division was already apparent during the first millennium in other parts of the country. The three groups of people were:

1. The hunter-gatherers (the San).
2. The pastoralists (the Khoi-Khoi).
3. The agriculturalists (the Bantu) (Ross, 1999:7-8).

As the Southern African region became settled, the agro-pastoralists (Bantu) dominated those regions that were ecologically appropriate for their lifestyle. These areas included roughly the eastern part of modern South Africa, the eastern perimeter of Botswana and the northern reaches of Namibia. To the west, where the climate was drier, they could not sustain their agro-pastoral lifestyle and avoided these regions. The Khoi-Khoi, on the other hand, lived largely along the well-watered southern plains, the Orange River and in the highlands of the western escarpment south and north of the river. The San were in contact with the Khoi-Khoi and Bantu peoples. However, they also inhabited the areas where agriculture and pastoralism could not be practised, especially in the mountains of the Drakensberg, the Western Cape and in the semi-arid Karoo and Kalahari (Ross, 1999:8).

Climatological factors therefore had a great influence on the distribution of the early peoples of South Africa. In the case of the San,² it was also persecution by the other groups that led them to exist in the mountainous, semi-arid, and arid regions of Southern Africa (Wilcox, 1986:14).

We can therefore assume that the early peoples of South Africa, from *Australopithecus africanus* to the Bantu people, were all greatly dependent on the natural environment for their basic needs (food and water). This was before the settlement of South Africa by Europeans. Yet there is a pattern between ESA humans and Iron Age humans regarding their utilisation of the natural environment. Early Stone Age humans and those of the MSA and LSA had a hunter-gatherer existence. The Khoi-Khoi introduced pastoralism into South Africa. The Bantu people of the Iron Age initiated agro-pastoralism, most notably in the eastern parts of South Africa, at first. At around 1700, these practices spread into the west and south-eastern part of the country (Wilcox, 1986:14-15).

Crops were only introduced into the region a century after cattle and sheep. This combined farming management of agro-pastoralism, "entailed the steady subjugation of the landscape, but for the first few centuries of such settlement the farmers, naturally enough, concentrated in and on the deep soils of river valleys in KwaZulu-Natal and what used to be the Transvaal" (Ross, 1999:10). They did not possess large herds of cattle and sheep. An exception would be the far north and northeast of Botswana where larger herds were kept. This was adequate

² The San people lived in small groups centred around food and water when these were in an abundant supply. During periods of scarcity these groups would dissolve and scatter across the region (Ross, 1999:8).

to reduce the state of the environment and introduce a crisis for the pastoral societies by around 1250. Because of the settlement of large parts of eastern South Africa by agro-pastoralists, the bush was turned into agricultural land. The subsequent impact of this was the restriction of the tsetse fly "to a narrow zone along the Limpopo River" (Ross, 1999:10).

Thus, cattle played an important role in the life of the Khoi-Khoi and Bantu. Attwell (1986:5) states that: "Cattle were not only hardy and providers of meat, they also made a healthy addition to diet through milk and dairy products. Among both peoples they became the major store of wealth and the basis of exchange."

In other words, cattle and the cultivation of other food were important to the food security of these populations. Agro-pastoralism introduced to South Africa the notion of sustainable natural resources development to secure a healthy diet and underline the economic advancement of a large part of South Africa's early peoples (Ross, 1999:15).

What is also important of pre-colonial South African society is that the indigenous peoples lived in settlements. These ranged in size from single-family hamlets to settlements with more than ten thousand residents. However, the interaction between the different peoples over natural resources was not a problem because "the population was not large enough to cause shortages of land, game, and water supplies". There were about 200 000 San and Khoi-Khoi and between two and four million Bantus. At the end of the nineteenth century, the Bantu population was around six million, 80 % of the total population of Southern Africa. Thus, "serious warfare was probably infrequent – and so far as we know this remained the case until toward the end of the eighteenth century" (Thompson & Lamar, 1981b:18, 19, 22, 27).

Notwithstanding these advances regarding the utilisation of the natural environment, rivers were used for stock-watering and basic human water consumption. Irrigation was not known to these peoples and would only later be introduced by Europeans. Nonetheless, the humans of the Stone and Iron Ages were successful in their utilisation of the natural environment for their different lifestyles. Things would start to change concerning the way humans used the water resources of the Orange River when Europeans started to settle in South Africa.

In sum, water played an important part in the lives of non-European communities in southern Africa before and after Europeans arrived. This is true when considering that rain and peace were equivalent to each other. Water, and the abundance thereof, therefore played a role not only in the economic prosperity of the Khoi-Khoi, San and Bantu peoples, but also in their spiritual and political existence. The extensive use of water resources was most probably confined to stock watering and "domestic use" from free-flowing rivers and streams and natural lakes. The cultivation of sorghum and other crops relied on dry-land farming. This is evident in the importance that the indigenous peoples attached to rain.

4.4. The First Phase of the Frontier and Water Resources Utilisation

The colonial frontier process in South Africa was started by the Netherlands and was later sustained by Great Britain and the independent Afrikaner republics (*Zuid-Afrikaanse Republiek* (ZAR) and Orange Free State (OFS) in the last half of the nineteenth century). The frontier expansion was the product of the expansion of Europe and that of capitalism

(Thompson & Lamar, 1981b:14). This expansion was already underway during the last part of the fifteenth century with the Portuguese sailing around the African continent (Cameron & Spies, 1986:53). In January 1488, Bartholomew Dias de Novaes sailed down the coast of western South Africa and rounded the Cape. Yet he did not notice the mouth of the Orange River (Wilcox, 1986:17; De Kock, 1968:6) and therefore did not make a stopover for a short expedition.

Despite that, South Africa becomes known at an increasing rate by Europeans after 1500. Once the route around the Cape of Good Hope to India was found, the country was exposed to an entirely new set of influences, and subsequently to European conquest and settlement. It did not happen immediately, though. After Francisco de Almeida's death in Table Bay in March 1510, the Portuguese concentrated their efforts on the east coast of Africa, to the north of modern South Africa. From here, they could obtain gold, slaves and ivory that was not yet available to the south. The legend of the Kingdom of Monomatapa, a source of substantial riches in gold, was also one of the reasons why the Portuguese initially attempted to find a way around the Cape. It was also an incentive for the Dutch to settle at the Cape. The main motive of the early explorers of the African coast was therefore trade, especially in commodities with a high value in Europe. The shortage of food and water on board ship was one factor in the establishment of settlements in the seventeenth century (Boucher, 1986a:55, 60; De Kock, 1968:11; Wilcox, 1986:17-18; Ross, 1999:21). Yet this motive would only facilitate trade with India.

4.4.1. 1652-1834: Colonisation of South Africa and Land Grab

In 1650, the *Here XVII* of the Dutch East India Company (VOC) decided to establish a fortified refreshment station at the Cape of Good Hope. This was after the ship *Haarlem* was wrecked in Table Bay in 1648. The passengers and crew of the *Haarlem* spent a considerable time at the Cape before they were rescued, and forced experiment of residence suggested to the Company the idea of establishing a permanent relief station at the Cape (Lewis, 1934:1; Boucher, 1986b:61).

Consequently, on 6 April 1652, this post was established under the command of Jan van Riebeeck (Cameron & Spies, 1986:53; Ross, 1999:21). Attwell (1986:12) notes that this heralded the end of many indigenous communities in South Africa, at first most notably the Khoi-Khoi. The arrival of Europeans would have an underlying impact on the social structure of the indigenous population of South Africa, economic and political development, and race relations over time. Indeed, Ross (1999:21) states that: "In political and constitutional terms, the modern South African state is the lineal descendant of Van Riebeeck's settlement".

Moreover, because of the establishment of the settlement at the Cape, and the prior limited agricultural development at the station, the arrival of the Dutch heralded an era of commercial agriculture that would dominate South Africa's economy for the next 250 years (Schirmer, 1981:107). Following the establishment of the station at the Cape of Good Hope, frontier areas opened up as the Europeans immigrated north and east into South Africa (Thompson & Lamar, 1981b:15).

It is interesting that the Dutch settled at the Cape of Good Hope only four years after the founding of the modern state system in 1648. In this year, the Thirty Years War in Europe

ended, and the modern state system was established with the signing of the Treaties of Westphalia and Osnabrück. The twin treaties "redrew the map of Europe dividing it into vertically organised separate states recognised as sovereign within precisely delimited territories" (Schoeman, 1998:1). Notwithstanding this historical incident, South Africa, like all other colonies, was not immediately recognised as an independent sovereign state. It was merely a territory that facilitated the trade links between Europe and parts of Asia and east Africa. The modern South African state would only later be consolidated and become part of the modern state system.

Even so, the VOC initially had no vision that the refreshment settlement should become a foothold for the expansion of the European population in South Africa. The refreshment post had one purpose, and that was to make trade between the motherland (The Netherlands) and her colonies in the east more profitable (Boucher, 1986b:61). Yet the control over land was very soon assumed by whites after the colonial frontier experience started. These areas were used on a regular basis by hunter-gatherers or on a seasonal basis by pastoralists, or occasionally by slash-and-burn cultivators (Thompson & Lamar, 1981b:18).

The establishment of the trade and refreshment post at the Cape of Good Hope had no immediate impact on the utilisation of the water resources of South Africa's international rivers. This does not mean that water resources development projects, especially irrigation works, were not constructed in South Africa. The long drought of 1698-1704 probably made grapes more dependent on irrigation. A reliable water supply was also needed, in the area around Cape Town during those times, for the distillation of brandy. More than that, from Table Bay European settlers would later move into the interior and colonise large parts of South Africa. Twenty years after the settlement of the Cape by the VOC, it became clear that intensive agriculture was a failure. After this, the expansion of the frontier was based on extensive agriculture. In addition, the colony was faced with an economic crisis by the end of the seventeenth century. Over-production was constant due to a small market that was easily over-supplied. Farmers in the peripheral areas of the colony could not compete with commercial farmers near Cape Town because of poor roads and low prices for agricultural commodities (Lewis, 1934:2; Giliomee, 1981:95).

Either way, in 1685 Simon van der Stel led an expedition to the Copper Mountains in Namaqualand in the area of present-day Springbok. This is an indication that the interior was explored at an increasing rate from the late 1650s onwards. The main reasons for this were to look for a larger market for the exchange of cattle and sheep, and the discovery of precious metals (Boucher, 1986b:63, 64; Wilcox, 1986:18).

Also, in the 1690s farmers began to move across the escarpment and into the Orange River basin to settle land (Ross, 1999:25). This was linked to the transition from agriculture to pastoralism. Pastoralism required less capital and labour and was not linked to the risks of transporting perishables over large distances to the Cape market (Boucher, 1986b:66). The South African frontier, in contrast to the one in North America, was quite peripheral to the market economy. The exception was at the start and very end of the frontier era. From 1652 to 1700, the VOC oversaw commercial activities at the Cape. This area and the adjacent arable land "performed a minor but useful role in the capitalist system". The farmers, who started to settle outside the direct vicinity of Cape Town, traded mostly farm produce, sheep, and cattle to traders from Cape Town. Yet there was no market "for the bulk of their flocks

and herds and there were no real towns in the colony except Cape Town" (Thompson & Lamar, 1981b:27).

Land was not a scarce commodity for the European population either. This was especially the case during the first 130 years after their settlement at the Cape. The reason for this was that land could easily be taken away from the Khoi-Khoi (Giliomee, 1981:80).

By so doing, in 1703, the practice of settling more land in the Orange River basin and other parts of the interior gained momentum. Wilhem Adrian van der Stel was pivotal in this respect when he granted free pasture permits to farmers. A small fee linked to this permit system, in 1714, did not discourage farmers from moving across the escarpment (Boucher, 1986b:66; Wilcox, 1986:100). In 1717, the granting of free land ended. At this time, there were just over 400 farms. These comprised an area of about 194 square kilometres (km²) out of a total of 6 500 km². A land crisis ensued which was alleviated by the government giving grazing licences to stock farmers and permitting the trade in cattle with the Khoi-Khoi (Giliomee, 1981:80).

These farmers were those with paltry capital. In spite of their lack of capital, they began to take control of the interior. This has had a significant impact on the "indigenous" peoples of South Africa, especially the Khoi-Khoi and San, in that the farmers were responsible for taking their land and stock. In the process, they also forced these people to work for them. The farmers practised some agriculture, but mainly on a subsistence level at first. They also maintained their contact with the market in the Cape. This was done through the selling of their stock and other stock commodities such as butter soap and lard. The large herds of cattle and sheep which the Khoi-Khoi had built up required large stretches of land, especially in the semi-arid regions. The farmers practised a *trekboer* lifestyle, which they learned from the Khoi-Khoi. In the process, they lived on the herds of game, which were gradually hunted out in the Karoo. These were replaced with cattle and sheep, the products of which could be marketed in Cape Town. Alien plant species were also introduced into the Karoo region, and these had an impact on the biodiversity of the region. Thus, it appears that the ever-increasing expansion of herds had a disastrous impact on the long-term ecology of the Karoo (Ross, 1999:25-26).

Thus at the beginning of the eighteenth century a particular lifestyle evolved in South Africa – the *trekboer* existence. This lasted until the 1940s in remote places of the country. The *trekboers* were a special class of colonists. They practised an economy of stock farming in which hunting also played a role. During the dry season, they moved to greener pastures to sustain their flocks and herds. Because of the abundance of land, they could settle on the frontier with little capital in hand. This also gave them the opportunity to practise near-subsistence farming on an extensive scale and rely on the indigenous people for labour (Giliomee, 1981:80-81).

The spread of *trekboers* into the interior was also linked to hunting practices. Hunting not only supplied them with meat, it also broadened their knowledge of regions in the interior. The increase in stock numbers and the exhaustion of the veld resulted in farmers moving further away from settled areas. The government of the time even tried to prevent this by establishing borders, but it was unsuccessful. The population density was around two persons per ten square kilometres (km²) of the entire region where the Dutch lived. In the interior,

where pastoralists settled, it was about one person per square kilometre and in the arid regions, one person per 20 km² (Boucher, 1986b:66).

At the end of the eighteenth century agriculture in the Cape Colony was still dominated by subsistence farming. The market for produce was thus very small. Commercial farming opportunities became available only towards the closing of the frontier (1870-1900). The political order on the pioneering frontier was characterised by a lack of a single controlling authority. The VOC was interested in the Cape as a halfway station for its ships. It did not care much about the expansion of near-subsistence farmers over large areas. The Company was profit-driven, and kept its complement at the Cape as small as possible. For instance, in the 1790s there was a garrison of 1 000 individuals stationed at Cape Town. Tax collection was difficult, because of the spread of the population over vast areas. Under such circumstances, the government was unable to provide services. The lack of government control was directly related to extensive subsistence farming and very low white population densities (Giliomee, 1981:87, 89).

In any event, the interior of the Cape was a region abounding in natural resources – game and grazing land. The European population in this region doubled every generation. The areas of European settlement also expanded at the same rate. By the end of the eighteenth century, European farmers had taken over most of the land. This was the case in the area west of the Fish River and south of the Orange River. In these regions, and especially to the east, they were therefore the representatives of colonial rule. Further to the north, the colonial representatives were not white but of Khoi-Khoi and San descent. Their colonial power base was underpinned by their possession of guns and horses, which gave them an added military advantage over other peoples in the region. These representatives would be known as Griquas or Oorlams. In the valley of the Orange River and to the north of it they and the Korana started to threaten the Sotho-Tswana and Herero chiefdoms (Ross, 1999:26).

4.4.2. 1834-1900: *Mfecane* (*Difaqane*), the Great Trek, Boer Republics, and Discovery of Minerals

From 1652 to around 1834, Europeans were able to gain control over large tracts of land, in spite of their inadequate resources. The reason for this was that the San and Khoi-Khoi populations were too small, too weak, and divided among themselves to prevent their loss of land. From 1835 onwards, Europeans were able to gain control over more land that was controlled by Bantu-speaking peoples. The *Mfecane*³ or *Difaqane*⁴ facilitated this. The *Mfecane* or *Difaqane* was "catastrophic intra-African disturbances" which were started by wars "between 1816 and 1828 by the rise of Shaka's military Zulu state that disrupted and demoralized most of the African chiefdoms throughout the region . . ." (Thompson & Lamar, 1981b:23).

A consequence of the *Mfecane* was the depopulation of the Highveld savannah and KwaZulu-Natal. There were therefore areas of land to be settled by the *Voortrekkers*. Andries Pretorius, one of the Great Trek's leaders, states how his trek party found empty tracts of land north of the Orange River when they crossed the river. He says that: "... we found cities and

³ In the Nguni language it means 'crushed in a total war' (Edgecombe, 1986:115).

⁴ In the Sotho language this means 'forced migration' or 'hammering' (Edgecombe, 1986:115).

towns which had been sacked by natives and which were filled with slaughtered animals. Yes!, and what is more, that the weaker tribes had been compelled to eat their own children because they were continually pursued and wiped out through the blood thirstiness and love of raids of the more powerful tribes . . . it was a country of blood" (Van Jaarsveld, 1975:106-107; Thompson & Lamar, 1981b:23). The Great Trek heralded the second phase of the opening of the frontier in South Africa, with the settlement of large tracts of land north of the Orange and Vaal Rivers and south of the Limpopo.

4.5. The Second Phase of the Frontier

From 1835, the number of Europeans started to increase in the Free State because of the Great Trek (Wilcox, 1986:80). Moreover, the Great Trek also had an impact on the international political character of Southern Africa. It led to the establishment of two sovereign independent states: the South African Republic (*Zuid-Afrikaanse Republiek*) (ZAR) and the Orange Free State (OFS) (Fisher, 1900:76). Thus, starting in the mid-1830s, the international river basins, as dominions of sovereign control, would undergo a fundamental change. It was only later that the British Administration in the Cape Colony would grant full sovereign recognition of the aforementioned states. What is also important to note is that the information the *Voortrekkers* received from hunters, traders, missionaries and other trekboers on the interior of the country gave them the edge. They did not immigrate into totally unknown territory (Du Bruyn, 1986:130).

Between 1834 and 1840, about 15 000 Afrikaner farmers left the Eastern Cape and founded new states in the interior of South Africa (Du Bruyn, 1986:127). This signifies quite a large population movement from the Eastern Cape into the Orange River basin and the other international river basins of South Africa. However, one should keep in mind that not all these farmers went to settle in the Orange River basin only. Some, like Louis Trichardt, settled in the Limpopo River basin and others went to settle in the Incomati and Maputo River basins and other parts of KwaZulu-Natal. In February 1836, Hendrik Potgieter and his trek party reached and crossed the Orange River near present-day Bethulie (Wilcox, 1986:80). Henceforth, the political order of South Africa and the permanent settlement of the frontier would change forever.

It was in 1833 that the leaders of the *Voortrekkers* started to discuss the possibility of emigration from the Cape Colony. In 1834, Piet Uys went on an expedition through the Eastern Cape to KwaZulu-Natal (Schirmer, 1981:72). The purpose of this expedition was to ascertain the viability of a mass movement of people to the hinterland of South Africa.

The British Administration in the Cape however saw the Great Trek as illegal, for the *Voortrekkers* were British subjects. The *Voortrekkers* also took with them large volumes of gunpowder and many freed slaves without permission (Wilcox, 1986:80). A population increase, driven by migration, started to take place in the interior of South Africa. The *Voortrekkers* also moved into the territory (parts of the Free State) over which the Griqua, under Adam Kok, held sway. Kok claimed to have jurisdiction over them and disputed any claim to his territory. In 1845, the Governor of the Cape Colony, Sir Peregrine Maitland, convinced Kok to divide his territory. This division was into "alienable" regions where it was legal for Europeans to get land, and "inalienable" portions where it was unlawful to do so (Wilcox, 1986:80).

In the seventeenth century, groups of Khoi-Khoi started to settle in the interior, most notably in the Orange River basin, in reaction to the European land grab. At the end of the eighteenth century, the Griquas (*Basters* as they were also known) moved to the interior and established states at Griquatown and Phillipolis (Du Bruyn, 1986:128). Thus, it was not only the Great Trek that was the impetus for the establishment of new states in South Africa. By the end of the eighteenth century, the South African state started to take shape. This entity would later play an important role in the hydraulic mission. Furthermore, the internal migration of the Khoi-Khoi also led to an increased population in the Orange River basin.

Nevertheless, what were the causes of the Great Trek? The roots of the Great Trek are linked to political, demographic, economic, and miscellaneous factors.

Political factors no doubt played the dominant role. Firstly, the destruction caused by the Sixth Xhosa War (1834-5) on the livelihood of the Afrikaner farmers of the Eastern Cape was a stimulus (Ross, 1999:39). Secondly, there was displeasure among these farmers towards the policy of the British in South Africa, especially regarding Ordinance 50. This Ordinance removed all legal disabilities on "the free people of colour", especially the Khoi-Khoi and San. The London Missionary Society (LMS), under the leadership of Dr John Phillip, played a major role in the passing of it. The main gist of Ordinance 50 is summarised by Ross (1999:37). He states that John Phillip "... argued that, by preventing the Khoisan from taking their labour freely to the market, existing arrangements sinned against newly developed economic precepts and were therefore unjust and, by reducing the sum of wealth and thus increasing poverty, profoundly immoral". Thirdly, and related to Ordinance 50, slaves were freed and this was seen by the farmers as proof of the influence the "missionaries had over the colonial administration" (Ross, 1999:39).

In the fourth place, the Great Trek was a resistance movement against British colonialism and oppression (Du Bruyn, 1986:127). Fifth, more violent confrontations took place between the farmers and the Xhosa (Du Bruyn, 1986:129). In the sixth instance, there was also an increasing political alienation between the white farmers of the Eastern Cape and the British Administration of the Cape Colony. A strong British Administration limited the freedoms of political conduct of the Afrikaner farmer's defence, but could not guarantee their security. This contributed to their insecurity and unhappiness (Du Bruyn, 1986:129; Muller, 1968:154). Lastly, the farmers of the Eastern Cape had no say in the rule of the Colony. Even their share in the local governance was taken away. In other words, they were not part of a representative governmental system in the Cape Colony (Muller, 1968:158; Du Bruyn, 1986:130).

Economically the following reason can be stated. There was, since the 1820s, a greater demand for land for sheep farming that led to gradual emigration from the Eastern Cape to the north of the Orange River. Young farmers found it increasingly difficult to get land on which they could settle and start independent farming operations (Ross, 1999:39). To an extent, they could have opted for more intensive farming practices but required more time and suitable climatic conditions. Both the farmers and the Xhosa were pastoralists and pasture was of the utmost importance for their well-being. By 1830, the Eastern Cape had become overpopulated. The price of land rose sharply during the 1820s and 1830s and a number of droughts occurred during the same period. These droughts posed a direct threat to the lifestyle of the Afrikaner farmers, who saw it as demeaning to work as labourers for other

farmers. There was therefore a logical way out of this predicament: immigrate to the north where there was enough land and pasture (Du Bruyn, 1986:129).

There were also demographic causes: the *Mfecane* or *Difaqane* of the second decade of the nineteenth century (Edgecombe, 1986:115) played an important part as a cause of the Great Trek. This migration of Nguni- and Sotho-speaking peoples was far larger and more extensive than the Great Trek, but still had an impact on the start thereof. Firstly, it led to a depopulation of the interior of South Africa and land became available to Afrikaner farmers. Secondly, many *Mfecane* refugees settled in the Eastern Cape region, and this led to overpopulation and greater uncertainty regarding the security of the farmers in the area (Du Bruyn, 1986:128).

Another reason for the Great Trek was a sense of adventure and life on the "road" that was removed from the daily trappings of a settled lifestyle (Du Bruyn, 1986:130). Nonetheless, what were the consequences of the Great Trek on South African politics and South Africa's international rivers?

As regards the hydropolitical history of the international river basins, the Great Trek had the following outcome:

- It opened up the large hinterland of South Africa and consequently within one generation new territories were brought into the sphere of the European world (Schirmer, 1981:72; Du Bruyn, 1986:128).
- Ideologically, the Great Trek gave the Afrikaner a sense of republicanism, identity and the foundation of a racial policy (Du Bruyn, 1986:127). These would later have a profound impact on the formation of the South African state and the consolidation of its political economy from the mid-nineteenth century to the end of the twentieth.
- It had a profound influence on the colonial settlement of South Africa and the subjugation of the indigenous peoples, especially the Bantu (Du Bruyn, 1986:127).
- It led to the establishment of the ZAR and OFS as independent states in 1852 and 1854 respectively (Muller, 1968:182; Schirmer, 1981:76). This meant that South Africa's international river basins were effectively under the control of four entities and/or states: the Cape Colony, under British rule, the dominion of the Griquas, and the OFS and ZAR. Furthermore, the two Boer Republics could govern themselves and had a surplus of cheap labour (Muller, 1968:182), which could be employed in the agricultural sector. Moreover, they had enough land (Muller, 1968:182) for the establishment of an agricultural sector. The effective employment of the land did not start immediately after their establishment. The major reason for this was that the security situation was still characterised by uncertainty. During the Great Trek the Afrikaners came across a large number of Bantu communities and the Griquas, who raided, and were raided by them, from time to time (Ross, 1999:40; Du Bruyn, 1986:138). After the establishment of the two republics the farmers still had to move from their farms and towns to set up "laager" in the face of attacks (Du Bruyn, 1986:138). Thus, the hydraulic mission by individual farmers in the two republics did not start immediately after independence. They were still reliant on dry-land farming practices. This was especially the situation in the ZAR, where they could not devote much time to the building of the state (Du Bruyn, 1986:138). From this we can deduce that not much energy was spent on the establishment of irrigated agricultural practices because of an insecure environment. This was not the only reason, however. In

the middle of the nineteenth century not much was known about irrigation and the technology was not available for its establishment. This was also the situation in the Cape Colony and irrigated agriculture would only be propagated from the late 1870s onwards.

- The Great Trek also heralded the third phase of the opening of the South Africa frontier, or the so-called *Afrikaner* or new pioneering frontier (Giliomee, 1981:81).

4.6. The Third Phase of the Frontier

The *Afrikaner* frontier was a mixture of capitalism and subsistence farming practices. However, the subsistence element was predominant and, as has been suggested, no commercial farming activities appeared in the two Boer republics immediately after their establishment in 1854. Farmers also had to find labour in an environment where no market stimuli or government labour duress existed. As regards the land tenure system, the new Boer republics of the ZAR, OFS and Natal retained the Cape system. The *Voortrekkers* occupied land that had not yet been seized by other whites. Large tracts of land were taken over under a system of registering farms with the authorities. For instance, the payment of an annual quitrent was about ten shillings for a farm up to about 3 200 hectares (ha) in size. A further two shillings and sixpence was payable for an additional 100 morgen. There were, however, a number of *trekboers*, especially in the ZAR, who preferred not to take up land. The first settlers, on the other hand, were entitled to two farms as their "burgher right" (Giliomee, 1981:77, 82).

In 1847, shortly before the Boer republics came into being, British colonial rule officially extended to the Orange and Kraai Rivers. It was an important event in the hydropolitical history of the Orange River. It is not certain why Sir Harry Smith proclaimed the Orange River as the legal frontier. One guess was that it was because of reports of vast quantities of copper reserves in Namaqualand. The discovery of copper in this area led to the formation of the first mining company in South Africa – the South African Mining Company (SAMC). This could also be one of the first examples of the "flag following mineral discovery, foreshadowing the annexation of Griqualand West after the opening of the diamond fields" (Wilcox, 1986:24, 79). In 1854, large copper reserves were also discovered on the farm *Springbokfontein* (later *Springbok*) and mining operations were started by the SAMC (Wilcox, 1986:71).

In 1848, British sovereignty was established between the Orange and Vaal Rivers and east to the Drakensberg plateau. By 1849, the territory was made smaller when the Warden Line was drawn along the Caledon River. The river became the border between British territory and that of the Basotho under Mosheshoe. In the fertile area of the Caledon River valley the rainfall was higher than in the rest of the OFS and therefore much more suitable for the growing of grain. This area was valuable to white farmers, but for the Basotho it was of critical importance because the rest of their territory was too mountainous for the purposes of agriculture (Heydenrych, 1986:143).

Thus, land was still of the utmost importance for white farmers to make a living. Plans to use the Caledon River's water were not put forward because of the relatively high rainfall in the region. Therefore dry-land farming was still practised by the white farmers. Moreover, stock farming was of greater importance and did not require irrigation from the river. During much of the nineteenth century capitalism, the frontier, and land were closely linked. The *trekboers*

saw vast areas of land as a free commodity. These tracts of land were there for the taking. European social, legal, agrarian, and capitalistic ideas gave the notion of free land a new definition. During the nineteenth century whites in South Africa bought and held uninhabited lands. The reason for this was "the expectation that increased immigration would double their value; land located at a distance was purchased so that it could be sold on the market like futures in grain, gold, or any other commodity". Whites saw land in the same light as clothing: if it is worn out, one could throw it away and move on to a more fertile region (Thompson & Lamar, 1981b:29). Because of its abundance, land could be replaced. There was therefore no sense in constructing permanent water resources management infrastructures like dams and canals. It would have been a waste of valuable capital in any case.

This close link between the frontier and land was strengthened by the fact that land was substituted for money. The British government, for instance, paid citizens for military service with land guarantees. Also, through a number of land acts, the governments offered free land to advance settlement throughout the nineteenth century. This was also the case with the ZAR during the latter part of the same period. Furthermore, land or the ownership thereof was linked to individual status in the nineteenth century. It was a custom among the *trekboers* to own about 2 500 hectares, a custom which was also adopted by the *Voortrekkers* (Thompson & Lamar, 1981b:29, 30).

In 1857, an event took place that had a profound impact on the history of South Africa, especially concerning the distribution of one section of the Bantu population. This phenomenon took place among the Xhosa in the Eastern Cape and became known as the Cattle-Killing Delusion of 1857 (Wilcox, 1986:100).

After the War of the Axe (1846-7) the Xhosa encountered severe hardship when 40 000 head of cattle were seized from them for reparation. To exacerbate their predicament a severe drought also occurred in 1850, with a protracted war in 1855 against the British and lung sickness among their remaining cattle in the same year. The sickness killed about two-thirds of their cattle. The land was in a bad state and drastic measures were required to return it to its original health. A solution came in the form of two would-be prophets (based on the story of Jesus Christ). They were Sifuba-Sibanzi (the Broad-Chested one) and Napakade (the Eternal one). They "appeared" to a young girl, Nongqawuse, near the Gxarha River in the Transkei. They told her that if the Xhosas slaughtered all their cattle, burnt all their grain and destroy their pots, only then would their land return to its original health. They also promised that, should the Xhosa do this, they would come back with larger herds of cattle, the Xhosa would have enough grain and the whites would disappear. Thus, everything would return to normal. The Xhosa heeded this prophecy and about 90% of them slaughtered their cattle (about 20 000 head) and destroyed their grain (Ross, 1999:53).

On 17 February 1857, the Xhosa waited for the fulfilment of the prophecy. However, nothing happened, and thus Nongqawuse heralded a mass suicide of the Xhosa. Forty thousand died of starvation. Around the same number of Xhosa left their land to seek work in the Cape Colony. The Colonial government took advantage of the situation and forced the Xhosa into wage labour (Ross, 1999:53).

According to Ross (1999:53), "The Cattle-Killing" marks the end of the beginning of South African history. For the first time, an African society (other than the Khoi-Khoi) had been broken. Much land had already gone, but now Africans began moving out as labourers . . . It

was a process that was to be repeated less dramatically, throughout the rest of the country". Many of the Xhosas travelled to the towns and cities of the Western Cape to seek employment (Keegan, 1996:289).

Thus began the process of urbanisation by the Bantu of South Africa. Nonetheless, many worked on farms and some stayed behind to build up their livestock (Keegan, 1996:289). The "Cattle-Killing Delusion" would therefore start the gradual urbanisation of South African society. Furthermore, "in the eastern Cape an African commercial farming and trading class was emerging as an important economic and political factor out of the disintegration of Xhosa society" (Keegan, 1996:289). However, this episode in the history of South Africa did not have an immediate impact on water resources development. Economic development would have a more immediate impact.

During the period of the Great Trek, the frontier economy was gradually getting out of the grips of depression. There was acceleration in the transition from subsistence to commercial farming. The reason for this was an increase in the colonial European population from 25 000 in 1800 to 237 000 in 1865. This increase resulted in the development of roads, markets, and towns in the Cape Colony. The British government in the Colony also promoted economic development and firmed up tax collection (Gillmore, 1981:99). Ten years after the "Cattle-Killing Delusion" another significant event in the economic history of South Africa took place.

In 1867, the first diamond was discovered, near the Orange River in the Hopetown district. A diamond rush to the river diggings followed. This meant that railways had to be constructed, which facilitated the flow of people into the Cape Colony and public revenue rose rapidly, stimulating economic development. For instance, in 1855, colonial produce exported amounted to £971 000, and in 1875 it had increased to over £4 million (Union of South Africa, 1919:14).

4.7. The Final Phase of the Frontier

In addition, the discovery of minerals in South Africa heralded the final phase of the frontier. After the discovery of diamonds and gold, in 1867 and 1886 respectively, expansion of land settlement by whites accelerated, leading to more land coming under white control. Ever-increasing tracts of land were settled. Furthermore, the growth of the diamond- and gold-mining industries "brought an infusion of European technicians and capital and a railroad system deep into the interior" (Thompson & Lamar, 1981b:23). This technical skill, capital, and infrastructure were much-needed prerequisites for the development of irrigated agriculture later in the nineteenth century, at least in the Orange River basin in the Cape Colony. Irrigated agriculture would however not be implemented immediately.

Before the discovery of diamonds in 1867, farmers, especially in the OFS, concentrated on stock farming and wool production. In many cases they did not even produce enough wheat for their own consumption and had to import it from the Transvaal or barter it from Basutoland. The influx of huge numbers of fortune-seekers led to a change in the farming practices in the OFS. Nearly all land was settled and land prices increased substantially. There was also an increase in the hunting of game for food and hides. Hides were primarily used as a barter item. Consequently, many farmers found themselves in a predicament. They

could not use the traditional farming method of *trekboerdery* (trek farming – an extensive method), and fell on hard times. Some of them became *bywoners* (people living with settled farmers as labourers on these farms). This led to the so-called “poor white” problem (Van Schoor, 1987:252).

The problem of “poor whites” existed long before 1890, but it was in that year that the term was first used. The Afrikaner “poor whites” moved to the cities and the problem became a spectre of white politicians (Giliomee, 1981:104) – so much so that irrigation projects were developed to alleviate the problem, for instance the one at Hartebeespoort. Others took to transporting goods to the diamond fields. Due to the blossoming of Kimberley and surroundings, many farmers in the OFS started to move into diversified farming practices. They were no longer stockfarmers only, and started to plant wheat and vegetables. The production of foodstuffs by the OFS farmers was further stimulated by the discovery of gold on the Witwatersrand in 1886. By 1890, about 120 000 morgen of land were under cultivation in the OFS (Van Schoor, 1987:252).

In the first twenty-five years after the OFS’s establishment, the government did nothing to encourage stock farming and cultivation of foodstuffs. Despite criticism from the media and president Brand’s intention to encourage the planting of trees, there was no implementation of government irrigation schemes in the 1880s. The House of Assembly was always against these measures, with short-sightedness and self-interest being the obstacles. Traditional farming methods and a lack of imagination were also reasons that no progress was made on the agricultural front in the OFS (Van Schoor, 1987:252).

In both the OFS and ZAR, the frontier started to close as stronger central governments assumed control and land became scarcer. In 1889, the OFS started to receive revenue from customs. This had an enabling result on the politics and economy of the republic. The government could strengthen its control over its citizens and economic development. Before this, the OFS exported some wool, but imported wheat from Basotholand and the Cape Colony. Agricultural production was still mostly subsistence farming. The market at the Witwatersrand, the laying of a railroad and revenue from customs changed this. This brought an end to pre-capitalist, near-subsistence farming in the OFS, with the gold mines at the Witwatersrand leading to an increase in agricultural development in the north of the country (Giliomee, 1981:79, 101).

As regards the ZAR and economic development, the white population of the republic was too sparse and the commercial links too weak to bolster the development of regional economies. In the 1850s, there were mainly two small strips of settlement. One was in the west from Potchefstroom to Rustenberg and the other in the east from Utrecht to the Soutpansberg. The Highveld and other large areas were unoccupied by whites. In 1886, there was a ratio of less than one white per square mile in the ZAR. Of the 60 000 Afrikaners, most were concentrated in the southern half of the republic. By 1900, half of the land to which whites laid claim was unoccupied. Moreover, the ZAR was not part of South Africa’s economic heartland. The ports were far away, and the land was not suitable for the production of wool. Wealthy landowners did exist, yet many farmers were facing a crisis due to an exhaustion of resources for extensive subsistence farming. Trade was minimal and consisted mainly of barter. In 1886, when gold was discovered on the Witwatersrand, the ZAR was still not agriculturally self-sufficient. Besides this, the Afrikaners of the ZAR had great difficulty becoming cash-crop producers, because of their heritage as near-subsistence farmers

(Giliomee, 1981:103). To make a long story short, inadequate advances in knowledge prevented a shift from subsistence to commercial farming. By 1900, cheap land was unavailable and the frontier had closed in the ZAR. Before the closing of the frontier, drought and the Rinderpest of 1896, together with the Anglo-Boer War (1899-1902), crushed the farming community (Giliomee, 1981:104).

4.7.1. Drought and Rinderpest

From mid-1895 to late 1896, a severe drought raged over large parts of South Africa. Reports in the *Agricultural Journal*, published by the Department of Agriculture of the Cape Colony, were indicative of this drought. In July 1895, the Albany district reported that it "had no rain of any value for months ..." (*Agricultural Journal*, 1895a:365). In November 1895, the drought was so severe in the district that the Fish River had ceased to flow (*Agricultural Journal*, 1895b:585). In September 1895, it was reported from Warrenton that the season was dry and that rain was needed to improve the conditions of pasture (*Agricultural Journal*, 1895b:479).

The drought also led to distress in Namaqualand. The distress was so severe that a famine was reported in 1896. There were even rumours that some of the local residents had been driven to slaughter their children for food. These reports were unfounded. In any event, food had to be sent from the Cape to the region in order to alleviate the crisis, from which about 5 500 people suffered. The Cape Colony Parliament debated what to do about the crisis. Many MPs were of the opinion that the people in Namaqualand were too "lazy" to work the land in mission settlements. J.X. Merriman said that: "There were some places where there were large springs, but the people, through laziness and other causes, did not work the lands which were watered by these springs". He also asked parliament whether it was possible to implement irrigation works on the Orange River in order to settle some of the poorer people on land to be irrigated (Cape of Good Hope, 1896:109, 127).

This drought lasted until about the end of 1896. In December 1896 it was reported from Aliwal North "that the long-protracted drought which lasted in this district for upwards of eight months, ceased in the early part of this month, when copious rain fell, too late unfortunately to be of any benefit to last season's crops" (*Agricultural Journal*, 1896:1).

Not only was there a severe drought over large parts of South Africa during 1895-96, but the Rinderpest also swept through Southern Africa during that time. The Rinderpest broke out on 5 March 1896 in Bulawayo and rapidly spread south into Botswana. By 25 March 1896, the disease had infected the whole of Botswana with many Bantu people lost their cattle in Botswana. Because of the importance of cattle in the African political economy, it was proposed by the Cape Colony government that adult males should seek employment in the goldfields (Cape of Good Hope, 1896:110; South Africa, 1896:1, 23). Because of the outbreak of the disease and the drought in large parts of South and Southern Africa, 1896 became known as the "Year of troubles". It was estimated by the American historian, George Theal, in 1902, that the loss of cattle in monetary value was millions of dollars. In this year locusts also ravaged the agricultural sector of South Africa (Theal, 1897:434; Theal, 1902:464). These two events were the harbinger of things to come.

4.8. 1900 – 1909: The Closing of the Frontier and the Rise of Afrikaner Nationalism

Three years after the Rinderpest, the Anglo-Boer War broke out. The war was one of the most devastating ever fought on South African soil. It was also the greatest military confrontation in the colonial conquest of Southern Africa. This came as a surprise to both belligerent parties participating in the war – the Boer Republics and Britain (Van Zyl, 1987:329; Ross, 1999:72).

The war had a number of sources. There was a clash between Afrikaner (as the Boers were known) nationalism and British imperialism. The source of this clash is found in Cecil John Rhodes's ideal of creating a unified South Africa in which the ZAR and OFS would become British colonies. However, the two Boer republics resisted this initiative and communicated to Rhodes that they would like to remain independent. Within the ZAR, there was a large component of British subjects, the so-called *Uitlanders* (foreigners). These *Uitlanders* were in conflict with the ZAR because they had no voting right in the Republic and aspired to obtain that right. President Paul Kruger was not in favour of *Uitlander* voting rights, for he feared that the ZAR would lose its independence if there was a pro-British majority in government in the ZAR which would work towards the absorption of the Republic into the British Empire (Van Zyl, 1987:329; Ross, 1999:72).

Rhodes planned to gain control of the ZAR by initiating a raid (invasion) of the Republic in 1895. The British minister of colonies, Joseph Chamberlain, supported this plan. It became known as the Jameson Raid, after the leader of the group that led the expeditionary force, Dr L.S. Jameson. It was nothing other than an attempted *coup d'état* against the ZAR. The Raid failed, but had far-reaching consequences for South Africa (Van Zyl, 1987:330; Ross, 1999:69).

The Boer Republics were further alienated from the idea of a united South Africa under British rule. The divide between Boer and Brit widened and Afrikaners were strongly united in an upsurge of Afrikaner nationalism. The Afrikaners in the Cape Colony sympathised with their "brothers to the north" and the "Afrikaner Bond" broke its relationship with Rhodes. This led to Rhodes's resignation as Prime Minister of the Cape Colony. The OFS and ZAR's relationship became stronger, because the OFS saw the Raid as a threat to its independence. This led to an agreement between the two Boer Republics, in March 1897, that, in the event of a threat to their independence, they would support each other through any means at their disposal. In the light of this agreement, the Republics started to arm themselves militarily (Van Zyl, 1987:330; Ross, 1999:69).

The Jameson Raid therefore divided South African society into two camps: those who supported independent development (ZAR and OFS), and those who wanted to see a united South Africa under British rule (mostly English-speaking persons). The British government became more involved in the domestic politics of the ZAR, which it coupled with the grievances of the *Uitlanders* (Van Zyl, 1987:330-332).

The British government, through Lord Alfred Milner, who was appointed as governor and high commissioner to the Cape Colony in 1897, saw the ZAR, with its rich goldfields, as a threat to British hegemony in South Africa. There was the impression that the ZAR could rule South Africa, which would make British hegemony impossible. The discovery of gold in 1886 on the Witwatersrand changed the ZAR's status from a purely agrarian country to a

producer of a very large proportion of the world's strategic mineral (Van Zyl, 1987:331; Ross, 1999:69).

Milner also saw the ZAR as the fountainhead of Afrikaner nationalism. He believed that there was no place for an Afrikaner nation in South Africa; should this eventuate, the country would be lost to Britain. Milner therefore used every resource at his disposal to remove the ZAR as a threat to Britain in South Africa (Van Zyl, 1987:331; Ross, 1999:96).

At the beginning of 1898 Paul Kruger was overwhelmingly voted in as president of the ZAR. The OFS strengthened its relationship with the ZAR through the 1897 agreement. In the Cape Colony, W.P. Schreiner, with the help of the "Afrikaner Bond", took over the government from the Progressive Party in 1898. According to Milner, there was "no way out of the political troubles of South Africa except reform in the Transvaal or war". The chances of reform were slim (Van Zyl, 1987:332; Ross, 1999:71).

Milner used the *Uitlander* issue fully. The *Uitlander* issue was seen in the eyes of Britain as a scandalous affair – as discrimination against Britons. In 1899, before the outbreak of the war, the *Uitlanders* sent a petition to the British queen on grievances over voting rights, justice, administration, local authority, policing and public gatherings, and economic and cultural matters. Milner took up the opportunity the petition afforded, and used it as a reason for British involvement in the Transvaal's internal politics (Van Zyl, 1987:332; Ross, 1999:71).

Both Kruger and Milner made the mistake of thinking the *Uitlanders* to be a majority in the ZAR. This was not the case (Van Zyl, 1987:332). Kruger was therefore afraid that, should he give voting rights to them, the ZAR would lose its independence through an election. Milner, on the other hand, saw an overwhelmingly *Uitlander* vote as a stepping-stone to British control over the ZAR.

Milner convinced the British government that it should get involved in the ZAR's internal politics, as requested by the *Uitlanders'* petition. Chamberlain, however, told Milner that he should meet Kruger in Bloemfontein. This meeting was organised by President M.T. Steyn and Prime Minister Schreiner, of the OFS and Cape Colony, respectively. The conference was held on 31 May 1899. At the conference, Milner stated that *Uitlanders* should get citizenship after five years' residence in the ZAR and that those who had already been in the Republic for more than five years should get citizenship automatically. Kruger argued that it should be lengthened to seven years for those who were not yet living in the ZAR, and two years for those who had already been in the Republic for more than five years. The negotiations were a failure, because no compromise could be reached. Later the ZAR did accept the five-year consideration, but with conditions that Milner did not accept. For instance, the ZAR insisted that the British government should respect the sovereignty of the Republic and should no longer involve itself in the Republic's internal politics (Van Zyl, 1987:333). Non-intervention was therefore an important consideration on the part of the ZAR in its dealings with Britain.

The OFS was in agreement with the ZAR, but Steyn did everything in his power to avert a war. In the end he felt, like Kruger, that it was not about franchise but about the independence of the ZAR. The British in South Africa stood behind Milner, and public opinion in Britain was for a war against the ZAR (Van Zyl, 1899:333).

When further British demands were laid before the ZAR, Kruger answered with an ultimatum on 9 October 1899. Forty-eight hours later, on 11 October 1899, the ZAR and OFS declared war on Britain (Pakenham, 1986:200; Van Zyl, 1987:333; Davenport & Saunders, 2000:223).

This war was also known as the South African War, the Boer War, or, to Nationalist Afrikaners, as the Second Liberation War (the first being during 1880-1881) (Ross, 1999:72). The war had a devastating impact on the populations of the two Boer Republics. According to Ross (1999:72), the ZAR and OFS had a combined white population of 300 000. By the end of the war, 30 000 people from that population had died. Another 150 000 of the Republics' population were either prisoners-of-war or in concentration camps by the end of the war. The concentration camps were part of a policy by the British to crack the resistance of the Afrikaners. Inmates of these camps were mainly women and children who had been removed from the farms.

According to Davenport and Saunders (2000:225), "Faced with a type of warfare for which they were unprepared, the British commanders reacted with a good deal of unfeeling brutality". In March 1900, the British command, through Lord Kitchener, decided that the stalemate must be broken "by a double sweeping operation: to flush out the guerrillas in a series of systematic 'drives', organised like a sporting shoot, with success defined in a weekly 'bag' of killed, captured and wounded; and to sweep the country bare of everything that could give sustenance to the guerrillas: not only horses, but cattle, sheep, women, and children" (Pakenham, 1979:493).

Kitchener therefore decided to place the women and children in "protected 'laagers' alongside the railway lines". This was to prevent the guerrillas being helped by them. The placing of women and children in concentration camps and the burning of farms and agricultural produce defined the last phase of the war. After the war it was estimated that 30 000 farmsteads were destroyed, together with about 22 villages (Pakenham, 1979:494; Davenport & Saunders, 2000:226).

In the concentration camps, thousands of women and children died of infectious disease (mainly measles and amoebic dysentery). By October 1901 the mortality rate among the inmates had risen to 344 per thousand. By the end of the war, in 1902, 27 927 people had died in the 44 camps housing 111 619 people, of whom about 22 000 were under the age of 16. At individual camps like the one at Mafikeng, the figures for October 1901 represented an annual death rate of 173% (Pakenham, 1979:517; Davenport & Saunders, 2000:228; Ross, 1999:73).

The war also took a toll on the black population of the country. Blacks were used on both sides "to dig trenches, drive wagons, collect firewood, attend to horses . . . [as] convoy guards, dispatch riders, watchmen in blockhouses and scouts". Even so, the blacks and coloureds were highly pro-British. This does not mean that they escaped the scourges of the concentration camps, especially the blacks. There were 29 African camps housing 107 344 people by the end of the war. "The death toll was not as high in the white camps during the early months, but at the end of the war it was considerably higher, and rose to the very high figure of 372 per thousand . . .". Of the 107 344 black people detained in concentration camps, 14 154 were dead by the end of the war (Davenport & Saunders, 2000:231).

The two Boer Republics surrendered as a result of the hopelessness of their position and the suffering of their women and children in the camps. Yet one should not forget the plight of black people during the war. According to Ross (2000:73): "The British treated the Africans in the captured districts of the Transvaal [ZAR] and Free State [OFS] more harshly than they treated the whites, and the Boers shot any armed blacks they encountered".

The Anglo-Boer War, fought to determine which white authority held real power in South Africa, officially ended on 31 May 1902, with the signing of the Treaty of Vereeniging. The British annexed the Republics, as the Transvaal and the Orange River Colony (ORC). Although the colonies were not united, a single man, the high commissioner, Lord Milner, had authority over all four colonies (Cape, Natal, Orange River, and Transvaal). This was in addition to the protectorates of Basutoland, Bechuanaland, and Swaziland (Van Jaarsveld, 1975:210; Davenport & Saunders, 2000:233; Ross, 1999:74).

After the end of the war, emphasis was placed on the economic reconstruction of the new colonies. Part of the initiative was that the British authorities ensured that landowners in the Transvaal and ORC regained power over their farms. Irrespective of this, the war had an impact on South African society in that it accelerated the urbanisation of the Afrikaner. Afrikaners were impoverished and thousands left their farms and settled in cities. This heralded the end of their "old way of life". No longer was there an open frontier without the British on which to continue their extensive agricultural existence. "The borders were closed – the North was British" (Van Jaarsveld, 1975:210; Davenport & Saunders, 2000:236; Ross, 1999:74).

At around 1900, the closing frontier had a number of characteristics. Land resources became scarcer. Near-subsistence farming changed to more intensive utilisation of land and there was a gradual rise of commercial farming activities. Regional markets and towns also developed. This was a move away from distant markets and wandering traders (Giliomee, 1981:93). The aftermath of the war and the reconstruction of the economy of new colonies would be the defining characteristic of the years immediately after 1902.

In his economic reconstruction effort, Milner saw that he had to bring the mines of the Witwatersrand back into production as soon as possible, get agricultural production on track, build up the railways for the proper flow of goods, and complete the initiative of a customs union which came to end before the war (Davenport & Saunders, 2000:237).

Gold-mining production levels rose steadily from 1902 onwards. By 1904, they were back to their pre-war production level. They ballooned after that. The value of gold-mining rose from over £1 million in 1901 to £20.9 million in 1905 and £32 million in 1910. This was despite a serious labour crisis, which Milner resolved. He did this by recruiting Shangaan workers from Mozambique, and introduced "indentured" Chinese labourers from 1904. The Chinese were brought into the gold-mining industry to work as unskilled labourers. About 60 000 Chinese men were introduced to the mining industry between 1904 and 1907 (Ross, 1999:78; Davenport & Saunders, 2000:237).

However, there was a price to pay. In the mines, an agreement had to be reached with white mineworkers before they consented to the proposal. The result of this was a clear division of labour between skilled and supervisory workers (exclusively white), and unskilled workers (mainly Chinese or blacks). The second price was of a political nature. The controversies

surrounding the Chinese labour issue allowed *Het Volk*, a political party led by generals Louis Botha and Jan Smuts, to garner support on a populist programme (Ross, 1999:79). Both Botha and Smuts were Afrikaner generals during the Anglo-Boer War.

As a result of this programme, *Het Volk* won the Transvaal elections of 1907. This was a defeat for the British imperialist programme. It was the first time that there was a head of government in South Africa whose first language was not English. Three years after the electoral victory of *Het Volk*, the Union of South Africa was established (Ross, 1999:79).

4.9. 1910-1948: From Union to National Party Victory

4.9.1. Establishment of the Union of South Africa

In 1910, the Union of South Africa was established, with Louis Botha as its first Prime Minister (Davenport & Saunders, 2000:267; Ross, 1999:79). According to Geldenhuys (1984:1-2): "The Union of South Africa . . . was from a constitutional point of view little more than an enlarged self-governing British colony composed of four smaller self-governing colonies (the Cape Colony, Natal, Transvaal and the Orange River Colony)". According to the South African Act of 1909, Parliament consisted of the King of England, the Senate, and the House of Assembly. The Governor-general represented the British monarch. The King who acted on advice of a British minister appointed the Governor-general. This Governor-general, in return, received instructions from the King (advised by a British minister), regarding the signing of bills or reserving signature for the Crown. Furthermore, this Governor-general also served as a representative of the British government in South Africa. He was, moreover, the high commissioner (ambassador) for the British territories of Bechuanaland, Basutoland, and Swaziland. Two years after the establishment of the Union, and organisation, that later played a prominent role in South Africa's history, was also established in reaction to the exclusion of blacks from the Union process.

4.9.2. The Establishment of the ANC

In 1912, the South African Native National Congress (SANNC) was established in Bloemfontein. John L. Dube, a leading Natal educationalist, was the first president. In 1925, the organisation changed its name to the African National Congress (ANC). Yet it was not the ANC that initially challenged the segregation of South African political society. This was still in the hands of the mission-educated Christian elite. A majority of the ANC's first council were ministers of the gospel. The ANC lobbied government to end segregation through petitions and delegations, which were highly ineffective, for several decades. The ANC's symbolic function as a national forum for African opinions (Ross, 1999:85-86). It was only later in the twentieth century that the ANC would become a major political force on the South African political landscape.

4.9.3. The 1913 Land Act

The first attempted implementation of segregation after the establishment of the Union and regarding rural areas, which had been alienated into farms for white owners, was the Natives

Land Act of 1913. This Act established a clear distinction between African Reserves and white farming areas. Under the Act, no land could be shifted from one category to the other. This meant that blacks were no longer allowed to purchase land within white areas. The Cape Province was the exception. The courts in the province disallowed the Act because it made it impossible for blacks to acquire the "wherewithal to become voters" (Ross, 1999:88).

Because of the passing of the act in the other three provinces, about 87% of the country became known as "white land", and seven per cent, which increased to 13% in 1926, African Reserves. The Act also made it illegal for blacks to use white farmland, and to compensate the farmer with labour only. Sharecropping was therefore outlawed (Ross, 1999:88). The Land Act was a significant event in South Africa's domestic politics, the First World War, on the other hand, would have an impact on the country's foreign affairs.

4.9.4. The First World War

In 1914, the Imperial Government asked the South African government to invade German South West Africa, the colonial territory of a friendly power. The purpose of the invasion was to immobilise radio stations and capture Swakopmund, Luderitzbucht, and Windhuk (now Windhoek). Botha was told by Britain that if South Africa did not act, other Imperial forces would be sent. The South African government therefore had to view the matter from two sides. Firstly, it was a matter of immediate military necessity. Secondly, the longer-term national interest also played a role, with the incorporation of the territory in the Union as a possibility. There was, however, serious opposition both from a number of cabinet members and members of the opposition ranks towards the move. Individuals who desired the restoration of a Republic in South Africa were also opposed to the military involvement. They instead wanted to take up arms against the British, because the Anglo-Boer War was still a fresh memory. Among them was Gen. Mannie Maritz, a veteran from the Anglo-Boer War on the side of the Boer Republics (Liebenberg, 1987a:404; Davenport & Saunders, 2000:283-184).

On 9 October 1914, Maritz rebelled and joined the Germans. Other former Anglo-Boer generals also rebelled, most notably Gen. C.F. Beyers and Gen. C.R. de Wet. The rebels, many of whom were poor whites, were soon put down. The consequence of the 1914 rebellion was that it produced a number of legends and martyrs to inspire a new Afrikaner nationalist movement in the 1930s (Davenport & Saunders, 2000:284-285).

Despite the rebellion, South Africa managed to capture German South West Africa. The campaign was over in about three months and culminated in the surrender of the German governor Dr Theodor Seitz on 9 July 1915 and the German forces between Otavi and Tsumeb. From 1915 onwards South West Africa was administered by South Africa, initially more or less as a colony (Liebenberg, 1987a:409; Ross, 1999:84).

The administering of South West Africa (now Namibia) was to become one of the issues that would later contribute to South Africa's status as a pariah in world affairs. However, from 1915 onwards, the water resources of the territory would also be managed by South Africa, in particular the Fish River, a tributary of the Orange that originates in Namibia.

Apart from the management of the territory's water resources, the First World War had a significant impact in the operations in which the Department of Irrigation was involved. Large numbers of the Department staff went on active service and large quantities of the Departmental building material were placed at the disposal of the Department of Defence. As a result, the Department's activities were confined to the most essential. In addition, unprecedented rain (accompanied by floods) broke the severe drought that prevailed during the first part of the First World War in 1916. This necessitated the passing of special legislation to provide distress relief to the victims of both the drought and the floods. Thereafter the Department devoted itself to an active policy of continuous development. This policy led to the construction of a number of major dams with crest heights in excess of 20m above foundation level: the Hartebeespoort Dam (59m), Lake Mentz (34m), the Tygerpoort Dam (20m), the Kammanassie Dam (41m), the Grassridge Dam (24m) and Lake Arthur (38m) (DWA, 1988:2).

4.9.5. Miners go on Strike

One of the most important political events in the early 1920s was the strike on the gold mines of the Witwatersrand in 1922. It started as a strike, but later became a rebellion against the Smuts government. This event should be seen against the backdrop of the collapse of the South African economy, which started in 1920, after the post-First World War period of economic advancement and inflation. The symptoms of this depression, from 1920-1923, were mainly the same as any other depression before and after the early 1920s. These symptoms were a decreased gold price, loss of profit, large-scale bankruptcy, budget deficits, unemployment and wage cuts. Even the gold-mining industry was hit hard (Liebenberg, 1987a:414-415).

The gold price decreased (from £130 per ounce in Feb. 1920 to £95 per ounce in Dec. 1921) together with gold production (from 8 332 000 fine ounces in 1919 to 8 129 000 in 1921). Production costs also increased. Because of this, the Chamber of Mines decided that the wages of workers should be cut. On top of this, it was also decided that the ratio of black and white workers should be changed, in that more blacks should be employed. The miners did not agree to both these terms. The rationale behind the decision to employ more blacks was that the black mineworker was employed at £1 per week, while the white mineworker worked for £1 per day (Liebenberg, 1987a:414-415).

Coal miners started to strike on 1 January 1922. Their gold-mining counterparts started their strike on 10 January. This was after there was a cut in wages in both sectors. On the Witwatersrand 20 000 miners went off work. This also meant that 180 000 black mineworkers were unemployed. On 5 February, the miners on the Witwatersrand decided at a meeting to overthrow the Smuts government with violence, and to establish a republic. There was even violence against black workers (Liebenberg, 1987a:425-416).

On 10 March 1922, Smuts declared Martial Law, and the army, supported by the air force, went into Johannesburg. After a number of street battles, the strike was violently ended, with the suicide of the strikers' leaders, Fisher and Spendiff, on 14 March 1922. With the demise of the two, the influence of the Council of Action, that organised and mobilised the striking workers, was ended and the workers returned to their jobs (Liebenberg, 1987a:416).

The failure of the strike, in which 153 people lost their lives, meant that more blacks were employed at the expense of whites, and the wages of white mineworkers were lowered. For the Smuts government, the strike, and the violent suppression of it, had dire consequences. The strikers supported the opposition political parties, the Labour and National Parties. In June 1924, Smuts called a general election. His South African Party lost the election to the Labour-National Party coalition. Smuts resigned and the governor-general called on Hertzog to take over the reins (Liebenberg, 1987a:417-418).

4.9.6. Economic Prosperity

From 1924 to 1929, South Africa's economy flourished (Selby, 1973:235). The growth of the economy was mainly due to the discovery of new diamond fields, the protection of the agricultural industry, and the promotion of local industries. There was a sharp increase in the value of diamond production – from £6 million in 1923 to £14.5 million in 1927. This increase was due to the discovery of rich fields at Lichtenburg in the Western Transvaal (now North-west Province) and at Alexandra Bay at the mouth of the Orange River (Liebenberg, 1987b:425).

The coalition government also stepped in to stimulate the agricultural sector. This was done to stabilise, control, and develop it. For instance, the customs and excise tax on sugar was increased from £4 10s to £8 per tonne. The government also started to develop local industries. This was done for two reasons. Firstly, factories would give much-needed jobs to poor whites. Secondly, local industries would give the South African economy a more assured measure of independence. To protect local industries from external competition, the government started to increase import tax on certain goods from overseas. On the other hand, primary resources used in the production process were imported with no tax levied at all. The consequence of this protectionist policy was large-scale industrial development in the period 1925-1929. The number of factories increased from 6 009 to 6 238. The value of production grew from R49 million to R67 million, and the number of workers increased from 115 000 to 141 000 (Murray & Stadler, 1986:250; Liebenberg, 1987b:425).

On the industrial development front, government established the Iron and Steel Corporation Ltd. (ISCOR) in 1928. The reasons for the establishment of ISCOR are manifold. ISCOR would play an important role in stimulating industrial development. South Africa was also rich in iron ore and coal, two important resources needed to sustain such an industry. The National Party saw an opportunity, in the establishment of ISCOR, to make the country less dependent on Great Britain. The Labour Party, in the coalition, was "happy" about government involvement in the industry. This meant that capitalists would not "walk away" with all the profit (Liebenberg, 1987b:425).

4.9.7. Economic Depression

From 1929, South Africa increasingly began to feel the effects of the world economic depression. This depression, which started in the United States of America (USA) in October 1929, when the New York Stock Exchange (NYSE) crashed, lasted until 1932. From there it spread to the rest of America, and eventually to the rest of the world. This depression led to decreased wool, gold and maize prices (the price of maize declined by half from 1929 to

1933), unemployment increased drastically, and the number of bankruptcies grew enormously. There was, during 1930-1932, a general collapse of the South African economy (Selby, 1973:235; Murray & Stadler, 1986:254; Liebenberg, 1987b:431; Beinart, 1994:109). If that were not enough, South Africa also experienced a drought of immense proportions.

4.9.8. Drought

From 1932-1933, South Africa faced one of its most serious **droughts** of the twentieth century. In some places, the drought started in 1930. By October 1933, it was reported that nearly 6 million sheep had died. The drought therefore had a negative impact on the agricultural sector, in that production levels decreased dramatically. The drought was so severe that parts of the Orange and Vaal Rivers dried up. At Hopetown, the Vaal River could be crossed on foot (Keesing's, 16 October 1933:983; Liebenberg, 1987b:431).

In early December 1933, the drought was broken, when heavy rains fell over large parts of South Africa. The Orange and Vaal Rivers flowed again, and by mid-December 1933, the drought was definitely broken (Keesing's, 9-10 December, 1933:1015). There was also a link between the drought and social welfare policy.

4.9.9. Poor Whites

As regards the social history of South Africa, social welfare policies began before the end of the nineteenth century. This was stimulated by the rise of the "Poor White" issue. This issue was responsible for a number of projects (water resources development and road and rail projects included), reports, and conferences. These elements culminated in the Carnegie Poor White Commission Report of 1929-32. All these efforts achieved positive results during the 1930s regarding the problem of poor whites. The Kimberley conference in 1934 was called at which H.F. Verwoerd first made his name in public life. The establishment of the Department of Social Welfare followed in 1937. The problem of Poor Whites was gradually solved as the mainly Afrikaner poor were drawn, largely by community efforts, into forms of suitable employment (Davenport & Saunders, 2000:334, 665).

4.9.10. Abandonment of the Gold Standard

On 20 September 1931, Great Britain announced that it was abandoning the gold standard and sterling was devalued. This was an attempt by the British government to reflate its economy. The event that brought about the British decision was the European financial collapse, which was dubbed "a crisis within a crisis". South Africa did not follow the British example, however. Hertzog did this from a national economic independence and nationalism point of view. However, the highly valued South African pound made life very difficult for agricultural exporters in an already depressed market. Hertzog's cabinet therefore decided that it would tax the profitable mining industry, to support agriculture until these markets recovered. Nonetheless, Hertzog abandoned the gold standard in December 1932, after pressure from his former Justice Minister, Tielman Roos, and other Afrikaner politicians and the mining industry (Selby, 1973:235; Murray & Stadler, 1986:254; Liebenberg, 1987b:431; Beinart, 1994:111).

4.9.11. Afrikaner Nationalism

Due to Hertzog's increased unpopularity and the economic whirlwind of the early 1930s, he called an election in 1933. The South African Party won, and in 1934, it formed a coalition government with the National Party, to form the United South African Nationalist Party (UP). This government was called the Fusion government. Hertzog remained the prime minister and minister of external affairs, while Smuts became his deputy and minister of justice. Yet some Nationalists rejected the coalition. Dr D.F. Malan was one, and he and a number of other Nationalists from Hertzog's party established the Purified National Party. The break between Hertzog and Malan heralded a new phase in the history of Afrikaner nationalism. Where Hertzog had been the leader of Afrikaners, Malan increasingly became the central mouthpiece of the Afrikaner's ambitions. With this, Afrikaner nationalism became more aggressive in that the Republican ideal was now more strongly pronounced. Afrikaners also became more intolerant of other ethnic groups. The Voortrekker centenary celebrations in 1938 were a major stimulant of this (Murray & Stadler, 1986:255; Liebenberg, 1987b:445; Beinart, 1994:112, 113). On the economic front during the 1930s there were also major developments.

4.9.12. The Midas Touch and the "Long Economic Boom"

ISCOR started production in 1934. The result was that locally produced steel increased sharply. This increase stimulated small-scale engineering shops, metal works, and foundries. They developed particularly around the Witwatersrand, where most of the customers were to be found. Employment in this sector quadrupled between the mid-1920s and the end of the Second World War. There was, at the same time, an increase in textile and clothing manufacturing, and in the food and canning business. Total employment in manufacturing rose from about 120 000 in 1925-26 to around 380 000 at the end of the war (Ross, 1999:106-107). However, it was gold and the production thereof that played the major part in the stimulation of the South African economy in the 1930s.

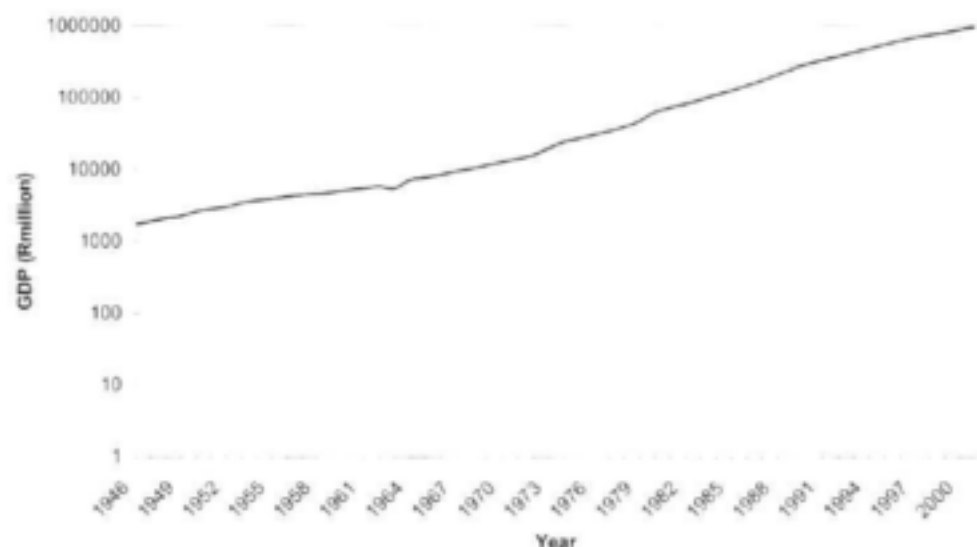
After the depression, South Africa's economy was stimulated by the production of gold. The demise of the gold standard resulted in the doubling of the gold price within a decade. This meant that lower grade ores could be exploited on a scale not previously imaginable. Gold production increased 33% from 333 316 kg in 1931 to 448 128 kg in 1941. This was a small increase. However, the tonnage of rock processed increased from 29 to 63 million tonnes. The total income from gold increased 2.5 times to £120 million in 1941. Employment in the gold-mining industry increased from about 200 000 black workers in 1929 to over 383 000 in 1941 and the number of white miners rose from 22 000 to 41 424 (Beinart, 1994:112).

The mining industry was not a large earner of state revenue before the depression. This changed in the post-depression world, especially in Franklin D. Roosevelt's "New Deal" USA. In South Africa, the Fusion government broke with precedent and imposed an excess profits tax on gold. The result was that state revenue from the gold-mining industry rose from about £1.6 million annually between 1925 and 1930 to over £12 million in 1933 and £22 million in 1940. Stated in another way, it meant an increase from six per cent of total state revenue to about one third. Beinart (1994:113) states that: "With resources on this scale, the

government could conceive of projects that had not been possible since the days of reconstruction after the South African War". Among these projects were water resources development schemes on South African international and national rivers.

Moreover, the income from the gold-mining industry diffused through the rest of the economy. This led to the so-called "long economic boom". This "boom" lasted from 1934 to the early 1970s. In the 1920s and 1930s, South Africa developed from an agricultural-mining economy to an agricultural-mining-manufacturing economy. The manufacturing industry's share of gross domestic product (GDP) increased from 8% in 1926 to 11% in 1936; by the 1950s, it was already well over 18% (see Figure 1) (Geldenhuys, 1990:331; Ross, 1999:106).

Figure 1
Gross Domestic Product (GDP) Increase: 1946-2001



Source: Statistics South Africa, 2002

White farmers were the greatest beneficiaries of the "long economic boom". The reason for this was that they were the people hardest hit by the depression and drought of the early 1930s. To assist farmers, considerable sums of money were transferred through Land Bank loans. For instance, £2.5 million was distributed under the 1932 Soil Erosion Act for dams, boreholes, and contour works. Support also came to farmers through a complex system of price protection. The process of stabilising and protecting prices started in the 1920s with wine and tobacco. In the 1930s, this included almost every agricultural commodity. Control Boards, as was the case in Britain, were established to manage the market. In 1937, a Marketing Act regulated the entire system. Under this Act Boards would work with white farmer cooperatives as sole purchasers of a number of commodities. By 1950 over 90% of white farmers belonged to at least one cooperative. Beinart (1994:113) notes that: "De Kiewiet argued in a memorable if not accurate aphorism that South Africa 'came . . . to be farmed from the two capitals, Pretoria and Cape Town'".

4.9.13. The Second World War

The outbreak of the Second World War on 3 September 1939 was another stimulus to South Africa's superb economic growth rate. The reasons for this were that repair facilities were provided to allied shipping, imports were also constricted and potential markets opened in the Middle East and South Asia. During the first two years of the war, there was little change in the economy of South Africa. However, as the war progressed life essentials and trade goods became scarcer, although there was enough money to buy these. The gold price increased from R14.80 per oz. in 1939 to R16.80 per oz. in 1945. There was an increase in exports and a decrease in imports, and other countries spent more money in South Africa. However, prices on consumer goods started to rise. Many agricultural commodities were also in short supply, like meat, sugar, maize, and wheat. These shortages in agricultural products fuelled the rumour that an agricultural country like South Africa could not satisfy the demands of the food security of its population. However, by 1947 these shortages were no longer a reality (Liebenberg, 1987c:458; Ross, 1999:106).

Despite the shortage of many consumer goods, the war years in South Africa were a time of wealth. This was because there was still a good external market for South African primary goods like gold, wool, and diamonds. Living standards, especially among whites, improved. This was especially the case with the poor whites because their income increased substantially. South Africa was a rich country after the war. During the period 1939-1948, industrial development increased sharply (Liebenberg, 1987b:458-459).

On the political front, the war had a different impact. Hertzog was of the opinion that the war was a war between European hegemonies, and that it had nothing to do with South Africa. He therefore stood for neutrality. Smuts, on the other hand, held the view that South Africa should militarily support Britain against Nazi Germany and Fascist Italy. The rest of the cabinet was divided on the issue: five supported Hertzog Smuts received support from six. The House of Assembly therefore had to decide the matter. On 4 September 1939, the House of Assembly voted 80 against 67 votes in favour of South Africa's involvement in the war on the side of Britain. The Fusion government split, and Hertzog resigned as Prime Minister. The governor-general asked Smuts to appoint a cabinet, which he did, and he became the new Prime Minister of South Africa (Liebenberg, 1987b:450-451).

On 6 September 1939, South Africa became directly involved in the Second World War. More than 2 million South Africans voluntarily joined the armed forces; this included 120 000 blacks. Large numbers of South Africans did military service and were directly involved in the war in North Africa, East Africa, Italy, and Madagascar (Stadler, 1986: 263; Liebenberg, 1987c:452).

4.9.14. Dissent and the Smuts Government

However, the most important political aspect during the period 1939 to 1945 was not the involvement of South Africans in the war. It was, rather, the domestic dispute that was unleashed by the war. South Africans were deeply divided over involvement in the war. Two groups emerged during this period: those who supported the war effort and those who were against it. A repeat of the 1914 rebellion was a possibility, but the Smuts government

confiscated all privately held firearms. Hertzog and Malan calmed their supporters and denounced any unconstitutional or violent practices during the time. The only Afrikaner nationalist grouping that perpetrated violence was the Ossewa-Brandwag (OB) (Ox-Wagon Sentinels). An extremist grouping of the organisation, the Stormjaers (Storm Troopers), committed acts of sabotage, and clashes between members of the OB and troops occurred. However, they were soon removed from society by landing up in intern camps and jail (Liebenberg, 1987c:455).

During the Smuts Government, between 1939 and 1948, blacks also started to voice their unhappiness. This was not because they were against South African involvement in the war, but because of the secondary status they had in South African society. This unhappiness among blacks manifested in the outspokenness of the Joint Council of Africans,⁵ established in 1936 by the Hertzog government, against the pass laws. These laws had to be scrapped, the Council argued. The Council's argument for this was that the pass laws were a constant irritation for black South Africans. The Council also asked government to buy more land for the establishment of black "homelands". It tried to convince government, in the third place, to appoint more representatives in the legislative organs of government. Thus, the Council was against government's segregation and discriminatory policies (Liebenberg, 1987c:460-461).

In the 1930s, the ANC was a passive organisation, but it gained new life during the war years. The reason for this was the establishment of the Joint Council of Africans and the proclamation of Roosevelt and Churchill's Atlantic Charter, which raised political awareness amongst blacks. Another reason was the election of Dr A.B. Xuma as president of the ANC in 1940. Xuma reorganised the ANC by amending its constitution, got the support of black intellectuals, indicated the importance of mass support, and started to progressively push for more rights for blacks. In 1949 the ANC adopted its Programme of Action, and in December 1949 the organisation committed itself to a plan of resistance (Liebenberg, 1987c:461-464).

Thus, the ANC started to play a more meaningful role in South African politics during the rule of the Smuts government (1939-1948). Before and during this time, the ANC's actions or opposition took the form of resolutions, protests, propaganda, deputations, enquiries, passive action, education, lectures, and distribution of literature (Motlhabi, 1984:39).

This role would become more pronounced in the early 1940s and more so from 1948, with the rise of the National Party to power and the advent of Apartheid. For instance, by 1941 the ANC was speaking explicitly of the right of franchise for all Africans in South Africa. As part of its policy, it demanded the representation of Africans in all government departments. During this time the ANC stood for "racial unity and mutual helpfulness, and for the improvement of the African people, *politically, economically, socially, educationally, and industrially*" (Motlhabi, 1984:40).

Nevertheless, industrial development in the post-war era, combined with population increase and an increase in the standard of living, placed drastic new and increasing demands on the limited water resources of the country. This necessitated urgent and innovative planning to provide water where it was needed. Where local resources were fully utilised water had to be imported from elsewhere. It soon became evident that the solution lay in the inter-basin

⁵ The Council consisted of 16 black members and six white members (Liebenberg, 1987c:460).

transfer of water from one catchment where supplies were not fully utilised to another catchment where the cost of such a scheme was justified by the demand (DWA, 1987:2). Most of South Africa's water resources were mobilised, especially from the early 1960s onwards, in this way. The governments responsible for most, if not all, of these projects were successive National Party Governments.

4.10. 1948-1990: Apartheid and South Africa's International Isolation

This section of the report looks at the period 1948 to 1990. Both these years were important in South Africa's political history. The year 1948 saw the gradual advent of Apartheid, on a grand scale. This policy led to large-scale turmoil, originating especially from black people's dissatisfaction with it, and South Africa's subsequent international isolation. During the period 1948 to 1990, South Africa became one of the world's most isolated states – a pariah or "pole-cat" in the world community. As one observer puts it, "In South Africa all social problems are complicated by race differences and race dominance, so much so that South Africa may be said to be one of the storm centres of the world so far as race relationships are concerned" (Longmore, 1954:196). The political dominance of one race over another, and the reaction from the rest of the world it created, was to set the tone for this period.

4.10.1. Codification of Apartheid

In 1948, the National Party⁶ came to power. Part of the reason the National Party won was that it played the "colour" or the "black danger card". The independence of India and Pakistan in 1947 and an anti-colonial sentiment in Africa instilled a fear among white South Africans that they might lose their supremacy over blacks (Liebenberg, 1987c:474-475).

Be that as it may, the ascendancy of the National Party opened "a new chapter in South Africa's domestic politics and foreign relations: it heralded the era of apartheid". During Malan's tenure in office (1948-1954), the legislative foundations of an apartheid South Africa were laid. A number of key policies were implemented. These included the following:

- The Prohibition of Mixed Marriages Act, 1949;
- The Immorality Act, 1950. This Act prohibited sexual intercourse between whites and non-whites;
- The Population Registration Act, 1950. This Act provided for the classification of every South African along racial lines; and
- The Group Areas Act, 1950. This Act stipulated separate residential areas for exclusive occupation by particular racial groups (Geldenhuys, 1984:1, 11).

In other words, successive National Party Governments implemented Acts that determined whom a person could marry; with whom one could have sex; what type of person one was; and where a person must live, according to a strict racial categorisation. For instance, sex between two black persons was allowed, but not between a white person and a coloured person. Moreover, a white person was not allowed to marry a black person, except outside the borders of South Africa (Liebenberg, 1987c:493-494).

⁶ Until 1951 the National Party was known as the *Heerenigde Nasionale Party* (Geldenhuys, 1984:1).

The apartheid policy of the Malan government was not a new policy. It was an old policy that can be traced back to the time when Jan van Riebeeck was commander of the settlement at the Cape of Good Hope. Van Riebeeck planted a line of trees to indicate the border between whites and Hottentots. In addition, at Union the laws governing African settlement in towns and cities varied from province to province, and indeed from town to town and city to city. This changed in 1923 when the Natives (Urban Areas) Act was passed, which unified the regulations. These technocratic policies were also underscored by a theory enunciated by Col. C.F. Stallard⁷ that South Africa's towns were for the whites, and that blacks were only to be there in so far as they were "ministering to the white man's needs". Furthermore, political power in the Union was in white people's hands. All whites (men and women) over the age of twenty-one years of age could vote. Africans, Indians, and all but a handful of coloureds were excluded from the voters' roll (Stent, 1948:71).

However, the apartheid policy before 1948 and after 1948 was not the same. The differences lay in the objectives, consistency, and determination with which the policy was implemented after 1948. Where before 1948 there were unwritten practices, these were implemented by the governments of Malan, Strydom, and Verwoerd through laws. The laws, mentioned above, classified apartheid into a number of categories: social apartheid, residential apartheid, cultural apartheid, economic apartheid and political apartheid (Liebenberg, 1987c:493; Ross, 1999:98).

Malan also initiated the removal of coloured people (descendants of the Khoi-Khoi and San peoples) from the voters' roll in 1956. This was during the premiership of J.G. Strydom, and after a continued political and legal battle. For blacks in the so-called reserves, a three-tier "Bantu authority" system was created in 1951. This system was a mixture of traditional and Western forms of authority (Geldenhuys, 1984:11).

4.10.2. The Tomlinson Commission

In 1951, the Tomlinson Commission was appointed by Dr E.G. Jansen, then Minister of Native Affairs. This Commission stood under the leadership of Prof. F.R. Tomlinson, professor of agricultural economics at the University of Pretoria "and an authority on Bantu Affairs". The rationale behind its establishment was to investigate the socio-economic problems of the reserves with a view of increasing their human carrying capacity. Verwoerd, when he took over from Jansen, privately resented him for appointing the Commission. Verwoerd would also later reject the findings of the Commission on a matter of principle. Instead, Verwoerd set up an inter-departmental committee to investigate the location of industries near the reserves to cut down on the "black invasion" of white urban areas (Keesing's, 27 March, 1956; Davenport & Saunders, 2000:388-389).

Verwoerd, as Minister of Native Affairs, implemented apartheid with zeal. He summarised the policy of apartheid as follows: "Apartheid comprises a whole multiplicity of phenomena. It comprises the political sphere; it is necessary in the social sphere; it is aimed at in Church matters; it is relevant to every sphere of life. Even within the economic sphere, it is not a

⁷ Stallard was the leader of the extremist Dominion Party during the 1930s (Liebenberg, 1987b:449).

question of numbers. What is of more importance there is whether one maintains the colour bar or not" (Davenport & Saunders, 2000:392).

Verwoerd was the foundation layer of the ideology of apartheid, and according to Davenport and Saunders (2000:392), "Verwoerd himself became its leading glossator". The Tomlinson Commission's report was published in 1956. The Commission was required "to conduct an exhaustive inquiry into and to report on a comprehensive scheme for the rehabilitation of the Native Areas with a view of developing within them the social structure in keeping with the culture of the Native based on effective socio-economic planning" (Davenport & Saunders, 2000:392).

According to Davenport and Saunders (2000:392), after the publication of the report it was "possible to take stock of the Verwoedian claims [to Apartheid] for the first time". The terms under which the Commission published its report seemed to have been "open-ended, but they precluded proper correlation in the Commission's Report of policy proposals for African life in both the white areas and the Reserves". This was pointed out by the Commission. However, only one member felt free to suggest "that the policy of separate development should itself be looked into, and abandoned if found impracticable". The entire Commission took the following viewpoint regarding the matter of separate development: "... there is little hope of evolutionary development" towards a common society, and "not the slightest ground for believing that the European population, either now or in the future, would be willing to sacrifice its character as a national entity and as a European group". The Commission furthermore stated that this situation should be accepted as "the dominant fact in the South African situation" (Davenport & Saunders, 2000:392).

One of the objectives of the Commission was to determine how far the Bantu Areas were capable of carrying the African population. It reached the following conclusion regarding this: if a gross income of £120 per year per family were taken as a guide, it would be possible to provide land for only 20% of the families living in the reserves. However, that was too little of the black population in South Africa at that time. It therefore changed the standard to an annual gross income of £60 for mixed and pastoral farming, and £110 for irrigation and sugar-cane farming. This was large enough to attract enough blacks to full-time farming in the Reserves. It also stated that with improved methods of agriculture the land could be made to yield substantially better profits (Davenport & Saunders, 2000:392).

Because pastoral economic units required 275 morgen of land and agricultural units 52.5 morgen to yield the desired income, it meant that there was enough land in the Reserves to support 51% of the Bantu Reserve population as it stood at the time of the 1951 census. The Commission envisaged that three million morgen should still be bought, under the Land Act of 1936. It calculated that the Bantu Areas would then be able to house 2 142 000 people in households engaged in commercial farming. As a result, this left some 16 300 pastoral farmers and some 282 000 mixed farmers in the Reserves for whom alternative means of living had to be provided (Davenport & Saunders, 2000:392-393).

To improve conditions for the resettlement of blacks on the Reserves, the Commission was convinced that there should be better marketing methods for farmers, better credit facilities, better farm planning and stabilisation of tenure, with limited encouragement for successful farmers to buy a second lot if they had paid for the first, and the channelling of funds through a development corporation for the introduction of cash crops – i.e. sugar, fibres and timber in

particular. The Commission members also saw good prospects for mining development in the northern Transvaal, and to a lesser extent Natal. It furthermore saw the need for industrial development both in the Bantu Areas and on their borders (Davenport & Saunders, 2000:393).

In these Areas they also wanted to encourage black entrepreneurs, who could receive assistance from the same development corporation. This corporation might also initiate its own enterprises. A majority of the Commission's members argued that white-sponsored industries should be allowed in the Reserves. This was to increase the carrying capacity of the Bantu Areas, create a better balance between urban and rural employment, and encourage Africans to acquire skills. As part of the initiative for the introduction of industries, the Commission took a good look at the 26 towns and villages of the Transkei, 34 centres in Natal and Zululand, various *statte* of the Tswana in the western Transvaal, and other well-spread centres, as likely nuclei for the establishment of towns (Davenport & Saunders, 2000:393).

It was only in the Vaal Triangle (the country's economic heartland) that the Commission found insufficient space for a Bantu homeland. It concluded that: "the Bantu population of this largest development complex will, therefore, have to be concentrated chiefly in urban residential areas for Bantu ... on a regional basis". The Commission hoped that it would be able to draw African workers away from existing industrial centres. This would be done by encouraging industrial firms to decentralise their activities and establish factories on the borders of the Reserves. Here labour was cheaper and basic resources – water in particular – presented fewer problems, unlike cases in which it had to be transported over long distances from its source to where it was needed (Davenport & Saunders, 2000:393).

Water therefore played an important role in the development of the homelands. This was particularly true in the case of agricultural development and the decentralisation of industries, which were placed away from the water shortage and closer to where there was water in abundance. The decentralisation of industries under the premierships of Verwoerd and Vorster was a failure, making it unpopular with industrialists. However, the agricultural development was less of a failure. A typical homeland's economy consisted a small number of people employed in tertiary activities (teaching, retail trade *etc.*), while the majority were farmers. The type of farming was mainly subsistence with an emphasis on dry land production of a number of crops – especially maize, which was the staple and livestock (Bantu, 1970: 22; Hattingh, 1972:81; Davenport & Saunders, 2000:461).

One of the problems that the government faced was how to stimulate economic growth in these underdeveloped areas. This was a problem not only in South Africa but in many parts of the developing world. It was argued that South Africans could only solve these problems through "peaceful co-existence and cooperation". Agricultural development was the main impetus to the socio-economic development of the homelands. The rationale behind this was first to establish a primary sector (i.e. agriculture) in the economy and then from this to develop a secondary economic sector (i.e. industries) (Bantu, 1964:200; Bantu, 1970:21, 28).

In the case of the homelands the agricultural sector had to be developed from subsistence and near-subsistence farming to endeavours that were more commercial. This type of development was based on the Chinese proverb: "Give a man a fish and he will eat once; teach him to fish and he will eat for the rest of his life". Thus, self-sufficiency of blacks in the

homelands was the rationale behind this type of development (Bantu, 1964:200; Bantu, 1970:21, 28).

From this argument, the Tomlinson Commission Report was the blueprint for agricultural development in the homelands. The Report noted that the homelands have vast potential for agricultural development because of the large natural resource base. For instance, by 1956 there were already 122 irrigation schemes in the Bantu areas, with a total of 13 366 morgen under irrigation. These areas made up 20% of South Africa agricultural production potential, the Report concluded (Houghton, 1956:121; Bantu, 1970:22).

The Commission made the following recommendations for the improvement of irrigation farming in the homelands:

- Determined action must be taken to improve and replan all existing schemes, so that each holding could provide a full-time living to a Bantu family. This was after a number of schemes (28 out of 37) fell into disuse in the Transkei and Ciskei.
- New schemes, which could be operated by simple diversion weirs and furrows, must be developed during the next ten years.
- Irrigation schemes must be regarded as an integral part of rehabilitation schemes, which will "embrace the preservation of water resources and 'sponges' in the catchment areas" (Houghton, 1956:121).

Thus, one of the most important objectives of the South African government regarding the agricultural development of the homelands was to intensify agricultural production. This was to be done by irrigated agriculture. In this regard, the Tomlinson Commission Report states that: "Among the various systems and types of settlement in the Bantu Areas, irrigation farming is undoubtedly the only form of undertaking in which, under European leadership and control, the Bantu have shown themselves capable of making a full-time living from farming, and of making advantageous use of the soil for food production". In 1956 "highly specialised" forms of irrigation farming, such as the growing of vegetables and fruit, had already been undertaken by blacks. This was done on either an individual or a cooperative basis. By 1970, a large number of black farmers were settled on irrigation settlements. Furthermore, by the same year, of the total irrigable area of 54,225 ha in the homelands, 21,773 ha had already been developed and settled (Houghton, 1956:120; Bantu, 1970:25).

In addition to irrigation settlement, a number of irrigation projects had to be implemented. For instance, in 1964 the Shiombo Irrigation Scheme in the Mtale River, in Venda, and a hydroelectric project was opened. Through irrigation schemes, the people of the homelands were encouraged to use agricultural land more efficiently. The main purpose of this particular scheme was to augment the water supply to stimulate agricultural development and to improve living standards. Other works included those in the Tugela River basin (Msinga Irrigation Complex), the Maputo River, the Buffalo River of Ciskei to stimulate industrial development, those in the districts of Mapumulo, Nongoma and the Qamata Irrigation Scheme in Transkei to name but a few. (Hansen 1962: 115-116; Bantu, 1963a:198; Bantu, 1963b:139; Bantu, 1964:200).

Thus, from a water resources management perspective, water was mainly mobilised in the homelands to stimulate irrigated agriculture from the mid-1950s and early 1960s. This was

already the case in South Africa before the end of the nineteenth century. Furthermore, vast quantities of second-order resources were also needed to implement the Recommendations of the Tomlinson Commission Report, not only in terms of irrigation development, but also within the broader establishment of the homelands. To implement the recommendations of the Commission would cost £104,468 000 in the first ten years alone. The single largest item on the budget was £27.4 for soil reclamation. The budget of the Department of Native Affairs would also have to be increased from £9 million to £20 million at the end of the 1950s (Davenport & Saunders, 2000:393-394).

If the correct tempo of developing the Bantu Reserves were kept up, the black population in the Reserves would reach ten million by the end of 2000. This would be done through the provision of 50 000 new jobs per year, of which 20 000 were to be in secondary industry and the rest in commercial and professional employment. There would also be self-government in these Areas under the Bantu Authorities Act. Political power would remain in white hands, especially in the white areas. In these areas, the African population, without any political rights, would not be larger than the white population. All these conclusions of the Commission were supported by a major faulty premise. This was the growth rate of the African population (Davenport & Saunders, 2000:394).

The predictions of the black population growth rate were extremely inaccurate. This was proved by the 1970 census (when B.J. Vorster was Prime Minister). Projections of a black population by 2000, in 1972, showed that there would be about 36 million black people, as opposed to the Commission's projection of 21.36 million (Davenport & Saunders, 2000:427).

What was Verwoerd's reaction to the Commission's Report? He accepted only parts of the strategy set forth by it. For instance, he rejected the concentration of landholding, for it would undermine the chiefs on whom the Bantustan strategy depended and precipitate even more rapid urbanisation. He also rejected direct investment by white-owned firms into the homelands. This was so that Africans could develop separately "at their own pace". This would protect communal resources and local African entrepreneurs. It was also an answer to critics who feared that homeland industries might threaten white workers' jobs in established industrial areas. The strategy of the government, regarding the Tomlinson Commission, was to neutralise the growing strategy of black nationalists and urban political movements (Beinart, 1994:154-155).

Whites were to be one group with one territory, while blacks with similar recent histories were to be settled in a series of separate minority nations. In the words of one observer, "There was to be no English homeland in Grahamstown and Durban; no Jewish in Sea Point. But there were to be Xhosa homelands in the Ciskei and Transkei, a Zulu homeland in Natal, Tswana in the fragmented zones which became Bophuthatswana, Pedi in Lebowa, Shangaan in Gazankulu, and others in more minuscule pockets of land" (Beinart, 1994:156).

Thus, the Tomlinson Commission examined ways of improving the development of the homelands economically, but within the parameters of apartheid. To do this, plans were put in place to combat soil erosion and large numbers of people had to be moved off the land (Beinart, 1994:154). At the same time, the Commission came up with the strategy to separate black from white. This strategy later became known as "grand apartheid" under Verwoerd's tenure of government.

4.10.3. Verwoerd becomes Prime Minister

Verwoerd succeeded Strydom as prime minister in 1958. Verwoerd introduced "grand apartheid" or separate development, as it was officially known. He was appointed to the cabinet on 18 October 1950, and took up the position as Minister of Native Affairs. Eight years later, in 1959, Verwoerd disclosed his racial "new vision" for South Africa's black people. This "new vision" was embodied in the Promotion of Bantu Self-Government Act. This Act provided for the establishment of eight homelands for each of the "separate national units" comprising the Union's black population. According to Geldenhuys (1984:11): "It was the first time that territorial separation was legislatively explicitly linked to ethnic separation". Political apartheid found its embodiment in the Bantu Self-Government Act (Liebenberg, 1987c:497; Davenport & Saunders, 2000:388).

Blacks in the homelands (as the reserves became known), through the extension of the "Bantu system of government" (1951), would under white custodianship progressively develop into self-governing entities. Verwoerd stated that if it was within the ability of the blacks to develop to "full independence", that would happen. In 1963, Transkei became the first homeland to receive the status of self-governance (Geldenhuys, 1984:11).

4.10.4. Black Resistance to Apartheid

The advent of apartheid and its increasing encroachment into all spheres of life did not go unnoticed in South Africa, especially among black South Africans. Their resistance towards the policy increased shortly after the policy's implementation. In the early 1950s, the ANC initiated the "Defiance Campaign". This Campaign was intended to effect political change *via* mass non-violent disobedience (Geldenhuys, 1984:11; Ross, 1999:131).

The reaction of the ANC and the PAC to their banning and the violence at Sharpeville introduced a new phase of black resistance. In June 1961, the ANC endorsed violent resistance. For this purpose, it created a subsidiary body, *Umkhonto we Sizwe* (the spear of the nation), to implement this violent campaign. The PAC also took the same route as the ANC, through a similar body as *Umkhonto we Sizwe*, called *Pogo* (Pure). After 1960, and the creation of these bodies within the ANC and PAC, South Africa became the scene of a number of sabotage attacks (Geldenhuys, 1984:11; Ross, 1999:131).

For instance, *Pogo* managed to assassinate a few collaborating chiefs in the Transkei and Ciskei. However, both these organisations were soon after crippled by the infiltration of government security operators. Nelson Mandela and Oliver Tambo of the ANC went overseas to gather support. Tambo remained in exile for thirty years, and became the ANC's president. He held the organisation together with quiet dignity and great political skill. Mandela, on the other hand, returned to the country and was soon arrested, tried (during the Rivonia Trial) and sentenced to life imprisonment on Robben Island. Together with Mandela, Walter Sisulu and Govan Mbeki were also sentenced to Robben Island in July 1963 (Ross, 1999:131).

4.10.5. "Winds of Change"

In February 1960, Harold Macmillan, former British Prime Minister, gave his historic "Wind of Change" speech in the South African Parliament. Shortly after Macmillan's arrival in the country, he asked the government if he could meet the ANC and the Liberal Party. The South Africans saw these organisations as too radical to operate in the existing political climate, and the request was ignored. Macmillan also told Verwoerd that Britain could no longer support South Africa's claim that the racial policies of the country were outside the competence of international organisations, like the United Nations (UN). This was a political blow to the Verwoerd government, but the worst was still to come when Macmillan delivered his "Wind of Change" speech (Geldenhuys, 1984:11; Barber & Barratt, 1990:67).

The speech was a shock, because Britain played a leading role in Africa and was a driving force behind African countries' independence. Thus, Macmillan was seen by the South African government as speaking for the West. Barber and Barratt (1990:68) have the following to say about what Macmillan said regarding white fears in South Africa: "Finally Macmillan unearthed and exposed the whites' own fears – fears about decolonisation, about Western attitudes and about the strength of African nationalism. He exposed the fears and stripped away the illusions, and was bitterly resented for doing so". These "fears" Macmillan was referring to were the fears that decolonisation would ultimately lead to a black majority government in South Africa. In fact, the general theme of Macmillan's speech "was that anti-colonial nationalism which had swept across Asia was now sweeping through Africa, and Western interests were best served by coming to terms with it" (Barber & Barratt, 1990:68).

In other words, the West was supporting decolonisation, and South Africa was the only African country with a white minority government that stood outside the decolonisation drive. This was out of fear of black majority rule and all the "bad" things, in the eyes of white South Africans, that went with it – i.e. communism, violence against whites, total disintegration of society, civil war, etc.

4.10.6. Sharpeville

Shortly after Macmillan's speech, on 21 March 1960 the "most dramatic and tragic instance of black protest against government policies" took place. This was the shootings at Sharpeville, a black township near Vereeniging (Geldenhuys, 1984:11; Barber & Barratt, 1990:69).

Sharpeville changed the character of the operation of black nationalism in South Africa. Before the Second World War, the movement used pacifist means in an attempt to bring about reform. During this period, the movement also consisted of a small middle class. From 1945 to 1960, the movement became more broad based, employed civil action, and sought a radical change in the existing social and political structure of South African society. However, it still did it through peaceful means. Sharpeville changed this. The movement became revolutionary in its aims and methods as protest turned to resistance. Violence against the state was organised by small, dedicated groups, and conducted alongside non-violent activities. The movement also spread its activities abroad, thereby internationalising its resistance (Barber & Barratt, 1990:70).

Violence against the government was also used by a small group of radical whites. This movement, called the African Freedom Movement, organised sabotage against property. They had plans to release prisoners from Robben Island, and one of their members, John Harris, planted a bomb at Johannesburg railway station in July 1964. The bomb killed one person and injured many others, but the group was soon broken up by the police (Barber & Barratt, 1990:72).

4.10.7. Verwoerd's Rule is Strengthened

The violence the ANC and Pan Africanist Congress (PAC) used against the government led to the banning of the organisations on 9 April 1960. A day later, Verwoerd was shot twice in the head by a white farmer. However, he suffered no serious injuries. His escape from death was seen as a miracle from the Almighty, and he himself interpreted it as a sign from God. Consequently, his control over the National Party, which was already great, became absolute, and his rule confirmed. Moreover, the banning of African opposition, which occurred between Sharpeville and the Rivonia trial, brought about a hardening of apartheid rule. From then on apartheid would become more repressive. For instance, in reaction to the adoption, by the ANC and PAC, of their policy of overt violence, the South African government approved legislation that increasingly infringed on the freedom of the individual (Davenport, 1977:286, 287; Liebenberg, 1984:508; Ross, 1999:133-134).

4.10.8. The Republic of South Africa

The Republic of South Africa was established on 31 May 1961, and constituted "the most cherished ideal of Afrikaner Nationalists". After the establishment of the Republic, the application of the policy of separate development was accelerated. This was done to such an extent that the Transkei was granted self-government in December 1963; something not even Verwoerd had foreseen a few years earlier. Subsequently, from 1961 onwards, foreign criticism of South Africa's racial policy grew increasingly strident (Liebenberg, 1984:508; Geldenhuys, 1984:11).

After the establishment of the Republic, Verwoerd's first priority was to ensure the security of white South Africans. He therefore wished in the future to see Afrikaans-speaking and English-speaking South Africans unite. For instance, on 8 June 1961 he had the following to say in the House of Assembly: "Everything points to the necessity for us to get together, because what is our problem for the future? It is to ensure that this White Republic of South Africa remains white. From now onwards, it is our common white heritage that counts above anything else. From now onwards, therefore, in all our utterances, in our speeches, in our work, we ought to regard everything that divided us in the past as an epoch in our history that came to an end with the establishment of a Republic outside the Commonwealth. From now onwards we have something else to achieve . . . that is that we must make it possible for a white nation to continue to maintain itself here" (Liebenberg, 1984:508).

4.10.9. The National Party's Support

That being the case, from 1961 to 1966, the National Party's support gained steadily. Three aspects were responsible for this:

1. Verwoerd, with his friendly demeanour, dynamic leadership, and self-confidence, appealed to the people. He was, to many, a sort of father figure in whose hands the future of the whites was perfectly safe.
2. Events elsewhere in Africa were also an aspect. In many African states, black governments came to power, and many whites left these countries. This was seen as proof that whites and blacks could not share political power. Verwoerd's policy of separate development was therefore seen by whites as the correct way to govern South Africa.
3. The actions of revolutionary elements in South Africa (ANC and PAC) convinced many people of the necessity for a strong government, which would not hesitate to take firm action against these elements. Of all the different political parties, (i.e. United Party and Progressive Party) the National Party most fully met this requirement (Liebenberg, 1984:510).

However, one event impeded the growing strength of the National Party between 1961 and 1966.

4.10.10. Verwoerd is Dead

On 6 September 1966, Verwoerd was assassinated by one of the parliamentary messengers, Demitrio Tsafendas. Tsafendas was brought to trial but was found to be insane; he said that he had been ordered to do so by a giant tapeworm. The judge therefore ordered him to be detained at the State President's pleasure (Botha, 1967:1-10; Liebenberg, 1984:511; De Klerk, 1998:41).

Liebenberg (1984:511) sums up Verwoerd's rule as Prime Minister in the following way: "In the eight years in which Verwoerd held power, his prestige grew steadily. At the time of his death he dominated the political scene in South Africa to a greater extent than any previous Prime Minister. He was the great visionary who drafted fixed plans for the future [the Orange River Project (ORP) included]. He was a master of detail who maintained a firm grip on all the departments of his government. He was the great oracle who knew the answers to all South Africa's problems. As the apostle of separate development, Verwoerd guarded jealously against any departure from his dogma. He would not allow any White man to establish a factory in a Black homeland. He would not allow any Black to become a member of a White scientific society. He would not allow any New Zealand rugby team, which included Maoris, to tour South Africa. That this dogmatic attitude was detrimental to South Africa's image and to sound human relations, and manifested an inability to distinguish what was important from what was unimportant, were factors Verwoerd did not understand".

Former President F.W. de Klerk writes in his autobiography that: "Dr Verwoerd had utterly dominated his cabinet with his intellect and forceful personality. The marginal comments that he had written on government submissions and reports were regarded almost as holy writ and continued to influence policy for years after his death" (De Klerk, 1998:41).

Former President Nelson Mandela says the following about Verwoerd's death in his autobiography: "Although Verwoerd thought Africans were lower than animals, his death did not yield us [ANC political prisoners on Robben Island] any pleasure". He furthermore states that: "Political assassination is not something I or the ANC have ever supported. It is a primitive way of contending with an opponent" (Mandela, 1994:417).

Even so, Verwoerd was South Africa's most dominant political figure during his reign as Prime Minister. He was the centrifugal force around which South African politics revolved. It was his policy of grand apartheid, in particular, that set the tone of domestic politics as well as South Africa's relations with the rest of the world. The South West Africa/Namibia issue was of particular importance regarding this relationship with the rest of the world.

4.10.11. The Namibia Issue

In the same year Verwoerd was assassinated the General Assembly of the UN terminated South Africa's mandate over South West Africa. The Assembly entrusted the administration of it until independence to the Council for Namibia. South Africa refused to accept the decision, especially regarding South Africa's withdrawal from South West Africa. The Security Council of the UN declared South Africa's continuing presence in Namibia illegal. In March 1969 it also recognised the legitimacy of the struggle of the people of Namibia against South Africa's presence and requested all states to refrain from any relations with South Africa that could imply recognition of the Republic's authority over Namibia (Geldenhuys, 1990:141).

The General Assembly also recognised the South West African People's Organisation (SWAPO) as the sole and authentic representative of the people of Namibia. By doing this, it was conferring legitimacy on its armed struggle and gave SWAPO observer status in the UN (Geldenhuys, 1990:141).

4.10.12. Vorster becomes Prime Minister

Verwoerd was succeeded by B.J. Vorster on 13 September 1966. As Minister of Justice, before his succession as Prime Minister, Vorster was always in the news. This was due to the activities of the revolutionary elements in South Africa, which were quite active during 1961 to 1966. It was Vorster's task, as Minister of Justice, to keep them under control. *The Rand Daily Mail* branded Vorster one of the National Party's "young extremists", after his appointment to the justice portfolio in 1961 (Geldenhuys, 1984:33; Liebenberg, 1984:511-512).

Vorster soon showed a remarkable degree of political flexibility compared to Verwoerd's tough stance on domestic and international policies. Vorster also adhered to the basic tenets of separate development. However, he "did not display the same unmerciful consistency as Verwoerd in rigorously applying apartheid to virtually all facets of human interaction in South Africa. Vorster was prepared to make concessions in some, admittedly peripheral, areas of race relations" (Geldenhuys, 1984:33).

Notwithstanding Vorster's flexibility on apartheid policy, especially on the sports front, he took a tough stance on security matters. Security legislation was further strengthened with measures such as the Suppression of Communism Amendment Act, 1967 and the General Law Amendment Act, 1969. An important act regarding security matters was the Public Service Amendment Act, 1969. This act provided for the establishment of the Bureau for State Security, also known as BOSS. BOSS was directly responsible to the Prime Minister and was headed by General H.J. van den Bergh – head of the Security Police. Political apartheid was further extended by the Prohibition of Political Interference Act, 1968. This act made it an offence to belong to and assist a racially mixed political party (Geldenhuys, 1984:35).

Geldenhuys (1984:35) writes the following about the legislation, "This was part of a new package of legislation that also included the *Separate Representation of Voters Amendment Act*, 1968, which finally ended all coloured representation in the House of Assembly, and the *Coloured Person's Representative Council Act*, 1968, in terms of which a partly elected, partly nominated coloured council (CRC) with limited subordinate powers of legislation was created. The *South African Indian Council Act*, 1968, gave statutory authority to the Indian Council already established in 1964, but which remained wholly nominated with advisory powers only. In 1974 half the Council's members became elected, the other half nominated".

Vorster also followed the course Verwoerd took regarding blacks. The Black States Constitution Act, 1971, was designed to expedite the constitutional development of the homelands. This was done by stipulating that special legislation of the South African Parliament was no longer needed to substitute the homelands' territorial authorities with legislative assemblies and therefore to bestow self-governing status. In 1972, seven other homelands joined the Transkei as self-governing homelands. They were Ciskei, KwaZulu, Lebowa, Venda, Gazankulu, Bophuthatswana, and QwaQwa (Geldenhuys, 1984:35).

The government was increasingly exploring the possibility of political representation of Indians and coloureds, but the black section of South African society was ignored in this respect.

4.10.13. Commission of Enquiry into Water Matters

As regards the country's water resources, a Commission of Inquiry into Water Matters was appointed in July 1966 by the State President, C.R. Swart. The objective of the Commission was to inquire, report upon and submit recommendations on all aspects of water provision and utilisation within the Republic, the broad planning of policy regarding this "with due regard to the arrangements with neighbouring States relating to common water resources" (RSA, 1970a:xii).

The Commission was to give special attention to the following aspects:

1. The available and potential water supplies and sources, surface and underground, in the different areas and the present level of water usage and utilisation including rainfall, by various sectors of the national economy.
2. The systematic development, safeguarding, stabilising, and conservation of the available and potential water supplies and sources.

3. The future water requirements of the entire country to ensure a balanced development and growth of the national economy.
4. The location of industries in relation to the available and potentially available water sources from the point of view of assured and economic water provision, and the submission of data upon which decisions at government level can be taken regarding localities where the establishment of industries must be encouraged, in which connection the proximity of labour sources should also be taken into account.
5. The determination of the areas which must be utilised for irrigation farming and stock-breeding, and the determination of the areas which must be allocated for afforestation and timber production, and the preparation of the necessary master plans regarding this.
6. The present utilisation of water for cooling purposes by means of cooling towers connected with existing power-generation stations, and the possibilities of alternate cooling processes with a view to saving water.
7. The utilisation of atomic power stations at the coast for the generation of electricity, using sea-water for cooling purposes, and power generation elsewhere to save South African water resources.
8. The desalination of seawater in general and the possibilities of using atomic energy for the desalination process.
9. The availability and application of techniques to combat evaporation losses in storage dams.
10. Planning for the protection of catchment areas for the prevention of excessive evaporation losses and soil erosion.
11. The need for hydroclimatological, hydrological and irrigation farming research and facilities, and the personnel requirements regarding this.
12. The compilation of a broad long-term national master plan for the coordinated development and conservation of and control over water resources, with which may be included a rational allocation of the available water among the various users according to the estimated requirements of the country.
13. The programming of construction phases with a view to the realisation of the master plan.
14. Capital requirements for the development of water sources, and the likely rate of capital expenditure required to keep pace with the country's development.
15. The methods, which can be applied immediately to effect the increased saving and re-use of water.
16. Any other matter which the Commission may regard as relevant (RSA, 1970a:xii-xiii).

The Commission published its findings and recommendations in 1970. Regarding the use of water resources to produce food the Commission found that there was no urgent need to accord a high priority to the provision of additional irrigation facilities for the benefit of agriculture. The Commission, however, stated that this did not mean that no new irrigation projects should be implemented. "It is meant merely to emphasise the principle that justification for such projects should, in each specific case, be based on careful socio-economic analysis, the weighing of costs and benefits against those associated with alternative allocation of funds and of the water that would be demanded" (RSA, 1970a:2).

It furthermore reported that: "Neither on economic nor on strategic grounds is there any urgent need for the large-scale provision of additional water for irrigation within the foreseeable future. Emphasis should far rather be placed on raising the productivity of agriculture and animal husbandry on the already available dry land and irrigation soils and

particularly on the achievement of higher yields per unit of water applied" (RSA, 1970a:2). Thus, the idea of "more crop per drop" is about 30 years old in South Africa.

As regards the homelands, the Commission stated that the largest of Bantu homelands were situated on the eastern escarpment. This region has the country's richest water resources. Consequently, water supplies for the homelands and decentralised border industries would afford little difficulty (RSA, 1970a:3).

The Commission also found that: "... unless the essential steps are taken to plan the exploitation and augmentation of our water resources, to conserve and re-use our available supplies, and to manage and control our resources in the most efficient manner, serious shortages will be suffered somewhere before the close of the century" (RSA, 1970a:3). Thus, the saving of the country's water resources was already an issue in the late 1960s and early 1970s.

The saving of water resources used in urban areas was possible without the lowering of living or health standards, the Commission concluded. Such savings were to be affected by the modifications in the type and size of toilets, improved water use methods, elimination of leakage, pressure regulation at distribution points, the instalment of individual metering, and the reduction in the size of urban plots (RSA, 1970a:6). These recommendations later became known as water demand management (WDM).

Water savings were also to be implemented, especially regarding power generation, by making more use of hydroelectricity, by establishing nuclear power stations at the coast, and by the adoption of water-saving measures at coal-fired power stations. Nonetheless, appreciable quantities of water should be reserved for power generation purposes, according to the Commission (RSA, 1970a:7).

One of the solutions to the country's water problems was the inter-basin transfer scheme. This was to provide water for South Africa's large metropolitan areas, new industrial nodes, and irrigation projects. The Commission noted that: "This demands the thorough planning of our water resources to ensure that optimum benefits will accrue to the whole country. In applying this policy, socio-economic principles that embrace the interests of the country as a whole rather, than mere sentimental or geographical considerations, must be decisive" (RSA, 1970a:9).

The Commission also looked into South Africa's relations with its neighbours as regards water resources of mutual benefit. In this respect the Commission mentioned the plans to draw water from outside the country's border – e.g. the Okavango Delta. The Commission found that, although such schemes were technically viable, "they can be undertaken only in consultation with the relevant foreign interests". The unit cost of the water was one of the limiting factors for the implementation of such international inter-basin transfer schemes. On international law principles, contained within the 1966 Helsinki Rules, for instance, the Commission stated that these rules were very loose and that the use of international water resources was generally fixed by agreement. During the 1970s, South Africa was negotiating with Swaziland, Portugal, Botswana, Lesotho, and Rhodesia on matters regarding the joint utilisation of common water resources. In this regard, the Commission recommended that: "... whenever the opportunity arises, all feasible steps [should] be taken to ensure that the Republic's shares of the relevant waters be defined and ratified, so that appropriate account

may be taken of them in planning. In this context it is appreciated that often other factors must be considered and that the development of the relevant rivers to optimum mutual benefit necessarily depends also on a *good neighbour policy*" (emphasis added) (RSA, 1970a:13). This good neighbour policy was not to be applicable in the case of South Africa's relations with Angola in 1975, after the communist-backed MPLA took control of Angola.

One of the most important recommendations of the enquiry was the establishment of the Water Research Commission (WRC). Without the WRC water resources management in South Africa would not be as well informed by centrally coordinated research as it is at present. The WRC is funded from a levy on water use (B. Rowston, personal communication, 20 January 2004).

4.10.14. The Angolan War

In 1975, South Africa became militarily involved in the Angolan civil war. This followed the *coup de' etat* in Portugal in 1974 and the withdrawal of the Portuguese from its African colonies, particularly Angola and Mozambique in 1975. The *coup* was a watershed in the history of Southern Africa and indeed South Africa's foreign relations. When the Portuguese withdrew from Angola the three rival factions to whom the government of Angola had been entrusted, the Popular Movement for the liberation of Angola (MPLA), the National Front for the Liberation of Angola (FNLA) and the National Union for the Total Independence of Angola (UNITA), became locked in a military conflict from the beginning of 1975. Throughout that year, it became clear that the MPLA was winning the civil war, because it was well supplied by arms from the Soviet Union, and it started to receive Cuban support (Geldenhuys, 1984:39; Davenport & Saunders, 2000:527).

South Africa, after seeing that Angola would be taken over by a Soviet-backed government, sent troops into the territory. However, South Africa started to retreat after the arrival of three Cuban troopships and sophisticated rocketry in Angola. By March 1975, the retreat had ended. The effect of the South African invasion was that the Russian-backed MPLA government was seen as the legitimate government of Angola by the Organisation of African Unity (OAU). The MPLA government was also granted international recognition. The South Africans continued to lend support to UNITA in the south of Angola. This kept the civil war in that area of Angola going, and made it harder for SWAPO to build up its bases with a view to infiltrating into South West Africa (Davenport & Saunders, 2000:528).

There was some division in the South African government regarding the handling of the Angolan affair. P.W. Botha, then Minister of Defence, took a pro-interventionist stance, to keep Soviet expansionism in Southern Africa at bay. By doing this, his Department became directly involved in the making of South African foreign policy. Hilgard Muller and Brand Fourie from Foreign Affairs favoured a "hands off", approach, similar to the one adopted towards Mozambique after it gained independence in 1975. However, their voices were less effective than that of the Department of Defence, and Botha won the day (Barber & Barratt, 1990:192).

South Africa intervened in Angola for two main reasons (that actually represented two sides of the same coin): (1) South Africa's own security concerns, and (2) perceived security threats that dictated the need to prevent the MPLA taking sole power, or even to dislodge the MPLA

altogether. Regarding South Africa's own security needs, it intervened because of Soviet and Cuban involvement, to protect South West Africa, and the Kunene River Project. However, the underlying, but unspoken motive, was to ensure a non-hostile, cooperative Angola, with Soviet influence eliminated, which would not threaten South Africa's dominance in Southern Africa, especially in Namibia (Barber & Barratt, 1990:194).

4.10.15. *Détente*

South Africa's military invasion of Angola in 1975 was one of the events that stood out as a landmark in South African international affairs. Another was *détente*. In February 1974, Vorster spoke of a "power bloc" of sovereign independent states taking shape in Southern Africa. After this he introduced the concept of a "constellation of politically completely independent states" maintaining close economic ties. These initiatives were a way of safeguarding South Africa's position in Southern Africa. A third was through the seeking of settlements to the issues of Namibia and Rhodesia (now Zimbabwe). This led to the *détente* initiative, which was a joint venture between South Africa and Zambia in an attempt to resolve the Rhodesia issue. In Namibia, South Africa in September 1975 initiated the Turnhalle constitutional conference. In this, all ethnic groups were for the first time drawn into the process of planning Namibia's political future. Geldenhuys (1984:39) is of the opinion that: "These moves were no doubt inspired by a sense of urgency in view of Portugal's liquidation of its African empire".

The *détente* initiative reached its apex in August 1975 with the Victoria Falls conference between the Rhodesian government and black nationalists. The architects of the conference, Vorster and Kenneth Kaunda of Zambia, were also present. The era of the *détente* initiative was, however, short-lived. Its demise was primarily caused by the collapse of the joint South African-Zambian settlement initiative for Rhodesia, as well as South Africa's intervention in the Angolan war, 1975-1976. From 1976 onwards, Southern Africa entered a period of rapidly escalating conflict. This conflict was characterised by the active involvement of external powers, namely the Soviet Union and Cuba on the military front and the Western powers, particularly the US, in the diplomatic field (Geldenhuys, 1984:39).

4.10.16. Domestic Political Turmoil

Domestically, political turmoil surfaced again. On 16 June 1976, violence erupted in Soweto. This was after secondary pupils marched in protest against the use of Afrikaans as a medium of instruction in their schools. The protest march was called by the newly formed Soweto Students Representative Council (SSRC). The students met and clashed with police at the Orlando West High School. The police fired into the crowd after the riots escalated from stone-throwing by students and tear gas and warning shots from the police. One youth, Hector Peterson, was killed. The Soweto riots heralded months of large-scale and widespread racial turmoil across South Africa (Geldenhuys, 1984:35; Barber & Barratt, 1990:204).

According to one astute observer, the Soweto riots "dramatically underlined the depth of racial cleavages in South African society. The protracted violence severely undermined white confidence. The deteriorating economic climate and fresh memories of South Africa's involvement in the Angolan war served to strengthen a public mood of gloom" (Geldenhuys,

1984:35). South Africa also came under pressure from the international community regarding its handling of the riots in Soweto and elsewhere in the country. Moreover, a survey conducted by the Bergstraesser Institute, in 1977, found that 57% of urban blacks saw the Soweto riots as a "good thing for the future of South African people" (Geldenhuys, 1984:214, 199).

The Vorster Government reacted to the Soweto riots by banning a number of black consciousness organisations, and many individuals, black and white. Amongst these was the South African Council of Churches. In 1977, Steve Biko was arrested and died after torture in the cells of John Vorster Square police station in Johannesburg. About 12 000 youths fled the country. It was also difficult for organisations to "mature and develop nationally or to elaborate specific programmes". Nonetheless, there was a strong belief amongst black youths that the system was so unjust that it could not last (Beinart, 1994:221-222).

The Soweto riots of 1976 also forced government to reconsider the living conditions in black townships. Electrification of Soweto and other townships became a more urgent priority, with many social implications. In 1979, tentative schemes were reintroduced for black private property in the urban areas. This was twenty years after the government attempted to abolish it. The National Party also started to deracialise its ideology and to project a more incorporative image. This image was of a state that was more national rather than simply Afrikaner (Beinart, 1994:227).

4.10.17. P.W. Botha and the "Total Onslaught"

In 1978, P.W. Botha became Prime Minister in the place of Vorster. Botha was elected Prime Minister on 28 September 1978 after the so-called information scandal, which forced Vorster to resign from office. Vorster's security chief and information Minister, Dr C.P. Mulder, misused public money in a campaign to persuade the world of the government's credentials (Barber & Barratt, 1990:247; Beinart, 1994:225).

Attwell sums up Botha's character when he writes that, "Mr Botha represented in his own persona the modern experience of the Afrikaner. Unintellectual and dour, he had worked his way up the party machine as a bootboy with native cunning and adroitness. As Minister of Defence he had shown a healthy respect for armed might and had proved himself willing to use it ruthlessly in the abortive invasion of Angola in 1975-76. He was the living embodiment of *kragdadigheid*; a quality Afrikaners much admire and which can be loosely translated as the willingness to use force unsparingly. Nonetheless, he was a man who admired knowledge and specialization, and was prepared to listen to experts" (Attwell, 1986:124).

Even so, Botha faced a regional context which had changed radically. This change took place after the Portugal coup of 1974. Before this event, South Africa was surrounded by a circle of settler and colonial states. These colonial states were Angola and Mozambique, and the settler one was Rhodesia. Rhodesia had made its Unilateral Declaration of Independence (UDI) from Britain in 1965 and the white settlers fought their own campaign against the black Zimbabwean liberation movements. "But from the mid-1970s the intensity of the war became more severe and despite South African assistance and an 'internal settlement', settler rule succumbed in 1979. In 1980 a black Zimbabwe African National Union (ZANU) government

under Robert Mugabe was elected" (Beinart, 1994:226). The Mugabe government is still in power today.

Because of the collapse of these "settler and colonial states" around South Africa, the government increasingly perceived itself to be the subject to a "total onslaught" from the north. The hinterland of Southern Africa was not seen as a source of labour, or a road to possible expansion, or even as an economic trading zone, anymore. It was seen, rather, as a potential threat to the white-ruled South African state (Beinart, 1994:226).

This perceived threat originated from a number of newly independent states and non-state entities. SWAPO was able to launch an increasingly effective challenge to South African rule in Namibia from bases in Angola. There was also a concern within the South African strategic community that the ANC was finding nearby military bases from which to launch its armed struggle. Mozambique, because of its proximity and its socialist government, was seen as a major potential threat. Because of this, South Africa supported the rebel Renamo organisation to challenge the newly established Frelimo state (Beinart, 1994:226).

These events and political processes in the Southern African sub-continent had an important impact on the Botha government. His administration placed a heavy emphasis on South Africa's security. This found expression in the need for a "total national strategy" to resist a "total onslaught" on the country from across its borders. Botha announced this "total national strategy" in Parliament in March 1980. The major "culprit" of this "total onslaught" from inside and outside the country was communist powers. According to Geldenhuys (1984:38): "The total national strategy involves the mobilisation of South Africa's total physical and human resources in a national endeavour to thwart the onslaught". The ANC's armed struggle, culminating in armed attacks against police stations and SASOL in 1980, was seen as the internal force at work against the survival of South Africa (Geldenhuys, 1984:38; Barber & Barratt, 1990:253-256).

The government argued that the survival of South Africa was under threat. It also argued that the security and survival of whites and blacks alike were being threatened by a common enemy (Geldenhuys, 1984:38).

Part and parcel of the "total national strategy" was Botha's concept of a constellation of Southern African states; an idea he inherited from Vorster. He promoted the constellation concept further and gave it more substance than Vorster did. Through it he promoted closer regional ties in Southern Africa. This became a major foreign policy initiative under Botha's administration. "In one of the earliest authoritative statements on a constellation, Foreign Minister Pik Botha in March 1979 envisaged between seven and ten states representing 40 million people south of the Kunene and Zambezi Rivers joining forces in a formal constellation and devising "a common approach in the security field, the economic field and even the political field." This group of constellation states was to include Botswana, Lesotho, Swaziland, Rhodesia, Namibia, and South Africa. The three former independent homelands Transkei, Bophuthatswana, and Venda would also be included. There was even a possibility that Zambia too would join as well as Mozambique (Geldenhuys, 1984:41).

This constellation idea failed to materialise. The main reason for this was the big ideological divide between South Africa and the other newly independent Southern African states. These states, except for the three homelands, were unwilling to have relations with South Africa.

They also did not recognise the homelands, Rhodesia, and South African-controlled Namibia as their equal partners (Geldenhuys, 1984:41).

Related to these factors, after Mugabe came to power in Zimbabwe, he made it clear that he would not join such a constellation. Instead, and in reaction to South Africa's external security ambitions, Zimbabwe, along with Botswana, Lesotho, Swaziland, Mozambique, Angola, Zambia, Malawi and Tanzania, established the Southern African Development Coordination Conference (SADCC) (today the Southern African Development Community (SADC)). These states became known as the front-line states. This newly formed organisation worked to reduce the nine black states' dependence on the South African economy and transport network. After its formation in 1981, this grouping was named the counter-constellation which reflected the black states' opposition to South Africa's proposed constellation idea (Geldenhuys, 1984: 41; Barber, 1998:339).

4.10.18. The Economy

On the economic front, South Africa's economy continued to grow from the 1950s well into the 1970s, with some downturns here and there. Some of the industrial development highlights during this period was ISCOR commencing steel production in 1952 and in 1955 Phoscor (Foskor) starting with the production of phosphates at Phalaborwa, and SASOL with fuel from coal at Sasolburg. Between 1948 and 1975, the Gross Domestic Product (GDP) increased by an average of about 4.75% annually. During the same period, the South African population was growing by about 3% a year. The flourishing of the economy was in part due to the system of apartheid. Apartheid was not a form of forced labour, but the sanctions placed on the recalcitrant and the prohibitions placed on black Trade Union activity weighted matters heavily in favour of the employers. Under these political conditions the mining industry, as well as others, prospered. Combined with this, and during the "long economic boom", countries producing primary products, South Africa included, were in a general advantageous position (Liebenberg, 1987d:517; Ross, 1999:132).

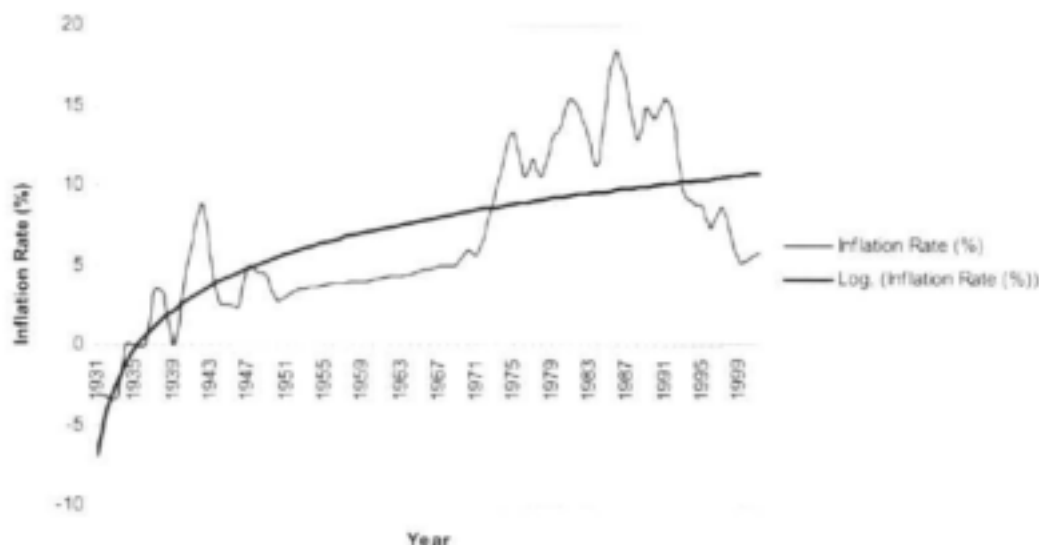
The first downturn in South Africa's economy came after the Sharpeville incident. A major economic reaction to Sharpeville was the outflow of capital from the country. In the succinct words of one analyst, "Although South Africa had since 1958 experienced a "general slackness in economic activity", Sharpeville aggravated the recession – especially as it gave rise to a substantial outflow of foreign capital. Except for two years between 1946 and 1959, South Africa had been a net importer of capital. Sharpeville reversed the trend, causing a monthly capital loss of R12 million in 1960 and early 1961. South Africa's holdings of gold and other foreign exchange reserves plunged to their lowest levels since World War II" (Geldenhuys, 1990:332).

With the severe security clampdown in the aftermath of Sharpeville, tranquillity was restored. This calm was a necessary condition for the re-establishment of economic confidence. From 1962 to 1967, South Africa experienced rapid economic growth. It was the longest period of sustained growth with an average growth rate in the production of services and goods was 6.3%. This was also the highest in South Africa's post-Second World War history. During the same period, there was a net inflow of capital of over R260 million (Geldenhuys, 1990:332).

Yet conditions which characterised world economic growth were disastrous for South Africa in the long term. South Africa was ill-equipped to cope with the downturn in the world economy after 1973 (Ross, 1999:132).

The decline in the world economy (and that of South Africa) started with the Middle East War of October 1973 (Yom Kippur) and the resulting oil crisis. The oil crisis led to steep increases in energy costs, which had a profound impact on the world economy. This seriously impacted on South Africa's economy, despite the country's large coal reserves and its oil-from-coal process, because of its dependence on imported oil, which was responsible for 25% of its energy needs. Higher costs of imports, including oil, foreign exchange problems, and inflation (see Figure 2) led to a depressed economy. The gold price, as in the past, was crucial in this regard. In the early 1970s, it rose substantially after the fixed dollar price had been abandoned in 1971 (Barber & Barratt, 1990:177-178).

Figure 2
Average Inflation Increase (%): 1931-2001



Source: Statistics South Africa, 2002

By 1974, the price of gold rose to \$198 an ounce, which served to push up the economic growth rate to 8.3% by that year. Then a decline in economic growth set in. By 1976, the gold price decreased to \$103 per ounce, with a growth rate of only 2.9% in 1975, 1.3% in 1976 and zero in 1977. The decline in the economies of other industrialised countries was also responsible for South Africa's reduced earnings from its other mineral exports that depressed the country's economy even further. South Africa furthermore faced an oil embargo, which the Organisation of Petroleum Exporting Countries (OPEC) imposed on it and other Western countries in late 1973. Notwithstanding this embargo, oil imports were assured, especially from Iran (90% of South Africa's oil imports), with whom South Africa

had good relations until the overthrow of the Shah in the Iranian Revolution in 1979 (Barber & Barratt, 1990:177-178).

Moreover, and until 1973, there had been no economic imperative to convert the country's low-skilled, low-paid labour force into one whose productivity could rival that of the economies of South-East Asia, which were industrialising fast. For instance, Bantu education was specifically intended to keep the level of African advancement, and therefore of the skills of blacks, at a low level. It was only from the early 1970s that there was an expansion of Bantu education. Notwithstanding this expansion, the emphasis was on quantity and not quality. The result of this was that the depressed economy could not absorb the school leavers, and South Africa's manufacturing exports lagged behind its competitors (Ross, 1999:132-133).

According to Ross (1999:133): "[South Africa's] share of total world trade in manufactured goods declined from 0.78 per cent to 0.27 per cent between 1955 and 1985, and its share in the exports of a group of developing countries, whose starting positions were approximately the same, fell from about an eighth to less than a fiftieth over the same period. Equally, the machine-tool sector totally failed to take part in the growth of the 1950s and 1960s. By 1980, the productivity of the South African labour force was stagnating".

What else could have had an impact on the South African economy's stagnating growth rate during the period, apart from international and domestic events? The South African government's economic insecurity is also to blame. The state's approach to industrialisation was driven by this insecurity, and not by a desire to nurture potentially profitable new industries. The government's response to this insecurity was to impose high tariff walls on imported goods, resulting in a less competitive manufacturing sector. In this regard, Ross (1999) compares the involvement of the South African government in the economy to that of countries of the Communist bloc. Examples of this involvement were SASOL, ISCOR, ESCOM, and railway concerns. South Africa therefore had conservative fiscal policies, which were in part a result of this insecurity due to apartheid with no new innovative enterprises launched. The conclusion to be drawn from this is that "apartheid had left the country particularly vulnerable to the challenges of the world economy in the last quarter of the century" (Ross, 1999:133). It was not all doom and gloom, though.

In the early 1970s, there was a period of general improvement in the South African economy (1972-74). The decline, after the Middle East oil crisis, started to set in during late 1974. This renewed downturn in the economy was further exacerbated in 1976 by the Soweto uprisings. In economic terms, it was a rehearsal of the repercussions after Sharpeville, but this time much worse. The capital account again suffered a serious blow. In 1977 a net outflow of capital of R810 million was recorded, this after there was a net inflow in the years previously. In 1978, the capital outflow reached R1.3 billion. However, the South African economy recovered two years after the Soweto uprisings. This economic recovery is explained by the attitude of capitalists towards apartheid. Apartheid did not initially inhibit manufacturing and local and international investors reacted favourably to political stability even if it was produced by repression. By crushing the black rebellion, the government restored confidence in the South African economy. A downturn in the economy again occurred in August 1981, when South Africa went into its worst recession since the 1930s. A low gold price and a serious drought were the major contributing factors (Geldenhuys, 1990:332-333; Beinart, 1994:235).

As regards water resources development during the period of the "long economic boom", large dams and water supply systems were constructed by government at a proliferating rate. As the economy expanded, larger volumes of water were needed to help sustain economic growth. Nonetheless, there is a downside to this, when looking at the environmental consequences concerning the construction of large dams and irrigation projects. In the words of one analyst, "The demand for water and electricity had increased as regional mining, industry and municipalities expanded. However, it was the demonstration of the political power of the state through the conquest of nature, rather than the generation of hydroelectric power or the supply of water, which guided construction decisions. No thought was given to the long-term environmental consequences of dam construction or water diversions and the notion of sustainable development did not exist" (Showers, 1996:1).

Nonetheless, the statement made by Showers (1996) that it was the political power of the state, rather than the supply of water or the generation of hydroelectricity, through the conquest of nature, that influenced decisions regarding the construction of large dams and other water supply projects, is debatable. She is correct in stating that political power plays a role in the construction of water development projects. However, the international political economy and national economic situation of a state also play a role.

The reason for this is that water resources development projects (dams and irrigation works) were an outflow of the economic development of the South African state. These projects were in fact needed to supply water and hydroelectricity. The political power of the state through the conquest of nature is always at play as well. For instance, when he announced in 1962 that the ORP would be constructed, Le Roux spoke about the grandeur of the project, but the main rationale was the role the project would play in the socio-economic development of the country. In addition, water development projects in South Africa prior to 1994 were constructed not to alienate the agricultural sector of South Africa (mainly white commercial farmers) from the National Party. Water resources development projects were thus a means to an end (socio-economic development and the holding on to political power of the then ruling party) and not an end in themselves (political power expressed through the conquest of nature).

Even so, Showers (1996) is correct and to the point when she notes that no consideration was given to the long-term environmental consequences of dam construction or water diversion in South Africa. This is evident in the numerous reports on water resources development projects and their impact on the environment. Nowhere, in any of the reports before the mid-1980s, was there ever any mention of the environmental consequences of these projects. What was of importance was how these projects would contribute to the socio-economic development of the country, and how they would alleviate water scarcities in many parts of the Republic (see chapters 5, 6, 7 and 8).

4.10.19. Political Reform (Petty Apartheid)

The shock of the Soweto uprising in July 1976 made the government realise that there was a need for domestic political changes to reduce internal and external pressures on the state. There was a growing recognition of the need to devote more resources to black education, to upgrade employment and living conditions for black workers, to improve labour relations

structures and to remove discriminatory measures in the social field (so-called petty apartheid). There were reforms in these fields before Botha was elected Prime Minister. However, the political system remained unaffected. Vorster faced right-wing resistance and hesitated in his response to the Soweto uprising. Botha was prepared and willing to start on the journey of domestic political reform (Barber & Barratt, 1990:256; Beinart, 1994:227).

Regional pressures and domestic challenges initiated political reform on the part of government. This was in the period from 1978 to 1984. In 1978, P.W. Botha warned whites to "adapt or die". And in Washington in 1979 Piet Koornhof declared that "apartheid is dead" (Beinart, 1994:227). Barber and Barratt (1990:256) state that, "Reform would in Botha's view broaden his political base to include a significant proportion of the English-speakers, particularly the business sector where he had already, as Defence Minister, found a readiness to cooperate. His version of reform would, he believed, also enable him to gain support from Coloured, Asian and even some black leaders [excluding the ANC and PAC and other anti-apartheid groups inside South Africa], without affecting the political dominance of whites. Such cooperation and support was necessary if the TNS [total national strategy] was to be employed effectively. In this approach he had the backing of his senior Defence Department advisers".

The policy framework for domestic reform was contained in the twelve-point plan. Botha presented it in August 1979 before a National Party Congress in Durban. This was to be the answer to the total onslaught. The plan, which outlined a coordinated strategy including the broad lines of both domestic and foreign policy, set the agenda for Botha's premiership and gave a new sense of direction for his government and party after the uncertainties of the past few years. As such it was a "landmark statement of principles which were pursued fairly consistently during the following years" (Barber & Barratt, 1990:256-257).

Domestic issues would dominate the plan. These issues were the relationship between whites, coloureds and Indians; segregation on residential and educational level as a means to cement social contentment; the removal of hurtful and unnecessary discriminatory measures; the recognition of economic interdependence within South Africa; and the maintenance of free enterprise as the basis of South Africa's economic and financial policy (Barber & Barratt, 1990:257).

Regional relations along the lines of the constellation also featured in the plan. There was a link between domestic and regional policies in the principle, which strove for a peaceful constellation of Southern African states. The regional dimension was further emphasised when the plan referred to "a policy of neutrality in the conflict between superpowers, with priority given to southern African interests" (Barber & Barratt, 1990:259).

4.10.20. Sanctions

Domestic turmoil again reared its head in the mid-1980s. The conflict between the demands of domestic security and the needs of the economy was again illustrated. In 1984, South Africans witnessed the most intense, widespread, and protracted racial unrest the country had ever experienced. It lasted for two years. This unrest was worse than that in 1976, which started in the Vaal Triangle (southern Transvaal and northern Free State) on 3 September 1984 and spread to the rest of the country. The unrest grew out of the context of economic

hardship (due to recession and drought) and opposition to the constitutional changes brought on by Botha's twelve-point plan. The spark in the powder keg was rent increases by the new local councils in the Vaal Triangle (Barber & Barratt, 1990:304; Geldenhuys, 1990:333).

The international community was not slow to respond to the unrest. For instance, foreign banks in 1985 recalled their short-term loans to South Africa. This left the country in a foreign debt crisis. Large numbers of foreign countries began to disinvest. In 1985 and 1986, the US imposed wide-ranging economic sanctions against South Africa. The European Community (EC) also imposed various punitive measures against South Africa during that period (Geldenhuys, 1990:333).

Geldenhuys (1990:330) is of the opinion that: "The interdependence between South Africa and the international community is most evident in the economic sphere, particularly in foreign trade. This very interdependence has made the South African economy the main target of its isolators, for it is in this area that external punishment can inflict demonstrable material damage. The economic arena thus at the same time provides the most visible and tangible manifestation of South Africa's international integration and of its ostracism". On the economic front, the domestic political order of South Africa, based on the philosophy and implementation of apartheid, started to threaten its access to world markets. Apartheid also placed the economic fortunes of the country in jeopardy (Price, 1987:104).

As has been suggested, sanctions were one of the ways by which the international community isolated South Africa. Various forms of sanctions were used: economic (linked with trade in goods), financial, military, and cultural. Among the most debilitating sanctions in terms of water resources development projects were economic sanctions. These sanctions had a severe impact on South Africa's ability to earn foreign revenue and to export goods that were either directly produced by these projects (irrigated crops) or indirectly by using the water from these projects in the production processes. In addition, the loss in foreign revenue made it more difficult for the government to finance these projects.

In 1987, the South African Foreign Trade Organisation (SAFTO) listed no less than 72 countries that had applied trade sanctions against South Africa. Many of the countries that originally imposed trade sanctions on South African goods were not among South Africa's top ten trading partners. For instance, India imposed a total ban on trade with South Africa in 1946; becoming the first country to do so, even before it gained independence. Jamaica did the same in 1959. In the 1960s, several more countries prohibited all trade with South Africa. They included Kuwait, Singapore, Malaysia, and Cyprus. By 1963, about 25 countries had already declared a total trade ban against South Africa (Geldenhuys, 1990:335, 337).

Of importance, though, was when South Africa's most important trading partners started to implement trade bans. These included the United Kingdom, which had to bend to the will of the Commonwealth to implement trade bans on goods like Krugerrands and computer equipment to the South African security forces. An oil embargo was also imposed, and the exporting of nuclear materials to South Africa was prohibited (Geldenhuys, 1990:335, 337).

What was also far-reaching were the trade bans imposed by the US. This already started in 1978 when it prohibited the exporting of computers to the South African security forces. This was followed in 1982 by a ban of computer exports to any "apartheid-enforcing" agency of the South African government. In 1985, the most severe trade restrictions on South Africa

from the US were imposed by the President's executive order of 9 September 1985. The restrictions imposed by the order included *inter alia* the imposing of additional restrictions on the export of computers to official institutions in South Africa, prohibiting most nuclear exports, banning official marketing export assistance to US firms in South Africa unless they met certain labour requirements, and outlawing the import of South African gold coins⁸ (Geldenhuys, 1990:337).

This ban was followed in 1986 by the Comprehensive Anti-Apartheid Act (CAAA). This Act greatly extended the scope of US trade sanctions against South Africa. The purpose of the CAAA was "to set forth a comprehensive and complete framework to guide the efforts of the United States in helping to bring an end to apartheid in South Africa and lead to the establishment of a non-racial, democratic form of government" (Geldenhuys, 1990:337-338).

To undermine apartheid, the CAAA detailed a wide range of punitive measures. Trade sanctions involved prohibition on the following imports from South Africa: Krugerrands, products of parastatal organisations, uranium and coal, iron and steel, and agricultural products, "as well as a ban on US government procurement from South Africa". Export goods from the US were also banned. These included the following: computers, nuclear items, and crude oil and petroleum products. The US also banned government assistance to trade with South Africa (Geldenhuys, 1990:337-338).

The economic impact of trade sanctions is a matter of debate. A projection by Dr Chris van Wyk, Managing Director of the Trust Bank of South Africa, put the accumulated loss of export earnings as a result of trade sanctions at R10 billion by 1990. The trade sanctions from the US alone, under the CAAA, were according to another calculation estimated to constitute a loss of R920 million (Geldenhuys, 1990:340). In short, from 1946 to 1990 South Africa faced increasing rejection as the government developed and implemented its apartheid policy, and as it clamped down on black dissent by using violence.

Geldenhuys (1990:143) sums up South Africa's isolation position, prior to 1990, in the following way: "South Africa's position is unique [among other isolated states in the world at that time - i.e. Chile, Israel, and Taiwan]. There is no dispute about its statehood *per se*, but the nature of the state is very much in contention. The outside world insists that the state of South Africa includes the four homeland-states given independence under South African law; their independence has thus not been internationally recognised. The South African government, in turn, faces a crisis of international legitimacy, with most foreign governments challenging its right to rule South Africa".

4.10.21. Drought

The early to mid-1980s sanctions dominated South Africa's international relations with the rest of the world, but they were not alone in impacting on the country's economy. Drought also played a role. The drought started in 1978 and lasted until 1987. It was the most severe drought for between 200 and 500 years. For instance, the cumulative inflow of water into the Vaal Dam over the eight-year period from 1978 to 1986 was only half of that of

⁸ The importation of gold coins to the US was the main theme in Richard Donner's film *Lethal Weapon II*, starring Mel Gibson and Danny Glover.

the drought of the 1930s. The severe drought resulted in water restrictions being imposed on all consumers in South Africa's economic heartland and in other parts of the country as well. These restrictions were further intensified in the Rand Water Board's (now Rand Water (RW) delivering area and by municipalities that received water from it (DWA, 1986:1).

4.10.22. Namibia and Retreat from Angola

Returning to international relations, at a special session in September 1986, the General Assembly again considered the question of South Africa's presence in Namibia. The Assembly strongly reiterated its earlier call in 1966 upon states that had not obliged, "to cease forthwith, individually and collectively, all dealings with South Africa in order to totally isolate it politically, economically, militarily and culturally". There was, however, an irony regarding South Africa's illegitimate authority over Namibia. Geldenhuys (1990:142) writes that: "Both the UN and several individual states – including the US [United States], Cuba, Angola and Soviet Union – repeatedly negotiated with South Africa to reach a settlement on Namibia, thus ironically giving at least implicit recognition to South Africa's authority over the territory". South African control over Namibia was finally removed when Namibia gained its independence on 21 March 1990 (Geldenhuys, 1990:142, Meissner, 2000b:114). From then onwards, Namibia was in control of its own water resources, particularly the Fish River, and to a certain extent the Orange River (where it forms the border between Namibia and South Africa) as well.

In 1988, South African armed forces retreated from Angola, for the last time, never to return. This came after the Cuban forces had acquired such a measure of air superiority in the border war with the help of new Russian aircraft that they succeeded in pinning the South Africans down north of the frontier at Cuito Cuanavale. At the same time advancing columns of Cuban, Angolan and SWAPO forces threatened to cut off the line of retreat. This forced the South African government to the negotiating table. On 4 May 1988 South Africa, Angola, Cuba, and the United States began discussions in London. After this session, the Angolans and South Africans met in Brazzaville in the presence of Dr Chester Crocker (the American Assistant Secretary of State for African Affairs). By the end of August, all South African troops were out of Angola, including those in the area surrounding Cuito Cuanavale (Davenport & Saunders, 2000:554-555).

The scene was set for a peaceful resolution of conflict between Angola and South Africa. In December 1988 the peace protocol was signed by South Africa, Angola and Cuba, allowing for the implementation of UN Resolution 435 on 1 April 1989, and the start of an election campaign on 1 July, to pave the way to Namibian independence (Davenport & Saunders, 2000:555).

4.10.23. F.W. de Klerk and the Disintegration of Communism

In January 1989, P.W. Botha had a mild stroke. He decided to cut down on his commitments by relinquishing the leadership of the National Party while remaining State President. By a small majority, the party caucus in Parliament elected F.W. de Klerk as its new leader. From February 1989, the division between the Presidency and the leadership of the Party meant that neither Botha nor De Klerk could exercise real power. De Klerk did, however, started to

dismantle the power of the "securocrats", most notably that of Magnus Malan. In September 1989, general elections were held which the National Party won. It therefore retained parliamentary power. De Klerk was elected President after Botha had been forced to step down (Ross, 1999:182).

Following the first few months of De Klerk's Presidency, a significant event took place on the international arena. This was the disintegration of Communism in Eastern Europe. The end of Communism there reached its climax with the fall of the Berlin Wall in November 1989. De Klerk, (1998:160-161), himself, sums up the opportunity this afforded the government when he says that: "Within the scope of a few months, one of our main strategic concerns for decades – the Soviet Union's role in southern Africa and its strong influence on the ANC and the SACP [South African Communist Party] – had all but disappeared. A window had suddenly opened which created an opportunity for a much more adventurous approach than had previously been conceivable". This "adventurous approach" heralded a new era in South Africa's history.

4.10.24. 1990 to the Present: Political Reform and a Democratically Elected Government

On 2 February 1990, De Klerk delivered a "package" of political reforms in a speech at the opening of parliament, which would pave the way to concrete reforms in South Africa in the coming decade. In his speech he announced the release from prison of Nelson Mandela and the unbanning of the ANC, the SACP, PAC and a number of lesser organisations; the release of a further category of ANC prisoners and the lifting of the State of Emergency regulations (these regulations had been in force since the mid-1980s) affecting the media and education. The Separate Amenities Act was also repealed and a moratorium was placed on the death penalty. "I [De Klerk] intended to underline our commitment to establishing an internationally acceptable culture of human rights by instructing the South African Law Commission to produce a report on a charter of human rights with a view to a future constitution". De Klerk (1998:163) furthermore states that: "Although most observers had anticipated that I would announce the release of Nelson Mandela, no one had dreamed that I would do so much – that with one stroke I would remove all the reasonable obstacles to genuine constitutional negotiations".

Within little over a week, between De Klerk's speech and the announcement of the release of Nelson Mandela (10 February 1990), the South African government had succeeded in "dramatically changing global perceptions of South Africa". The speech removed one of the main causes of the confrontation between South Africa and the rest of the international community – apartheid. The other cause, the independence of Namibia, was also resolved when that country gained its independence on 21 March 1990 (De Klerk, 1998:168, 170). On Sunday 11 February 1990, Nelson Mandela was released from prison, after 27 years of incarceration on Robben Island in Table Bay (Davenport & Saunders, 2000:559).

Immediately after De Klerk's speech, the old order was starting to be dismantled and South Africa re-entered the international community from which it was disbarred previously. For instance, in August 1994 South Africa joined the SADC. Even so, the core of the dismantling of apartheid was the repeal of the Population Registration Act in 1991. It was no longer possible for people to claim rights, or be deprived of them, on the basis of racial or ethnic

classification. At the same time, the Group Areas and Natives Land Acts were repealed, and a catchall Abolition of Racially Based Measures Act passed. This Act removed about 60 pieces of legislation. The last vestige of apartheid was therefore removed. The repeal of these acts led to a ballooning of the urban population, as blacks from the rural areas came to the towns and cities in search of a better life. They swelled the numbers of the informal settlements and back-yard shacks. It also led to increasing competition for the scarce jobs in the urban areas (Barber, 1998:336; Ross, 1999:185).

4.10.25. CODESA

On 20 and 21 December 1991, a Convention for a Democratic South Africa (CODESA) at Kempton Park, near Johannesburg, was called. This occasion was attended by eight mainstream parties, including Inkatha from KwaZulu and most homeland administrations. During the first few months, it seemed as if CODESA was getting nowhere. In May 1992, CODESA II collapsed. This was followed by the Boipatong massacre. After the breakdown of CODESA and the Boipatong massacre, and slightly later the Bisho massacre, the National Party and ANC were forced to realise that a negotiated settlement had to be found. Finally, in 1993, an Interim Constitution (Act 200 of 1993) was drafted during CODESA negotiations. This Interim Constitution contained 34 constitutional principles, adopted during July 1993, which acted as the guiding criteria by which a new constitutional text would be measured. Furthermore, the Interim Constitution had to be replaced by a draft new constitution within two years time. This draft new constitution was adopted on 8 May 1996. On 10 December 1996, President Nelson Mandela signed the constitution into law at a ceremony in Sharpeville, and on 4 February 1997, the new constitution (Act No. 108 of 1996) was put into force. Regarding water resources, the Constitution stipulates, in Article 27 (1), that everyone has the right of access to health services, adequate food and *water* and social security (Constitution, 1996; Taljaard & Venter, 1998:24, 25; Ross, 1999:189; Davenport & Saunders, 2000:560). Thus, access to adequate water is entrenched in the Constitution of the Republic of South Africa as a basic human right.

4.10.26. Drought

Even as South Africa was going through a turbulent transitional period the country experienced yet another severe drought, from about 1991 to 1995. A large part of the country was affected by this extreme weather event. Various municipalities in the Karoo experienced water shortages and the levels of irrigation dams in the region were critically low. Assistance was given in the form of geohydrological surveys and the sinking of boreholes. In 1992 the Hendrik Verwoerd Dam (now Gariep Dam) reached its lowest level yet namely 19%, but it increased to 28% in December the same year. The level of the dam was maintained above 30% by replenishment from the Hendrik Verwoerd Dam. An emergency pumping station was erected in the PK le Roux Dam. This was to augment the Van der Kloof main canal in the event of the level of the latter dam dropping so low that water could no longer be supplied through the dam's canal outlets. The prevailing drought also caused serious water shortages in the northern parts of the country. Drastic water restrictions had to be imposed in several areas. No water restrictions were imposed on the PWV complex or the Vaal-Hartz Government Water Scheme in 1993. This was mainly due to the sufficient storage in the Sterkfontein Dam. Yet water had to be pumped from both the Heyshope and Zaaihoek Dams

to the Grootdraai Dam because of the drought. This was to keep the SASOL II and III installations and the ESCOM power stations operating (DWAF, 1993:100).

In the Eastern Transvaal in 1993 it was particularly dry and it was feared that at one stage the Sabie River would stop flowing. If this happened it would have had dire consequences for the Kruger National Park. The content of the Braam Raubenheimer Dam (now the Kwena Dam) in the Crocodile River (Eastern Transvaal, now Mpumalanga) dropped to 10.4% during December 1992. The Vygeboom Dam's level dropped to only 2.2%. This dam is of strategic importance, because it supplies water to a number of ESCOM power stations. With only 2.2% in the Vygeboom Dam and hardly any flow into the Nooitgedacht Dam, the situation for ESCOM in the Eastern Transvaal was assuming critical proportions. Consequently, it was decided in the course of the year to go ahead with an emergency augmentation scheme from the Usutu to the Incomati River. Water was pumped across into the Incomati in April 1993. The drought was broken in 1995 after heavy rains fell over large parts of the country. These rains led to disastrous floods in northern KwaZulu-Natal and Mpumalanga. The December 1995 downpour, the fourth-largest in history, saw the Vaal Dam experience its largest flood on record. This did not lead to any damage due to efficient management, which brought control over the Vaal and Bloemhof Dams (DWAF, 1993:101; DWAF, 1996a:3). The drought was to have no impact on South Africa's transition to a democracy.

4.10.27. Democratic Elections and the ANC is the New Ruling Party

Between 27 and 29 April 1994, over 19 million South Africans went to the polls to cast their ballots in the first democratic election ever to be held in South Africa's history. There was no violence on the election days, which was a relief for, between 1992 and 1994, South Africa went through one of the most violent and bloody periods in its history. The ANC won 62.65% of the vote, followed by the National Party's 20% and the Inkatha Freedom Party's 10%. On 10 May 1994, Nelson Mandela took over the presidency from F.W. De Klerk, who was, together with Thabo Mbeki, sworn in as vice-president of South Africa (Ross, 1999:194, 196; Davenport & Saunders, 2000:568).

A government of National Unity was established, consisting of ANC, NP, and Inkatha Freedom Party (IFP) ministers. The government immediately "set about repairing South Africa's injured body politic". The Mandela administration planned to coordinate a massive Reconstruction and Development Programme (RDP). The responsibility of the RDP fell on the presidential office under the direction of a Minister without Portfolio, Jay Naidoo. The first budget introduced by Derek Keys, Minister of Finance, aimed to cut inflation while searching for R2 billion for health, welfare, education, housing, land, water, urban renewal and other development projects. Before the end of 1994, doubts had already been expressed regarding the delivery of these goods through the RDP. This was especially true in the field of housing (Davenport & Saunders, 2000:569).

After the ANC won the election of 1994, the party had the chance to address a diversity of social issues in South Africa. One of these was unequal access to water of a large part of the South African population. For instance, by November 1996, 18 million South Africans did not have access to safe water and sanitation. The RDP was the framework by which these social issues were to be addressed. The RDP's slogan, regarding water and sanitation, was *Water Security for All*. This reiterated the importance of clean water and sanitation to all

South Africans. The following policy objectives were formulated: the right to water for every South African, the satisfaction of every person's health and functional needs, an increase in agricultural output, and economic development (SAIRR, 1997:800, 811; Van Wyk, 2001:40, 45-46).

4.10.28. The Economy

On the economic front, there was little hope for rapid economic growth. This was due to the braking effects of earlier sanctions and a racially restrictive training system. These aspects hindered the country's capacity to expand production of beneficiated goods for the world market. "Economic growth was also impaired by the massive diversion of revenue to service high-interest loans raised in the sanctions era, a consequent rise in personal tax levels, and the hesitance of foreign investors to risk entering a small-scale market protected by exchange controls and seemingly threatened by 'wage-hungry' trade unions" (Davenport & Saunders, 2000:570).

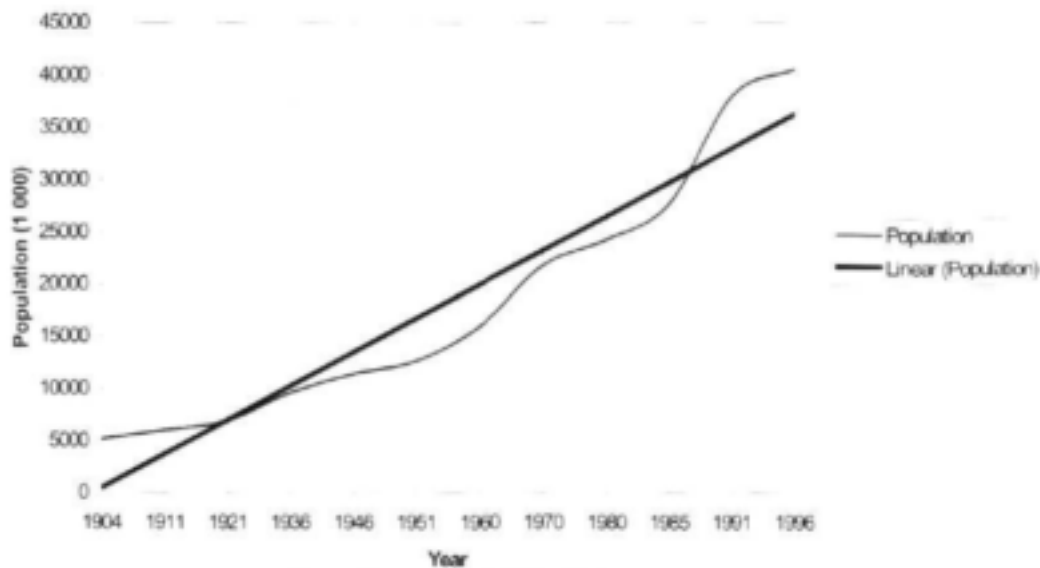
In 1996, the government of national unity announced its preference for an open economy with a new Growth, Employment, and Redistribution (GEAR) policy. This policy aimed to rebuild the economy through orthodox budgeting, tight control on inflation, and the creation of new jobs through the promotion of exports and the freeing up of the money market. It was also a move away from the leftist, basic-needs-orientated RDP to a rightist, neo-liberal economic policy (Davenport & Saunders, 2000:570; Peet, 2002:54).

Economic growth was one of the most important aspects in the delivery of services under the RDP programme. This is especially the case when it came to water delivery, for financial resources are needed to pay for the infrastructure. By 1998, three million of the 12 million people without water had already been provided with water. This meant that three million people did not have to walk long distances for their water needs every day, especially in the rural areas. It also meant that socio-economic development had been stimulated in these areas (Van Wyk, 2001:58-59).

However, it is not clear whether this policy is sustainable. The issue is also whether projects launched by the Department of Water Affairs and Forestry (DWAF) would be maintained at a sustainable level by local authorities in rural areas. In some rural areas up to 30% of services are not paid for. In 1999, it was reported in the press that the Working for Water Programme in some parts of the Western Cape was not a success (*Beeld*, 11 September 1999; *Die Burger*, 8 July 1999; Van Wyk, 2001:59).

Possible reasons for this, according to Van Wyk (2001:59) are poor economic circumstances, corruption, and the pressure of population growth (see Figure 3) on the country's water resources. In parts of KwaZulu-Natal, Zulu chiefs "blocked" the opening of water projects. It was reported that these chiefs were not part of the planning and management of the project. Vandalism also took its toll, like at the presidential project of R48 million at Sinthumule (*Pretoria News*, 14 March 1998; *Sunday World*, 18 May 1999).

Figure 3
Increase of South Africa's Population: 1904-1996



Source: Statistics South Africa, 2002

Privatisation also became an issue in some of the water management policies initiated by government. For instance, in 1997 the Confederation of South African Trade Unions (COSATU) and the South African Municipal Workers Union (SAMWU) protested in Nelspruit over the tender process in Mpumalanga to manage the province's water resources. The unions protested a decision by the provincial government to get the private sector involved in the management of water resources (*Mail & Guardian*, 9 May 1997).

4.10.29. The Second Democratic Election

In 1999, all South Africans over the age of 18 went to the polls for the second time since 1994. This election resulted in a massive victory for the ANC, which received fractionally less than two-thirds of the vote. Thabo Mbeki, who had been effectively running the country for the previous two years, was elected President (Ross, 1999:201). This gave the ANC another opportunity to implement its policies concerning South Africa's social issues.

4.10.30. Communities Affected by Large Dams

A significant event took place on 11 and 12 November 1999 in Cape Town, regarding the history of large dams in South and Southern Africa. This event was the South African Hearings for Communities Affected by Large Dams. At these Hearings participants from Southern African countries met to discuss and analyse the negative and positive social,

environmental, and economic impacts that large dams had had on their communities. The hearings were hosted by the Environmental Monitoring Group (EMG), the Group for Environmental Monitoring (GEM), and the Botswana Office of the International Rivers Network (IRN-Botswana), under the patronage of the Reverend Njongonkulu Ndungane, Anglican Archbishop of Cape Town (Stott, Sack and Greeff, 2000).

Secretariat staff of the World Commission on Dams (WCD) included Prof. Kader Asmal, South African Minister of Education, who chaired the WCD. Minister Ronnie Kasrils, South African Minister of Water Affairs and Forestry, and Justice Albie Sachs of the South African Constitutional Court were also present (Stott, Sack and Greeff, 2000).

At the end of the two-day event representatives of communities all over Southern Africa voiced their opinions of large dams in the Final Declaration. Yet in the Declaration there was not a call to halt forever the construction of large dams. Nonetheless, it became clear that the history of large dams and affected communities in Southern Africa "has been one of broken promises and incalculable losses". Because of large dams, most of them constructed in South Africa during the twentieth century, livelihoods, land, livestock, wildlife, cultural values, ancestral sites and lives had been lost. The community representatives also stated that: "Large dams have also caused a decrease in the standard of living of communities; a decrease in health levels; an increase in HIV/AIDS and other diseases as well as crime and inter- and intra-community conflicts". Because of these negative impacts, the meeting called for a *moratorium* on new dams until the WCD has published its findings and best practice guidelines (Stott, Sack and Greeff, 2000). The WCD findings and best practice guidelines, contained in its final report, were published at the end of 2000.

What also became known at the hearings was that, when large dams were planned and implemented, there had been inadequate community participation, inadequate information dissemination, and inadequate compensation. Communities were often forced to move against their will, to make way for large reservoirs. "They were not treated with dignity or with respect for their customs. In fact, large dams have been devastating to many of Southern Africa's local communities" (Stott, Sack and Greeff, 2000).

The hearings were not only about the past injustices suffered by communities and the negative impacts of large dams on their living standards. The participants also made a number of recommendations to ensure that past injustices were rectified, and to ensure that in the future communities would be treated in a just, equitable, and dignified manner. Some of these recommendations were as follows:

1. Effective participation of communities in the decision-making and implementation process must be facilitated;
2. There must be an increase in openness and transparency.

To achieve these objectives the following were recommended:

1. Communities must be empowered with information as to their rights and the development of community committees;
2. Funds should be provided for community and non-governmental (NGO) participation;
3. Binding and forcible contracts for compensation and resettlement programmes need to be entered into, and

4. Dams in all their aspects must be continually monitored (Stott, Sack and Greeff, 2000).

The hearings heard evidence from communities who were affected by the following large dam projects constructed in the four international river basins:

1. The Gariep and Van der Kloof Dams (Orange River);
2. The Lesotho Highlands Water Project (Orange River);
3. The Loskop Dam (Limpopo River);
4. The Maguga Dam (Inkomati River); and
5. The Pongolapoort Dam (Maputo River) (Stott, Sack and Greeff, 2000).

These aspects regarding the dams and the hearings will be discussed in the individual case study chapters.

4.11. Conclusion

This chapter has indicated some of the most important events in the history of South Africa in a concise manner. It was not the intention of the authors to write a complete history of South Africa. Many facts are missing, but it is not possible to include all the facts about South Africa's history in one chapter. Therefore, the chapter only looked at those events with the most likely impact on the hydropolitical history of South Africa's international river basins. This chapter illustrated the meaning of certain developments and related events. In the following chapters, the hydropolitical history of South Africa's four international rivers will be presented. This will be followed by the history of the institutional development of water resources management in the country. In the conclusion, the historical events and developments will be linked with the hydropolitical history of the four international river basins.

5. THE ORANGE RIVER BASIN

5.1. Introduction⁹

The Orange River basin is the most developed of all the rivers in Southern Africa, with at least 29 dams with a storage capacity of more than 12 million cubic meters (mcm) (24 in South Africa and five in Namibia) (see Figure 4). This number excludes the recently completed Katse and Mohale Dams in the upper reaches of the Orange/Senqu in the Lesotho Highlands. The largest of these are the Gariep Dam, with a storage capacity of 5 600 mcm, and the Vanderkloof Dam, with a storage capacity of 3 200 mcm (Heyns, 1995:10, 11), both of which are in South Africa – the former being a critical component of the ORP (Turton, 2003a).

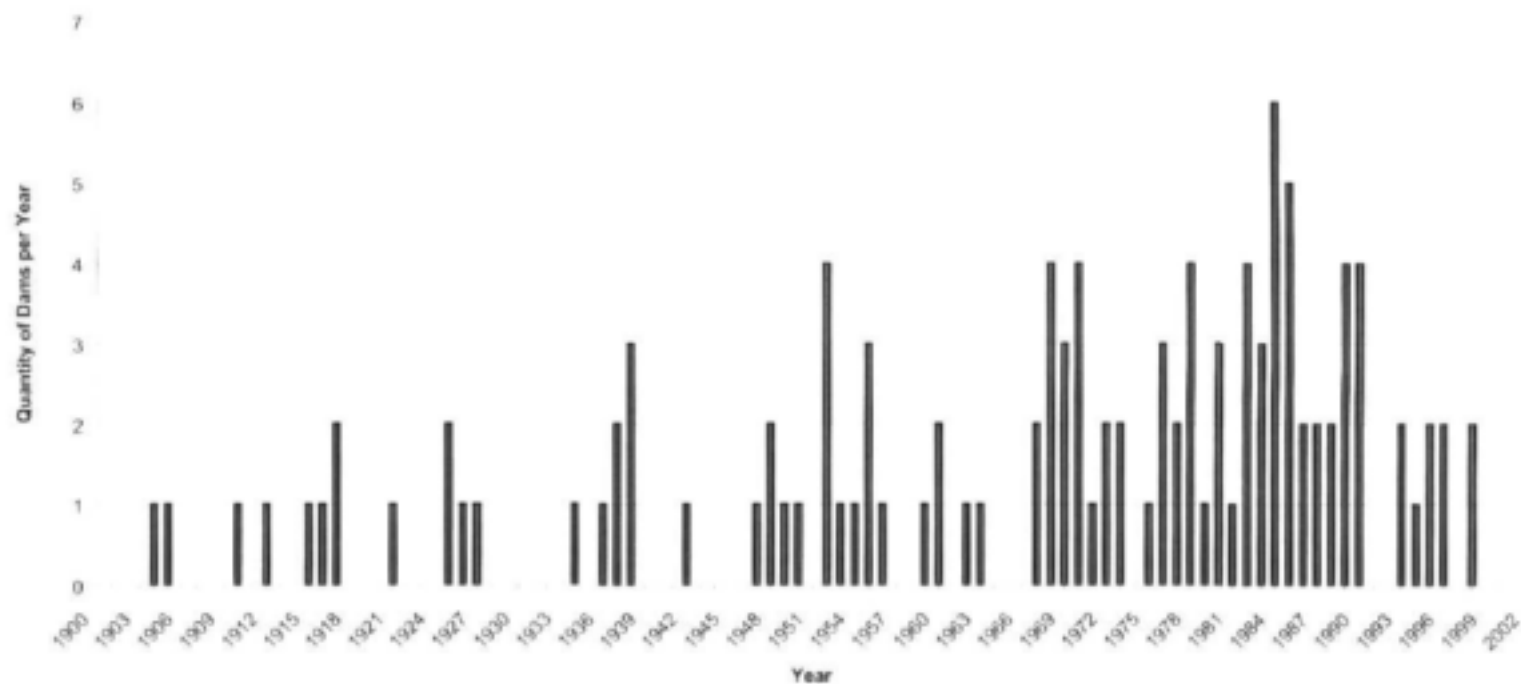
The fact that the Gauteng Province is 100% reliant on inter-basin transfer (IBT) water, all of which is channelled via the Vaal River system, illustrates the strategic importance of the Orange River basin. The South African national economy is, in other words, heavily reliant on water from this particular basin. The Orange River basin is the largest of all the “international river basins” in South Africa, both in terms of physical size, and in terms of the volume of water (MAR) involved. The importance of this river basin is also evident in the fact that the Orange is a recipient basin for three IBTs; a donor basin for three IBTs; with four intra-basin transfers also in existence (Turton, 2003a).

As has been suggested, this chapter will describe the hydropolitical history of the Orange River. Of all four river basins the Orange River has one of the longest histories, especially considering that the earliest remains of humans were found in the basin, near Taung in the North-west Province. It was only later, about 1.5 to 3 million years ago, that the exploitation of the river started on a grand scale.

In the first part of the chapter a physical description of the Orange River basin is presented. This is followed in the second part by a discussion on the early history of the Orange River. This part differs fundamentally from those of the chapter of the other three river basins. The Orange River was the first of the international rivers to gain interest from whites (in 1777), who later developed the river on a grand scale.

⁹ Part of the introduction to this chapter was taken, *verbatim*, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

Figure 4
Number of Large Dams Built in the Orange River Basin between 1900 and 2002



5.2. Physical Description of the Orange River Basin¹⁰

The Orange River basin has a total basin area of 964 000 km² with an annual MAR of 11 200 mcm. There are four riparian countries, with 4% of the basin area lying in Lesotho (upstream riparian), 62% in South Africa, 9% in Botswana, and 25% in Namibia (downstream riparian). Contribution to MAR by each riparian is unequally distributed, with 55% coming from South Africa, 0% coming from Botswana, 41% coming from Lesotho and 4% coming from Namibia. There are slight variations in this data between the riparian countries (Savenije & van der Zaag, 1998:30), but this is not contested in any way, so this minor discrepancy is hydrologically irrelevant. The Orange River carries approximately 20% of the total river flow in South Africa, with the Vaal being an important tributary (Basson *et al.*, 1997:40; Mohamed, 2003:218; Turton, 2003b).

The Vaal River is regarded as being a river basin in its own right and provides Gauteng with all of its water. Gauteng in turn accommodates 40% of the South African population, creates 50% of the country's wealth, and generates 85% of the electricity in the entire country (Conley & van Niekerk, 1998:146). In order to support this economic activity, the Vaal sub-basin has links to eight other river basins in a complex arrangement of IBTs that range from the Limpopo in the North, to the Sundays in the South (Heyns, 1995:18). In the Vaal basin, much of the water returns to the Orange River as treated effluent, which is available for downstream users (Conley, 1995:11). In addition, a staggering 100% of the economic activity in Gauteng is reliant on IBTs (Basson *et al.*, 1997:55). This makes the Orange River of great strategic importance to South Africa, hence the significance of the LHWP (Blanchon, 2001; James, 1980; Davies *et al.*, 1993:169; Davies & Day, 1998:299-304; Mohamed, 2003:220; Turton, 2003).

Not only is the river's water of strategic significance to South Africa, but also the other basin states sharing the river. For instance, Namibia has expressed an interest in obtaining more water from the Orange River, but for transfers to occur the large losses that are experienced in the Lower Orange would have to be taken into account (Conley, 1995:7, 11; Conley, 1996:17). Also, the city of Gaborone can be supplied with water from Lesotho in future, giving Botswana a strategic interest in the basin, even though it contributes no MAR and uses none of the water from the Orange River Basin at present (Turton, 2003a). Thus, the limited water resources within the river are determined by the yield based on current infrastructure. Changed operation and/or additional infrastructure could increase available yield allowing new development opportunities (P. Pyke, personal communication, 18 December 2003).

The Orange River forms the border between South Africa and Namibia. There has been confusion over the actual location of the border, with a demarcation in 1890 being the high-water level on the northern bank (Hangula, 1993:105), effectively depriving Namibia of independent access to the water (Heyns, 1995:11). There is a border dispute between South Africa and Namibia as a result of promises that the border would be moved to the middle of the river, which were allegedly made during the run-up to Namibian independence (*The Namibian*, 9 July 1999; Ashton, 2000:86-89; Meissner, 2001:35). Shifting of the border has never occurred and allegations are being made that South Africa has reneged on its

¹⁰ Part of the physical description of the Orange River basin was taken, *verbatim*, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

agreement. This has the potential to tarnish South Africa's hydropolitical image, which was damaged during Operation Boles in Lesotho during 1998, but it does not seem to be a major issue that threatens international relations.

These events are only some of the most recent taking place in the hydropolitical history of the Orange River, with its history dating back much further and can be traced back to times when humans first settled in South Africa. It was only from the 1760s onwards that the Orange River started to become more relevant, especially within the European culture and economy.

5.3. Early History of the Orange River Basin

Until the latter half of the eighteenth century, the main stem of the Orange was only known by the indigenous peoples of South Africa. In 1760, Jacobus Coetzee Jansz crossed the Orange River. This was during one of his hunting expeditions (Wilcox, 1986:18-19) because Jansz was an elephant hunter (Green, 1945:121). Jansz was not the first and the last to travel into the interior. The Orange River became known to the Dutch by the accounts of Khoi-Khoi and San people with whom they came in contact. It was not only curiosity that led Simon van der Stel and other Europeans into the interior to look for the river, but the lure of riches, like metals and ivory. Discovery was also on the agenda of some of the early explorers who ventured into the interior from the mid-1700s onwards (Wilcox, 1986:19).

Subsequent explorers followed in the footsteps of Jansz. In 1761,¹¹ Hendrik Hop launched an expedition into the interior to look for the Herero people and Coetzee's "camel" (giraffe that he came across during his travels in the interior). Hendrik Hop travelled beyond the river, but did not add any knowledge to the European settlement at the Cape regarding the river system (Wilcox, 1986:19).

Interestingly, the indigenous peoples of the Orange River were in a constant war over water and the sparse grazing in its valley. The reasons for this are summed up by Wilcox (1986:20). He notes that: "here was semi-desert to the north and to the south, with the Great River the only perennial river for some 300 km, and with but a few springs, so grazing cattle was only seasonal, after the scanty rains. For the Hottentots, therefore, not agriculturists and only occasional hunters and fishers, access to the Orange River Valley for much of the year was practically vital. The competition was made yet fiercer by the migration of other Hottentot tribes ... from the southern Cape where they were being ousted by the European farmers. The increasing population of Hottentots and their livestock drove out the wild game on which depended the Bushmen, who had prior occupation of the valley". The Bushmen therefore started to hunt the cattle of both the Khoi-Khoi and European farmers because of dwindling numbers of game in the Orange River valley. For instance, the Hop expedition lost 30 head of cattle to Bushmen raiders (Wilcox, 1986:20).

The competition over water and grazing in the Orange River valley among the indigenous peoples was fierce. For example, the successive wars led to a dwindling in the population of

¹¹ In the same year (1761) the first recorded murder occurred along the river when Coenraad Scheffer, part of Hop's expedition, shot and killed a Hottentot servant Ruyter. Scheffer was sentenced for the murder, but because he had a history of mental instability he was sent to Robben Island, from where he escaped nineteen years later, never to be heard of again (Wilcox, 1986:19-20).

males in many communities. This in turn led to the practice of polygamy among the Korana-Thaping people in that a person should marry his brother's widow (Wilcox, 1986:21).

5.3.1. Colonel Robert Jacob Gordon

In 1777, Colonel Robert Jacob Gordon journeyed to the Orange River in his first expedition. He reached it on 23 December 1777 on the south bank opposite present-day Bethulie where the Caledon River meets the Orange. Here he named the Orange River (unofficially) after the House of Orange and the Caledon Prince Willem de V. River. Col. Gordon also produced a number of fairly accurate maps of the river by using a quadrant and a mercury barometer (Barnard, 1950:334, 338, 341; Wilcox, 1986:25, 39).

In October 1778, Col. Gordon and Governor van Plettenberg journeyed to the Orange River. This was to mark the northern border of the Dutch East India Company's reach in the colony. The frontier then stretched to the Banks of the Zeekoe River 45 km south of the Orange (Wilcox, 1986:29).

Col. Gordon undertook his second expedition to the Orange River in 1779. This time he travelled north in the direction of the Orange River mouth and reached it on 17 August 1779. Here he officially named the Orange River in honour of the House of Orange (Barnard, 1950:353; Retief, 1897:35; Barrow, 1801:294).

His travelling companion, Col. William Paterson, described the ceremony in the following manner. In the evening, the party launched Col. Gordon's boat, and hoisted the Dutch flag. Col. Gordon proposed to drink the States' health, that of the Prince of Orange, and the Company. After this, he named the river in honour of the Prince (Wilcox, 1986:38).

What was the purpose of the second journey? One of the most important reasons for Col. Gordon travelling to the Orange River a second time was to see whether the river was navigable. This was significant, for if the river was navigable a harbour could be established through which copper could be exported. Col. Gordon noted, however, that not even a small boat could enter through the mouth and continue upstream. Secondly, he wanted to ascertain if it was the same river that he had visited in 1777. He was convinced that it was the same river for the river at the mouth had the same width and the vegetation growing on its banks was the same (Wilcox, 1986:38-39).

The official naming of the river was a significant occurrence in the river's hydropolitical history. It was here that sovereign control over the river was established, although it was not for purposes of full utilisation (that is, irrigation). The river also received a colonial name and would be known hereafter as the Orange and not the Gariep (Great) River, as it was known to the Khoi-Khoi.

Col. Gordon also travelled upstream from the mouth to where the Vaal River reaches the Orange. Here he named the Vaal River the Hey Garieb and the Orange, upstream from the confluence, as the Noe (Black) Garieb (Barnard, 1950:358).

5.3.2. More Expeditions by Other Explorers

After the first expedition of Col. Gordon, a Swede named Hendrik Jacob Wikar travelled along the river in 1778. It is noteworthy that he was the first European to have seen more than 400 km of the Orange River, including the Augrabies Waterfall (Wilcox, 1986:20-21).

What is also noteworthy about his expedition is that he tested the fertility of the alluvial soils found on the banks of the Orange River. He planted a number of pumpkin and watermelon seeds. When he returned to the spot two months later he noted that "everything was growing beautifully" (Wilcox, 1986:22).

This is the first known instance of interest by Europeans in the natural resources (soil) of the Orange River. However, no plans to settle the banks of the Orange River by farmers on a large scale were proposed by Wikar. Yet before 1777 the *Vereenigde Oos-Indiese Compagnie* (VOC) (Dutch East India Company) granted plots of land to farmers on the south bank of the Orange River (Wilcox, 1986:24). It is not known where exactly this occurred and whether these farmers started to cultivate extensive tracts of land.

After Col. Gordon and Wikar's travels a number of other explorers also ventured into the interior for different reasons. They were:

- Francois le Vailant in 1783 (Wilcox, 1986:42);
- Willem van Reenen in 1791 in search of gold, (Wilcox, 1986:49);
- John Barrow circa (c.) 1797/98, who first hinted at the utilisation of the Orange River for agricultural purposes;
- Carel and Jacob Kruger (two criminals convicted of forging Rix-dollars) (Wilcox, 1986:50);
- Cowan and Donovan, who travelled to the Molopo River (Wilcox, 1986:50);
- William Anderson in 1801 (Wilcox, 1986:50);
- J.W. Janssens in 1803 (Wilcox, 1986:62-64);
- Pieter Johannes Truter and Dr William Somerville, who went on an official expedition to attempt to establish cattle trade with the Bechuana (Wilcox, 1986:51);
- Tulbach H. De Graaf, with Dr M.H.K. Lichtenstein as naturalist and doctor to an expedition in 1805. When they reached the river near present-day Prieska, Lichtenstein noted that the river was susceptible to great floods. He noticed that trees had been deposited 15 metres (m) above the water line (Wilcox, 1986:50, 51, 53);
- Col. Richard Collins in 1809 (Wilcox, 1986:64);
- William Burchell travelled extensively throughout South Africa during 1811-1815. He arrived at the river near present-day Prieska in 1811 accompanied by William Anderson. He described the river in vivid detail, made a number of drawings, and catalogued the trees, flowers, and the large variety of birds he found at the spot and throughout South Africa. He also travelled up the Vaal River where the Riet River flows into it and the Noe Garieb (Wilcox, 1986:54-55). Burchell and the other travellers not only contributed to the knowledge of the ecology of South Africa, but also described the Orange River to some extent;
- Missionaries Hodgson and Broadbent in 1823;
- James Archbell, missionary, in 1823, who also mentioned the presence of diamonds, found by the indigenous people, along the Orange River (Wilcox, 1986:66-67, 85);

- George Thompson visited the Orange River in 1823 and 1824. He made a detailed description of the Augrabies Falls and named it King George's Cataract (Wilcox, 1986:66-67);
- A.G. Bain and J.B. Biddulph in 1825 and 1826;
- Schoon and McLuckie in 1829;
- David Hume also in 1829;
- Dr Andrew Smith in 1834;
- James Alexander in 1836 to the Orange River mouth, to assess its usefulness as a port (Wilcox, 1986:14);
- Sir Cornwallis Harris crossed the Orange River in 1836 (Wilcox, 1986:69);
- James Backhouse, Quaker missionary, businessperson, and botanist in 1839 (Wilcox, 1986:67); and
- In 1856, the missionary Richard Ridgill crossed the river, only to discover that it was in flood (Wilcox, 1986:49-50).

Barrow (1797 to 1798), for instance, noted that the river "might be made by the help of canals, to fertilize a vast extent of adjoining country". According to Wilcox (1986:62), this proposal was the forerunner for the Orange River Project (ORP). In addition, on this journey Barrow noted that the Orange River was in flood and that he was unable to cross it (Wilcox, 1986:62).

Collins, on the other hand, noted in 1809 on an inspection expedition to the frontier that a severe drought had lasted for a number of seasons. This led to the destitution of the Bushmen in the Colesberg district. He also named one of its tributaries in honour of Governor Caledon (Wilcox, 1986:64, 65). The drought that Collins spoke of in 1809 was also mentioned in 1811 by William Burchell, in that the river was so low that he could cross it with ease (Burchill, 1967:287, 293). The above outlines the first recorded account of the Orange River in flood and perhaps also a drought in its basin. The Orange River was therefore becoming increasingly known to European colonists.

The reasons for the numerous expeditions into the interior of South Africa are summarised as follows:

- Hunting,
- Trading,
- Discovery,
- Adventure,
- Fleeing the law (convicts),
- Search for gold (the legendary city of Monomatapa) and other mineral riches such as copper,
- To spread Christianity (setting up of missionary stations),
- To acquire new knowledge of the frontier (Wilcox, 1986:55-61).

These expeditions also had another impact, other than extending knowledge about the river. The indigenous peoples of South Africa (San, Khoi-Khoi, and Bantu-speaking peoples) became increasingly aware of the intrusion into their land. This constituted a danger to their autonomy, identity, and way of life. The erosion of their autonomy was intensified by an increase in the number of intruders and the appearance of new encroachers. These included,

in particular, the Huguenots in the late seventeenth century and the 1820 British settlers and those who followed the missionaries, traders, hunters, and trekboers. These interlopers on the land of the indigenous peoples had the intention to become permanent residents of the region. In these cases, a more or less open conflict over the use of natural resources – land and water supplies – followed. This later turned into a conflict over physical control over the entire territory and all of its inhabitants (Thompson & Lamar, 1981a:10).

5.3.3. The Arrival of the Missionary

In the early nineteenth century, a non-state entity started to establish itself in the Orange River basin – the church.¹² William Anderson instituted a mission station at Aakaap (later known as Rietfontein) 64 km north of the Orange River in Griqualand in the early 1800s. He later moved the mission to Klaarwater (later Griquatown) where there was a better supply of water (Wilcox, 1986:51; Keegan, 1996:83). To be sure, the church would later play an important role in the foundation of the hydraulic mission in the Orange River basin.

The individual missionaries who were stationed at their missions also contributed to the knowledge of the Orange River. A missionary station was established north of Kamiesberg in 1805. Another station was found in 1807. This one was located across the river in Great Namaqualand at Warmbad. This led to greater missionary activity with repeated crossings of the Orange River to follow (Wilcox, 1986:49).

There were some benefits to the church's coming to settle in the basin. In the early 1800s, the Orange River was known as a lawless frontier. Wilcox (1986:54) states that the American Wild West was highly civilised in comparison with the Orange River frontier. Thus, the missionaries had their work cut out for them. The missionaries who travelled to the mission stations at the Orange River and beyond contributed considerable knowledge about the river and the interior. What is missing, however, is the knowledge of the river held by the indigenous peoples of South Africa.

One of the expeditions undertaken by a missionary to the Orange River and beyond that had historic significance was that by Reverend John Campbell. He visited Lattakoo and Klaarwater in 1813. The purpose of his expedition was to inspect the missionaries of the London Missionary Society (LMS) (Wilcox, 1986:55). When he reached the Orange River, he gave a description of it. He stated that: "The river being as broad as the Thames at London Bridge, being also deep and rapid, the crossing with wagons appeared somewhat formidable" (Campbell, 1815). From this we can deduce that the river was flowing quite strongly and that 1813 was not a drought year.

The river was also most probably used for the first time to conduct a baptism by immersion when a Bushman was baptised (Wilcox, 1986:56). After Campbell visited Lattakoo in 1813, he followed it upstream to the Harts River and downstream from it to the Vaal River. He called this river the Yellow River. He saw the Vaal River as the main continuation of the Orange and the river that met it from the southeast (the Orange) as a tributary of the Vaal. He

¹² The first missionary attempt among the indigenous peoples of South Africa was the mission station that was established in 1737 by the Moravians at Baviaanskloof (which later became known as Genadendal), beyond the Hottentots Holland mountains east of Cape Town (Keegan, 1996:82-83).

named this river the Cradock River after Sir John Cradock, Governor of the Cape at the time. He claimed to have visited a part of South Africa that had never been seen by Europeans. However, he did not mention the journeys of Burchell to the same part of the world (Wilcox, 1986:57).

Even so, more information on the Orange River was becoming available to the people in the Cape and in England. For instance, the information Lichtenstein gathered about South Africa became known to those in Europe. John Campbell, for instance, also provided a description of the climate of the Orange River basin. He noted that during the hottest time of the day the ink dried in his pen even before it reached the paper. When travelling away from the river, in either a northern or a southern direction, he noted that the country was almost waterless (Wilcox, 1986:53, 58-59).

5.3.4. The Orange River as a Boundary of the Cape Colony

At around 1810, larger numbers of trekboers and hunters started to cross the Orange River into an area later known as the Free State. Two hunters, Gerrit Kruger and Paul Bester, did travel to the upper reaches of the Caledon River and met Moshesh, who was building up his power (Wilcox, 1986:66).

Either way, from 1824 stretches of the Orange River were being proclaimed as the boundary of the Cape Colony. Wilcox (1986:79) states in this regard that: "The Great River by its very existence had inevitably a profound effect on the history of South Africa as the cause of conflict for access to its waters and herbage; and as first a natural, and then a political boundary. The latter, however, was slow to come. Neither the Dutch nor the British Administration wanted the responsibilities of extending the boundaries of the Colony. All they had ever wanted was the Cape for its importance, strategically and commercially, between Europe and the East. The process of expansion was forced upon them [the indigenous peoples]".

A number of reasons for this "forced" expansion can be cited:

1. To increase the supply of livestock for the Colony, loan places were granted by the Cape Administration to farmers. This was done in an illegal manner beyond the frontier.
2. Traders and hunters travelled across the frontier in increasing numbers without the permission of the Governor. They met the indigenous peoples – the San, Khoi-Khoi and Bantu – which resulted in escalating conflict. These troubles were exacerbated by the activities of brigands and criminals fleeing from the law.
3. Missionaries and trekboers journeyed into the interior, and these people needed protection from the Cape Colony Administration and a certain amount of control over them from the Administration.
4. To establish order, sections of the frontier were advanced by proclamations. This resulted in the prior possession of San, Khoi-Khoi, and Bantu territories (Wilcox, 1986:79).

There was thus a gradual expansion of sovereign authority over ever-increasing parts of the Orange River basin and later the other international river basins in South Africa. This increased control also coincided with a ballooning of the European population in the Orange River basin.

5.3.5. The Appearance of Farm Dams

It was around 1828 that dams started to appear on some farms in the eastern part of the Cape Colony (Brown, 1877:584). It is not known whether these dams were located in the Orange River basin. These dams were mainly used for domestic purposes and the watering of livestock. They were earth embankment dams and mainly captured precipitation. The appearance of these dams could be an indication that farmers were reacting to a hostile environment and needed a measure of control over their much-needed water resources. These dams were permanent in nature, and this could also be an indication that not all European farmers lived a trekboer lifestyle. It is, furthermore, an indication that individuals started the early hydraulic mission, although on a limited scale. Yet not a lot is known about these dams, their quantity, and the manner in which they were constructed.

5.3.6. Discovering the Source of the Orange River

In 1833 Moshesh heard of the service missionaries conducted among the Griquas, sent some people to Griquatown, and invited some of missionaries to Basutoland. Three missionaries from the Paris Evangelical Missionary Society (PEMS) arrived shortly after the invitation. They were Arbousset and Casalis, both priests, and Gosselin, a missionary artisan. By this time the Drakensberg mountain range was well known from descriptions of traders, hunters, and trekboers. What was also inviting was that somewhere in these mountains lay the source of the Orange River (Wilcox, 1986:67).

In 1836 Arbousset and Daumas, a fellow missionary, set out to find it. They discovered one of the sources of the Orange River, which was a spring flowing from a mountain "in which other rivers took their rise". These rivers were the Caledon, Tukhela, and the Elands (the Elands River was mistaken for the Vaal River by them). This mountain they named *Mont-aux-Sources*. Thus, the Orange River was now known from source to mouth, "except for some short stretches" (Wilcox, 1986:67).

During their expedition, Arbousset and Daumas also mentioned that the Caledon River could be used for the purposes of irrigation. Arbousset stated in this regard that: "Notwithstanding its depth, and the steepness of its banks, the Caledon might, in certain places, be led and employed to irrigate and fertilise the soil" (Arbousset, 1846; Brown, 1877:595).

However, no efforts were made to start with immediate utilisation of the Caledon's water resources. Possible reasons for this could be the low population density and the subsistence agriculture, based on dry-land farming, practised by the Basotho. The Great Trek was also not yet in full swing, which meant that European farmers had not yet settled the land. If they had, it is doubtful that they would have heeded the advice of Arbousset and Daumas, for they did not possess the technological knowledge needed to start with irrigated agriculture.

More significantly, Arbousset and Daumas gave some detailed descriptions of the geography, hydrology and geology of the upper reaches of the Orange in Lesotho and the Caledon River (Brown, 1877:593-597). This would later prove useful data when J.C. Brown published his book *Hydrology of South Africa* in 1875 and provided reasons for the advancement of irrigated agriculture.

5.3.7. Drought

In 1834 Dr Andrew Smith crossed the Vaal River near its confluence with the Orange River. This crossing is significant in that he went through a nearly dry river (Wilcox, 1986:67). This is an indication that a drought must have prevailed in South Africa then. It could also have been a region-wide drought, because drought was one of the reasons why the Great Trek took place.

5.3.8. Navigation of the River

In 1854 an attempt was made to transport copper ore from Kotas on the Orange River to Alexander Bay. A ship, built in Britain, was to be used for the transportation of the ore from Alexander Bay to other international destinations. Yet the ship could not pass through the mouth of the river and nothing came of the endeavour (Wilcox, 1986:71). This did not herald an era of vast capitalist expansion. Land would still play an important role in South Africa's economy during this period.

5.3.9. A Start with Irrigation Projects?

Since 1860, reports were published by the government of the Cape Colony on the promotion and establishment of irrigation works in the Colony. This was to promote the development of agriculture in that part of South Africa. However, many farmers in the Colony did not see the potential of irrigation for this purpose, and many looked down on irrigation. This would be the situation until the end of the nineteenth century, where irrigation would only be implemented on a large scale in the south-western parts of the Cape Colony (Kanthack, 1909:26).

5.3.10. Border Dispute between the OFS and ZAR

During the late 1860s, the Vaal River was the subject of rivalry between the ZAR and the OFS. The two republics were in dispute over the border of the upper and lower reaches of the river. It was only in 1870 and 1871 when Lieutenant-governor Robert Keate from Natal arbitrated an agreed settlement that the dispute was resolved. In 1870, the border dispute regarding the upper reaches of the Vaal River between the ZAR and OFS was settled and the Klip River was proclaimed as the border between the OFS and ZAR. In 1871, the lower reaches were proclaimed between the two republics. Makwassiespruit was agreed as the western border between the two republics, leading to the loss of large tracts of land for the ZAR. The Klip River was designated the border between the two states. The Vaal River also became a border between Boer and Briton, and effectively a border between two political systems (Boer Republics and British Government in the Cape) and two white cultures (Van Zyl, 1968:303; Van Jaarsveld, 1974:251-254).

Yet it was in 1854 that the Vaal River lost meaning as a border between Boer and Briton when the OFS got independence from British rule. In 1854 the Orange River became the effective border between the two Boer sister republics and the British Administration in the

Cape. Only after the discovery of diamonds in the late 1860s did the Vaal River regain meaning as a border between the Boer Republics and the Cape Colony. The discovery of minerals brought about a change in the meaning of the South African interior for the British Cape government (Van Zyl, 1968:303; Van Jaarsveld, 1974:251-254).

5.3.11. The Pote Canal

In 1866, Charles Pote, member of parliament (MP), proposed that the Orange River be utilised for irrigation. His idea was inspired by the fact that the waters of the Orange River flowed to the sea, and were therefore wasted. He called this water a "wealth-diffusing mass of water". He furthermore noted that the waters of the river could be "turned to account, and making what were at present wildernesses into highly productive localities; and by so doing, the Northern districts [of the Cape Colony] would be capable of supplying more than all the breadstuffs now [1866] imported" (*The Argus*, 16 October 1866:2).

The project he foresaw was ambitious. He stated that the water level of the river was lower than the river's banks. Yet he believed that the water level must be higher than the banks near the river's source. He proposed that engineers be sent to its source to "look for holes – holes in the hidden bases of the hills – natural tunnels, through which the waters may be brought both out of their native bed and through the mountains of the Colony" (*The Argus*, 16 October 1866:2).

This proposal was refused by parliament. The reason was that the money needed for such a gigantic scheme could be spent more fruitfully. Dams could be constructed to conserve rainwater. There were also rivers other than the Orange on which such dams could be built. These were the rivers flowing from the watershed to the sea. Dams could more easily be erected in the Kloofs of these rivers, and would supply an abundance of water. Moreover, private enterprises did a lot of work in this regard. It was stated by Hare, an MP opposing the so-called Pote canal, that if this trend continued (of private enterprises constructing dams on rivers), irrigation projects would "be spread over the whole Colony" (*The Argus*, 16 October 1866:2).

This was an indication that there was no need for government to start with irrigation schemes. Although Pote's request was refused, there was a vision that the Orange River's water could be used to irrigate large tracts of land (*The Argus*, 16 October 1866:2).

5.3.12. Brown's Analysis

The hydraulic engineer's reports of 1876 and 1877 therefore initiated the hydraulic mission in South Africa. Two years previously, J.C. Brown published his book *Hydrology of South Africa*; this was followed in 1877 by *Water Supply of South Africa*. However, what was significant about the Gamble Report was that it was compiled by an official of the state. Brown, on the other hand, was a former government botanist at the Cape of Good Hope. The Gamble Report had therefore more legitimacy than Brown's books. Gamble was instructed by the Civil Commissioner of Crown Lands and Public Works, which implies that he was sanctioned by the state. Although Brown's books probably did not carry the same political

weight as the Gamble Report, it is nonetheless noteworthy what he had to say about South Africa's water resources at the time.

Brown's 1875 publication investigated the desiccation and aridity problems of South Africa and proposed solutions to them. He stated that South Africa's desiccation and aridity were caused by primary and secondary factors. The primary source of desiccation and resultant aridity was, according to Brown (1875:216) "... the elevation of the land, and the consequent flow of the water, which falls upon it as rain, by gravitation to the sea". Secondary causes are "... the evaporation of the remaining water, by which the aridity has been brought to the degree it has attained, - the desiccation thus completed having been promoted by long-continued destruction of forests, and bush, and herbage, and grass, chiefly but not exclusively by fire" (Brown, 1875:216).

Brown (1875:216-257) cited a number of droughts and floods to advance his argument regarding the climatic characteristics of South Africa. Accounts of droughts that he mentioned in his book had been supplied by missionaries travelling in the interior of South Africa and beyond its borders. In the early 1860s, Dr David Livingstone gave a description of a four-year-long **drought** in the arid parts of central Southern Africa. Ms. Anne Hellmore, wife of a missionary, also spoke of a prolonged drought that occurred from the end of the 1850s and into the early 1860s. She noted in one of her letters to her daughter in England that the draught oxen were at times without water for four to five days (Brown, 1875:216-222).

Brown (1875:227) used these accounts and said that in Southern Africa there is an "... abundance of the water supply to counteract the evils induced by the drought within the colony". Here he also referred to the prolonged **drought** the Cape Colony experienced in 1862. From the accounts of Livingstone, Hellmore, and the drought in the Cape Colony of 1862, we can deduce that a region-wide **drought** occurred from around 1859 to 1867 (Brown, 1875:228).

Not only were the "evils of drought" attacked. Brown (1875:229-244) also gave an account of devastating floods in parts of the Cape Colony to advance his argument about the abundance of water. These floods were as follows:

- The Port Elizabeth flood of 21 November, 1867;
- The floods experienced by the Western Province in 1869;
- The Beaufort West floods of 1869 and 1870;
- The Victoria West flood of 1871; and
- The Cape Town flood of 1872 (Brown, 1875:229-244).

In February 1874, a lot of rain fell over the Colesberg district, which resulted in the Orange River being in flood. The Orange River overflowed its banks on the OFS side, twelve feet higher than previously. This led to much damage and a number of farms along its riverbanks were submerged. This flood was preceded by a short drought at the end of 1873 (Brown, 1877:577-578, 589).

Brown (1875:241) noted that there was a cycle of droughts and floods in the Cape Colony. After a drought, floods would follow. He also said that, during a flood, huge volumes of water flowed into the sea and were thus wasted. Of the Port Elizabeth flood he noted that:

"Such a rainfall had not occurred for twenty years before, and all was allowed to run off to the sea, carrying destruction and desolation with it in its course, while it might have been to a great extent retained to clothe the fields with verdure and flowers and fruit" (Brown, 1875:234).

The floods of the late 1860s and early 1870s were followed by a drought in the Cape Colony in 1874. A resident from Burghersdorp wrote to a Cape newspaper on 7 November 1874 about the severity of the drought in that district. He or she stated that "Our market is badly supplied – some mornings not a single thing, not even an egg! Butter, if there is any, 4s 6d per lb. The country round about is as dry as a chip, the hills bare and brown" (Brown, 1875:245).

Brown (1875:258) noted that the aridity of South Africa "prevents the full accomplishment of their [colonists'] desires and purposes in developing the agricultural capabilities of the country". He recommended a number of "remedial measures" to check the aridity and desiccation of South Africa. These counteractions were based on a number of hypotheses:

- "If the escape of water by gravitation and evaporation be greatly in excess of the supply from the atmosphere, the desiccation will go on with rapidity";
- "If the disproportion between the escape and the supply be lessened the desiccation may still go on continuously, but with diminished rapidity";
- "If they be equalized the desiccation will be arrested";
- "If the escape of water be reduced below an equality with the supply the process of desiccation will be reversed . . ." (Brown, 1875:258).

He went on to state that: "From all this it seems to follow that any measure, and every measure, which has the effect of preventing the escape of water by gravitation or evaporation will, in its measure, tend to arrest the evil and promote the good" (Brown, 1875:258). The "remedies" he proposed were Calvinistic. He stated that: "The counsel given by a Hebrew prophet in other circumstances, 'Cease to do evil, learn to do well'". The "good" that should be done was as follows:

- If possible, the practice of burning the veld should be stopped;
- Conservation and extension of forests should be encouraged; and
- Where it can be done, irrigation projects and dams, together with other measures to conserve and utilise the water supply, should be implemented (Brown, 1875:258).

In his 1877 book, *Water Supply of South Africa*, Brown made a stronger plea for the conservation of water by the building of dams and utilising irrigation projects for economic gain.

The purpose of his 1877 book was to show the practical measures to be implemented in order to check the desiccation and floods of South Africa, and how such measures can be coupled with "agricultural operations". In this regard Brown (1877:9) said that: "Every cupful of water kept back from the sea, retained and evaporated and again absorbed by the soil, promotes vegetation; and, from the first moment, the capital invested in retaining it begins thus to bring in a return".

He stated that such infrastructure would be constructed using many financial resources. Yet floods caused a lot more damage. For instance, the Port Elizabeth flood of 1867 caused damage in excess of £30 000 and the Victoria West flood of 1871 about £300 000, with £350 000 worth of damage to public works alone (Brown, 1877:2). Thus, nature should be harnessed in order not to cause such damage, and to work for the economic advantage of humans.

Expressing what Gustav Wex, a hydraulic engineer in Austria had to say, Brown noted that much could be done to yoke rivers and reap economic benefits from them. Wex stated that government should, along with "the more intelligent portion of the population", play an active role in the execution of dam and irrigation projects. Wex gave the example of the Chinese in how they had used their rivers to transform their country into a "Flowery Land" at around 2300 B.C. (Wex, 1873).

The Chinese employed engineers to construct massive irrigation and IBTs in order to regulate the rivers. They also utilised groundwater for irrigation purposes (Wex, 1873). Regarding the IBTs Wex (1873) noted the following: "Throughout this extensive country [China] more than *four thousand* canals, many thousands of miles in length, have been dug as a network, uniting together the whole of the rivers and reservoirs, formed with the three-fold object: to carry off the superabundant waters of individual rivers in flood; to diffuse these over districts which are naturally comparatively arid; and, lastly, to maintain a lively inland navigation, and keep as inexpensive as possible throughout the whole land the transport by water of agricultural and industrial products".

The Chinese have "tamed and domesticated" their rivers and the same should be done in South Africa. Brown (1877:90) argued that this taming should be done in "earnest", because, and here he quoted King Solomon of Israel, who said that: "The slothful man saith, There is a lion in the way; a lion in the streets". Thus, if the country was to prosper, rivers and streams of South Africa should be "tamed and domesticated" and that laziness will be the greatest impediment to such endeavours, according to Brown.

Throughout his 1877 book, Brown gave a description of the agricultural conditions in some parts of the South Africa. For instance, he indicated that there were few agricultural activities. Farmers partly overcame this difficulty by storing rainwater in dams for stock watering in the district of Hopetown that bordered the Orange River, due to a scarcity of water. From this it can be deduced that no projects had been implemented to provide water to flocks and herds from the Orange River in the Hopetown district. Yet there had been discussions before 1877 on ways to raise money for the construction of extensive irrigation works in the district. It seems as if nothing came of these discussions (Brown, 1877:567).

5.3.13. The Civil Commissioners' Reports

In 1862, the Civil Commissioner indicated that there had been no plans for the construction of irrigation projects in the Colesberg division. The only place where an irrigation project at that time was to be found was on the Sea Cow River, a tributary of the Orange. The canal of this project had a length of about 3 000 m. The Civil Commissioner said, however, that it would not be practical to construct such projects on the Sea Cow, for the river ceases to flow during droughts. Yet dams could be constructed to conserve the water. A great difficulty in this

regard would be the silting-up of the dams. Another impediment in the construction of irrigation projects and dams stemmed from the fact that much of the land was in private hands. This was regarded as the main difficulty for government in their attempt to implement such projects. The construction of a canal through a farmer's land would not benefit that particular farmer. Yet the Civil Commissioner indicated that this difficulty could be breached "by legislative enactment, which should give the Executive the power of damming up streams, making cuttings and reservoirs where necessary, and resuming such lands as may be required for irrigation purposes at a valuation, provided that no equitable arrangement could be made with the neighbouring proprietors for the use of the water after its collection in reservoirs". The Civil Commissioner also said that it would be impractical to cultivate foodstuffs by irrigation (Brown, 1877:580-581).

The reason for this was that there was no suitable infrastructure to transport agricultural goods. He said that: "I am therefore of the opinion that, until the advantages of the railway system are extended to this quarter, the measure most advantageous to the division [Colesberg] would be ... Government making advances [of money] to landed proprietors upon reasonable terms for the purpose of their executing works for improving the supply of water on their properties". The interest on these advances should not be more than six per cent per year. If it were more, many landowners would not take up such loans (Brown, 1877:580-581). Thus, government should not itself start such projects, but only lend money at a reasonable interest for farmers to start such projects. This was echoed by the 1877 Gamble Report. Government was therefore to assist in the construction of irrigation works and dams.

The same situation was to be found in other divisions of the Cape Colony and in the Orange River basin. In the Albert division, on the banks of the Orange, farmers had dams on their farms by 1862. No significant irrigation projects were to be found, except for one that irrigated about 20 ha of land. No plans for irrigation works had even been considered. It was also stated by the Civil Commissioner of that division, Cromar, that the banks of the Orange River were too steep to built irrigation works. Yet some farmers were using the waters of the Zuurberg Spruit, a tributary of the Orange in the division, for irrigation purposes. The drought of the early 1860s meant that the spruit was not flowing and that many farm dams contained no water. In 1858, a certain Ziervogel gave evidence before the Select Committee on Irrigation that large dams were under construction in the Albert division (Brown, 1877:583-584).

What is of greater significance, though, is Ziervogel's evidence of an irrigation project of large proportions that had been discussed in the division. The following is an excerpt of a discussion between him and the Select Committee:

"Do you happen to know the Orange River? – Yes."

"Do you know its relative height as compared with Somerset? – I do not know its relative height, but I am aware that a great many years ago some people spoke of leading out the Orange River, and bringing it, by a cutting at Knichalter's Nek, into the Great Fish River ..."

"And do you think, if that water could be taken out of the river and distributed over the country, the land would be increased in value to any extent? – If it could be done; but we

must not think of such a thing as leading that river into the Fish River, – the cost would be tremendous”.

“But if it could be done, do you think the farmers receiving the water, with such a pressure as the Orange River at the back of it, would be willing to pay a rental for it? – They would, but not such a rental as would be sufficient for such a work. Though, if it could be done, I think it would be a piece of work which is not yet equalled in Europe. I know that in other countries rivers are led out; but then they have comparatively level land; while the land on this side of the Orange River rises to a great extent”.

“Are you aware that Sir George Grey submitted a plan of a canal from the Orange River down to the Colony? – I am not aware that Sir George Grey actually entertained such an idea; but I am confident that the expense of doing that would be so immense that we cannot entertain it”.

“Then, it is only a matter of expense, in your opinion? – It is a matter of expense, but it would be so enormous that we could not entertain it. The lowest piece of land where a cutting might be made, Knichalter’s Nek, between Cradock and Somerset, is a considerable distance from the Orange River, and at considerable elevation above the river. But the Orange River might be led out to irrigate an immense quantity of land lying along its borders” (Brown, 1877:585).

Just over a hundred years after Ziervogel’s evidence before the 1858 Select Committee on Irrigation, the government of South Africa would start with plans to build this irrigation project. This would be the Orange River Development Project (ORDP).

In the division of Aliwal North, the Civil Commissioner, Burnet, stated in 1862 that there were no proposals for irrigation projects. Yet almost every farm had one or more dams for agricultural uses. These included the irrigation of corn and stock watering. He indicated that the Kraai River could be used for irrigating farms along its banks and that the town receives water from the Orange River for domestic purposes (Brown, 1877:587).

The necessity for a more assured water supply was also noted in a report from the Civil Commissioner (Mr Wylie) in 1865. He stated that a drought was prevailing at that time and that farmers were moving around after water. Yet he said that the veld was in a good condition and that it was the farmers who were to be blamed for their hardship. They could have built larger and deeper dams for a more secure water supply. He blamed their plight squarely on laziness. Hard-working farmers’ flocks of sheep were in a good condition, he noted (Brown, 1877:568-569).

In 1875, there was another drought in the Cape Colony. The report of the Civil Commissioner stated that: “Public attention has lately been directed to the desirability of irrigation in this [Hopetown] division, by leading out the water of the Orange River in suitable places” (Brown, 1877:570).

In 1865, the Civil Commissioner, Green, of the Colesberg division, stated in his report that: “The agricultural operations of Colesberg are upon a very limited scale in proportion to its extent, arising from the impossibility of growing anything without irrigation, and from the scarcity of springs of sufficient strength”. Later in his report he also said that drought (in 1862 and 1863), locusts, and frost were other impediments to agriculture in the Colesberg

division and that irrigation was needed (Brown, 1877:572, 573). The drought in the Colesberg district of 1862 and 1863 was so severe that many of the farm dams were completely dry. This also gave rise to water theft, to such an extent that the farmers were considering raising funds for a police force to counteract it (Brown, 1877:575).

In 1864, the Civil Commissioner also gave statistics on the number of dams that had already been constructed on some farms in the district. Each farm had one dam (there were 315 dams to 311 farms). The difficulty with these dams was that they were slowly silting up. This was an important consideration to take into account regarding irrigation projects, because the dams were silting up, there was a great need for irrigation. For this purpose, the waters of the rivers had to be stored in large reservoirs. A few difficulties in this regard were stated. Firstly, the rivers were deeper than their banks and this would have entailed expensive "cuttings" being made. The dams could also have been cleaned but the costs of this were much higher. Farmers noted that this would be more expensive than constructing new dams (Brown, 1877:573).

In 1875, the Civil Commissioner reported that the agricultural conditions of the Colesberg district could be greatly improved by the construction of large dams. He stated that there were a number of suitable sites on which to build these dams, the selection of which should be left to a hydraulic engineer, "and his advice should be followed in every respect. Small dams are only disappointing", he indicated (Brown, 1877:579). The post of the hydraulic engineer was indeed created and J.G. Gamble was the first to be appointed. He was the hydraulic engineer until 1885 (Lewis, 1934:35).

Lewis (1934:35) has the following to say about Gamble: "He had no previous actual experience of irrigation, but he was a very sound hydraulic engineer and in every case his reports were farseeing and his opinions were expressed without fear or favour. He never hesitated to draw attention to adverse aspects of schemes in spite of the usual political pressure. It was largely due to him that we have rainfall records in the inland parts going back to 1876 and he published the first rainfall maps. As early as 1882 he suggested a water court to consist of a magistrate, and engineer and local farmers, and that a principle of law should be, after satisfying existing rights, 'to secure the least amount of waste of water and the greatest amount of productive cultivation'. In his first year he thought that government could grant water rights and suggested that the Italian practice of granting water-rights should be followed".

5.3.14. The Gamble Report

John G. Gamble was appointed during 1875/76. In 1876, he published his first report – not, unfortunately, recoverable by this research. However, the 1877 report was recovered. In this report Gamble notes that he had undertaken an expedition to the northern border of the Cape Colony in June 1876. This was most probably to the Orange River. In the 1877 report Gamble gave general suggestions as to the best ways of starting irrigation works. In this regard, he remarked that there was much "ignorance as to the difficulties involved" in implementing irrigation projects. He also cited "some points in the experience of other countries which may be of use to us in South Africa". These countries were India, Italy, Spain, Egypt, Germany, Belgium, Chile, and Victoria (Australia). One of the most important remarks he made regarding irrigation projects was the following: "In starting irrigation works

in an entirely new country like South Africa . . . we are under the disadvantage of having no previous successes or failures to follow or avoid" (Cape of Good Hope, 1877:2-9). This last remark is an indication that irrigation projects had not yet been considered by the Cape Colonial government before 1877.

What is also significant in Gamble's report from a hydropolitical perspective is that he asks whether it is government's responsibility to "construct or to aid?" Government was not clear on the role it should play in this regard. Gamble gave his advice. He said that: "Should Government determine to carry out works of irrigation on lands any portion of which is not Crownland, it seems to me very desirable that Government should acquire those lands before commencing work, and subsequently lease them. Otherwise the nation does not benefit directly from the increased value of the land, but only from the price given for the water" (Cape of Good Hope, 1877:9).

Thus, the state should claim sovereignty to the land on which irrigation projects are to be constructed. The state was therefore advised to operate in this manner to serve the interests of the nation. It is also evident that land played a more significant role than a river's water. Yet these two elements were still seen as interrelated. It was necessary to irrigate land to increase its value. Water's value, on the other hand, was from the outset not high. It seems as if it had no value at all, and would only acquire worth after infrastructural investments were made.

Notwithstanding the role of the state, the individual was to play a prominent role. Gamble suggested that government should only aid irrigation projects and not directly construct them. This relegated government to a supportive role. The formation of "associations of proprietors on any particular river from its source to the sea for the promotion of new works" was also suggested in the report. These associations should be encouraged by government. They would have had power, so that "the majority can compel the minority either to take the water or to sell the farms" (Cape of Good Hope, 1877:10). Thus, power would have been placed in the hands of non-governmental entities.

Within this power structure, working committees were to be chosen by farmers and village representatives on the river. These committees were to have the following functions:

- They "should employ proper engineers or surveyors to measure and level all existing works" and "to survey and contour the whole country affected";
- "They should instruct engineers to report on and design new works";
- "They should provide proper professional superintendence for new works";
- Regarding maintenance, "they should appoint officers to divide the water among the farmers and to prevent waste"; and
- "They should exercise minor judicial functions in case of dispute" (Cape of Good Hope, 1877:10).

What was therefore suggested by the report was that government should give such interest groups a certain amount of power within the river basin regarding the implementation and maintenance of irrigation projects. These associations would then assist government in the establishment of a countrywide irrigation infrastructure. What was therefore suggested was that government should share some of its "agential power" with non-state entities in order to get irrigation going. Whether these suggestions were implemented is unknown.

The 1877 report of the hydraulic engineer focused mainly on the accomplishment of irrigation works in the Eastern Cape, Breede River, and the supplying of drinking water to Port Elizabeth and Graham's Town (Cape of Good Hope, 1877:1-2). Thus, it excluded the Orange River basin. Notwithstanding this exclusion, the suggestions it contained were to be incorporated in the irrigation policy of the Cape Colony.

5.3.15. Irrigation Development in Fits and Starts

Farmers not only built dams for agricultural purposes; dams and canals were also constructed in the 1870s in a number of places in the Orange River basin. At Hanover, a canal of about one kilometre had been built by the municipality to supply water for "drinking and other purposes". The water was supplied from a fountain near Hanover (Brown, 1877:580).

Even so, parliament took heed of the 1877 Gamble Report. Laing, MP, noted that the Colony had no experience regarding irrigation works. He mentioned the examples that the Gamble Report cited and said that the Colony could learn much from Spain and other countries – most notably, India, Italy, England, Germany, Scotland, and Ireland – concerning the establishment of irrigation associations. He said that Spain had a similar climate to that of the Cape Colony, and that the practice of irrigation associations and irrigation works themselves were well established in that country (Standard & Mail, 8 June 1877: Page Unknown).

In 1878, a motion was proposed in parliament that government should start with a pilot irrigation project in Oudtshoorn. This would have entailed the construction of a reservoir at or near *Renoster Hoek* in the district. During the presentation of the motion, it was indicated that the 1877 Irrigation Bill had not yet been implemented. Some parliamentarians believed that irrigation works should be the responsibility of local bodies or associations and not governments (Standard & Mail, 11 June 1878: Page Unknown). Some the reasons for this were that such works would be too expensive, and that rainwater could not be conserved with any degree of success. Even John Laing did not support the motion (Standard & Mail, 19 June 1878:55). Others, however, indicated that reservoirs should be constructed by government to conserve water (Standard & Mail, 11 June 1878: Page Unknown). Such an action would be in the best interest of the country because it would facilitate agricultural development (Standard & Mail, 19 June 1878:55). It seems, therefore, that there was a lot of support for the Irrigation Bill of the previous year. That associations should construct irrigation works was seen as the best way forward, and government should play a supportive role only, as indicated by Gamble.

In 1879, the government of the Cape of Good Hope gave notice that it was not prepared to undertake large irrigation works at that time. Public Companies or bodies and private individuals could obtain the services of a hydraulic engineer, but had to pay him two guineas per day for his services (Cape of Good Hope, 1879:v-vi).

In 1882, the need was expressed in parliament for an irrigation commission to be established to look into the "best means of promoting and encouraging Irrigation and the storage of water". The reason for this request stemmed from the fact that the Colony, according to Vincent, MP, possessed "rich soil and climate, and all that was wanted everywhere was a regular supply of water". He also argued that rainfall was adequate and that there was a need

to store the run-off from rivers. Because of the lack of irrigation and storage works, the Colony had to import large quantities of foodstuffs on a yearly basis. This could have been produced locally. In 1881 the Cape Colony imported, according to Vincent, more than £500 000 of "bread-stuffs". The colony even imported £85 000 worth of butter. He also stated that farmers needed irrigation works to produce more food for the inhabitants of the Colony. What he was therefore proposing was that government should undertake such projects, in light of food self sufficiency (Cape Argus, 25 April 1882:63).

One of the difficulties that were raised regarding the issue was that most of the land was private property and that government would find it difficult to get the land. Government did not own land on which such projects could be implemented. Merriman, MP, objected to the expropriation of land. Another difficulty, as pointed out by Merriman, was that farmers would only buy water from government works in bad years, while this would not be the case in good years. Thus, these works would be a waste of money. Labour was also in short supply, although the money could be found to construct irrigation works. Farmers also had more profitable activities to keep themselves busy with, instead of growing corn. Meat, for instance, was the main foodstuff for a household diet. Some MPs also expressed the view that farmers had no guidance from government regarding irrigation schemes. A pilot government irrigation project would have solved this problem. To set up an irrigation commission would have been a waste of time because the hydraulic engineer, John Gamble, gave parliament all the information it needed (Cape Argus, 25 April 1882:63).

In May 1882, Merriman proposed in parliament that a committee should be appointed to deal with the following matters:

- That the time is right for large irrigation projects to be implemented by government;
- That the following irrigation works are recommended: (a) the Salt River Poort reservoir, at an estimated cost of £200 000; (b) the Slagter's Nek and Cookhouse tunnel at a cost of about £80 000; (c) Fourteen Streams, Griqualand West, Vaal and Hartz Rivers, £130 000. These projects had a total estimated cost of £410 000;
- That government should be authorised to make detailed surveys and investigations into these projects, and to take the necessary steps to obtain land (Cape Argus, 11 May 1882:94).

This proposal was based on a report that Gamble prepared regarding these irrigation works. These reports were proving that large-scale irrigation works could be undertaken. What was also significant was that Merriman indicated that government had not previously considered undertaking such works. He argued that the Vaal-Hartz irrigation works would turn "a desert into a garden" (Cape Argus, 11 May 1882:94). This irrigation project would be the largest in the colony. Other MPs were in favour of smaller irrigation works, closer to ports. Merriman was adamant that government should spend millions on irrigation works rather than on railways. He also mentioned that in America grain was carried 2 000 to 3 000 miles and then exported to the Cape of Good Hope. This was competition for the grain that was locally produced. Breadstuffs were imported from other countries to the Cape at a cost of £500 000 per annum. Irrespective of his pleas for large irrigation works, other MPs stated that there was no money available for such endeavours. M.J. De Villiers noted that the revenue from customs had decreased by £4 000 the previous month and that in May 1882 it had decreased by £10 000. He also said that irrigation works would be a success where there was a dense

population, cheap labour, and good markets. He was also of the opinion that irrigated grain would never be able to "compete with naturally grown grain". Other MPs like Ayliff were in favour of such works. He argued that any wheat that would be produced by irrigation would be enough for the local market. He also stated that flour was sold "at famine prices up-country" from Cape Town. C.J. Rhodes was also in favour of the Vaal-Hartz irrigation projects and said that 100 000 morgen of land could be brought under irrigation. This land would be near one of the "best markets in the country" – the Kimberley diamond field that would make the project profitable (*Cape Argus*, 11 May 1882:133).

5.3.16. The Prieska Irrigation Works

In 1885, A.B. De Villiers, MP, proposed that a committee should look into the possibility of an irrigation project at Prieska. He proposed this on the basis of a report by Gamble. De Villiers said that there were many advantages in bringing the water of the Orange River out to irrigate land at Prieska. Around 2 000 ha of land could be irrigated by the project. He proposed that: "Hundreds of thousands of muids of grain could be grown there, whereas at present a large quantity was annually imported from abroad" (Cape of Good Hope, 1885:482). In this regard he noted that every opportunity should be taken to stop the importation of foodstuffs that could be produced in the Colony. This would be in the best interests of the country and the people. He was of the opinion that the water of the Orange River was not as brackish as that at Van Wyk's Vlei, but was just as good as the Nile's water (Cape of Good Hope, 1885:482).

The residents of Prieska were also so "confident" of the results the project would bring them that they had already surveyed the river at their own expense. They were also willing to "let out the water at their own cost, if the Government would grant them 2 000 morgen of the commonage. They had made that known to the Government, but they had not yet received a satisfactory answer". Although De Villiers's arguments carried weight, other MPs were doubtful about the implementation of the project. Col. Schermbrucker said that the report of the hydraulic engineer, dated 12 January 1885, indicated that the "fall of the Orange River at this point was not great, and he doubted whether the work could be done for £30 000". Yet De Villiers stated that he knew of a farmer who would do the work for £2 000. Moreover, if it should be £30 000 this should not be a deterrent, "as it would return hundreds of thousands of pounds, which would be much better than to let those grounds lie idle". De Villiers, however, withdrew his motion, and left the matter in the hands of government (Cape of Good Hope, 1885:482).

5.3.17. Schröder and Lutz

In 1883, Reverend Christian Schröder, with help from a young trader Japie Lutz, started work on an irrigation furrow at Kakamas's Dutch Reformed Church missionary station. This was after Schröder had already noticed the potential of the river for irrigation purposes in 1871. On 2 May 1885, the furrow was completed and the people of the missionary station could irrigate their gardens with water from the Orange River (Green, 1948:87; Hopkins, 1978:13). This is most probably one of the first successful small-scale irrigation ventures in the river's history. What is also noticeable was that, small though it was, it was not a government-

sponsored scheme, but was implemented by a private individual, using private money, to a non-state entity – the church

In 1897, the Parliament of the Cape Colony gave the Dutch Reformed Church two farms along the banks of the Orange River, about 100 km west from Upington and the same distance north of Kenhardt, for establishing an irrigation labour colony. The main reason for his proposal was to alleviate the poor white problem in the Cape Colony. Schröder had done a lot of work on irrigation on the Orange River in the Prieska and Kakamas area. For instance, the irrigation works for the Kakamas irrigation works started in 1898, but were interrupted by the outbreak of Anglo-Boer War, after which work resumed in 1902. Schröder was not an engineer by profession but a Dutch Reformed minister who received his schooling in irrigation engineering from practical experience. The schemes he implemented were mainly intended to help poor whites (Cape of Good Hope, 1899a:198-199; Marchand, 1909:44).

5.3.18. Thomas Bain

In 1886, Thomas Bain, a civil engineer in the Public Works Department, published his book *Water-Finding, Dam-Making, River Utilization, Irrigation*. The inspiration for this book came when he journeyed through the Karoo, and pointed out to farmers how they could augment their water supply. He said, "... my hints were acted upon, and in many instances successfully carried out". These "hints" referred to the utilisation of groundwater in the Karoo (Bain, 1886:3). He also gave advice in his book on the construction of dams (see Figure 5a to 5d).

Figure 5a to 5d

Thomas Bain's Sketches of Dam Sites, Diversion Weirs, and Dams

Figure 5a

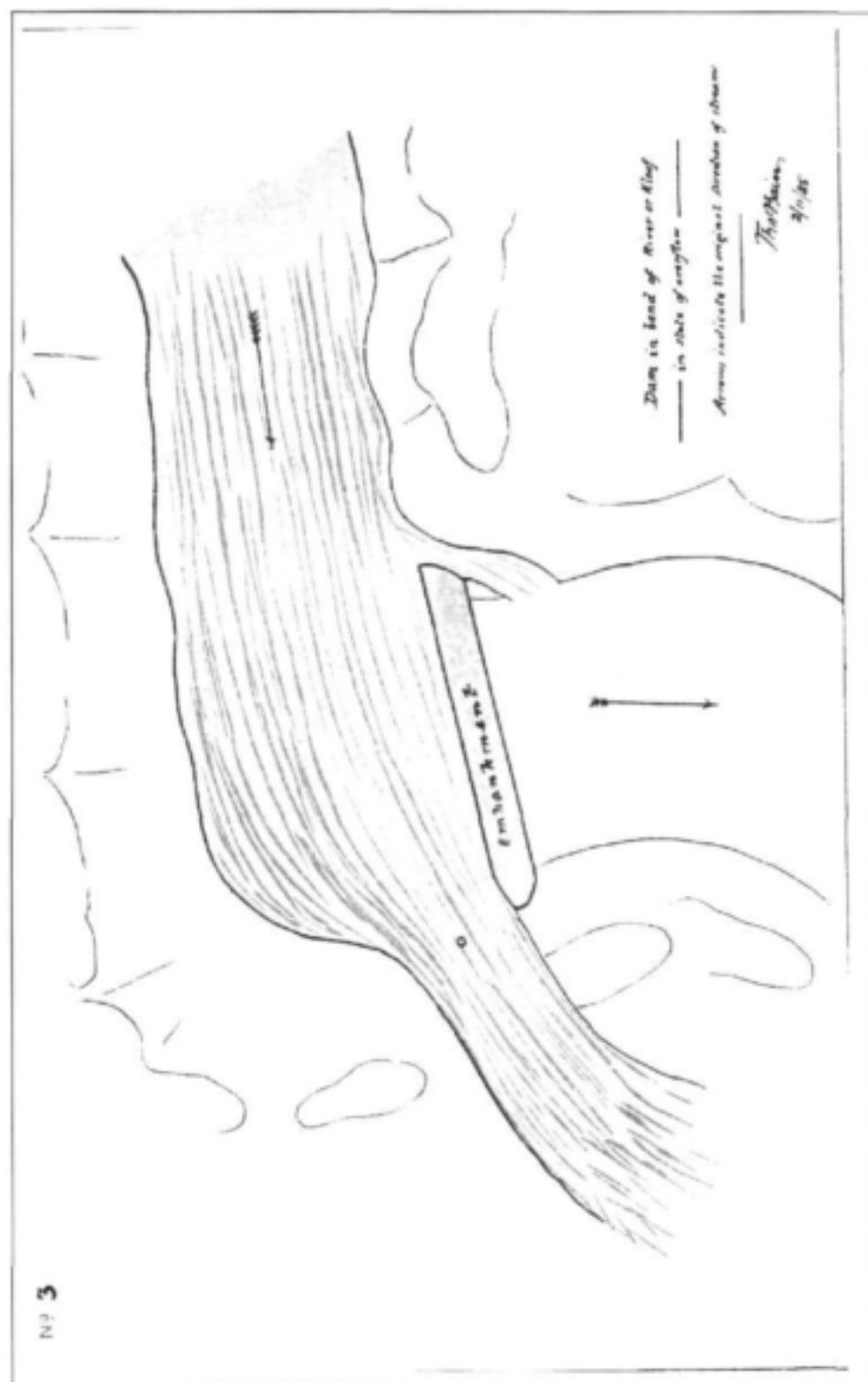


Figure 5b

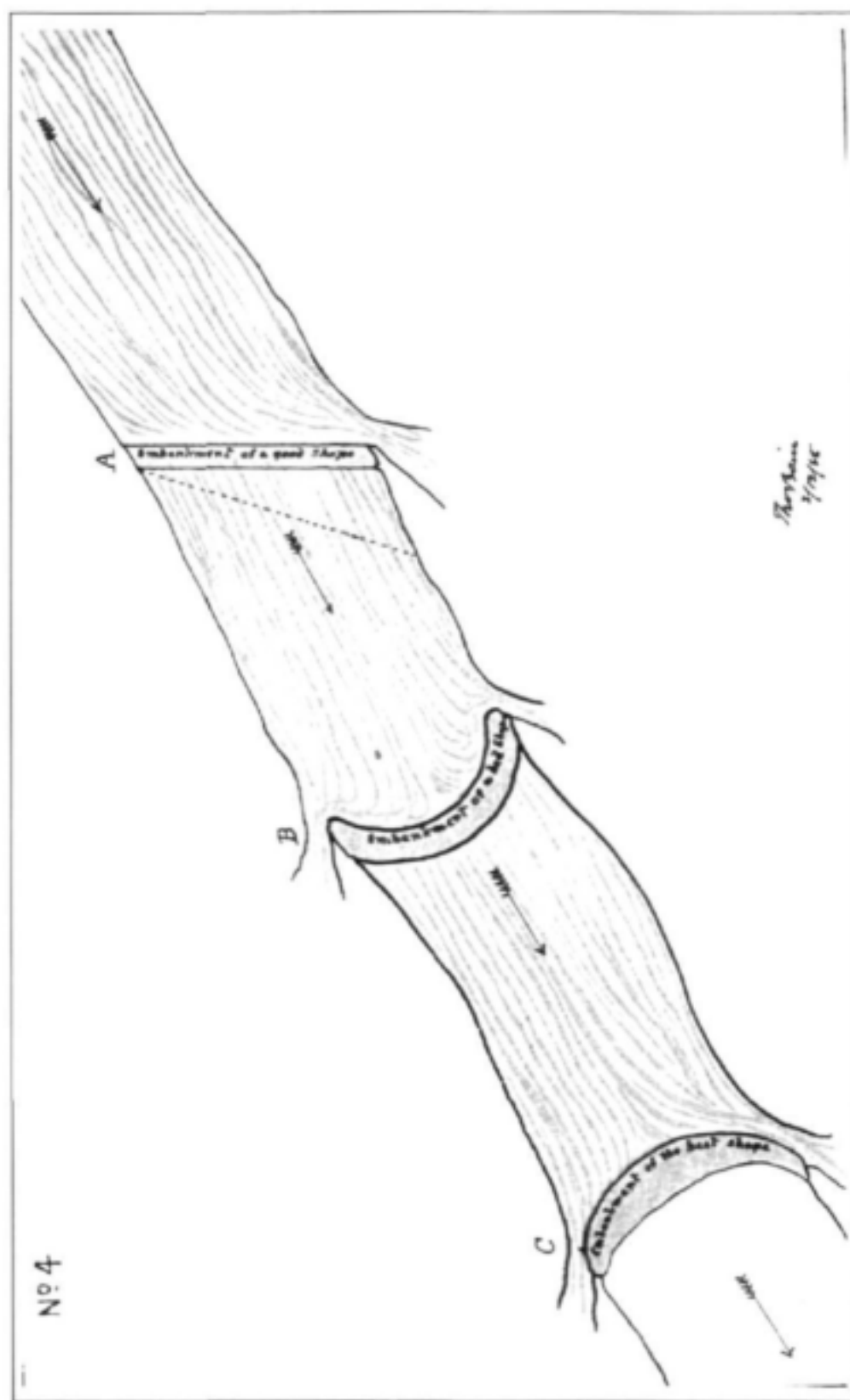


Figure 5c

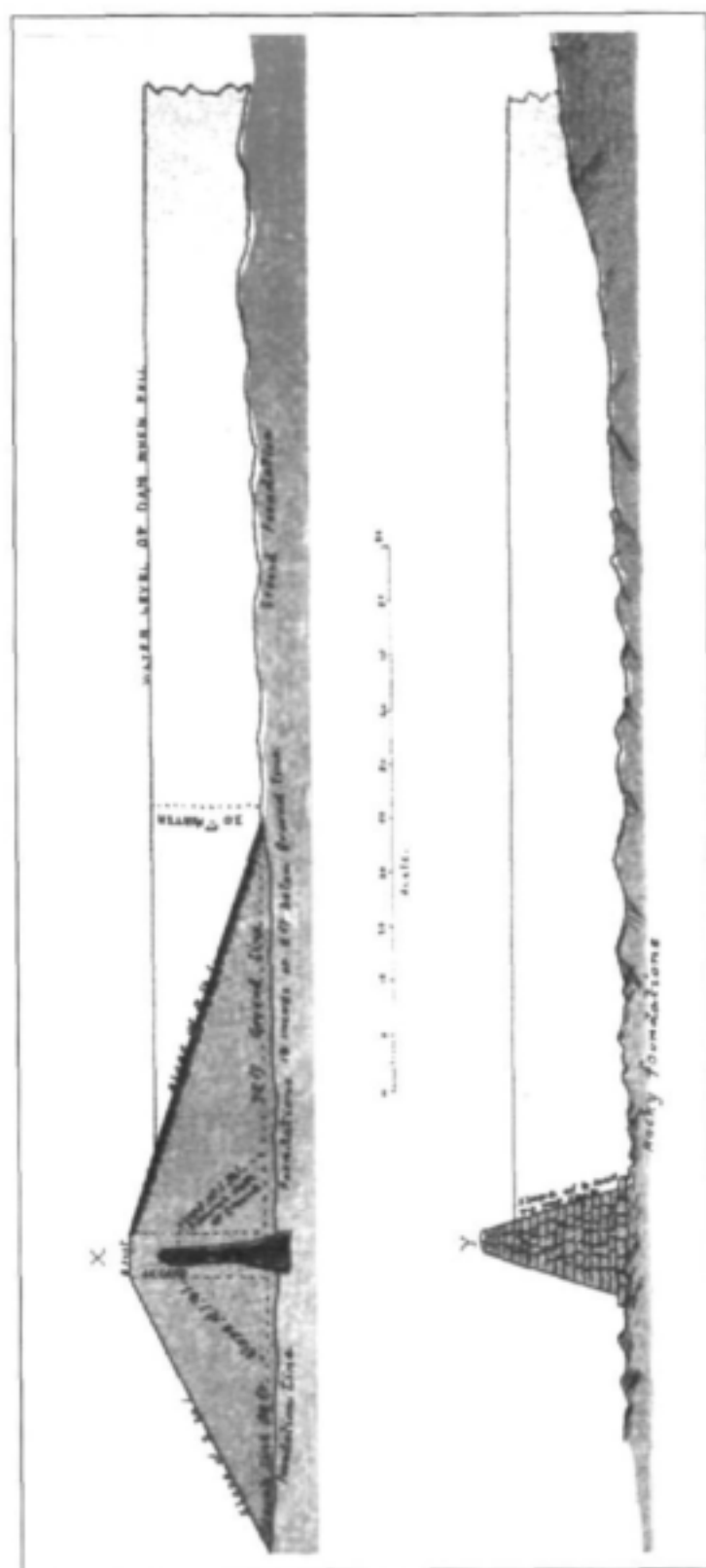
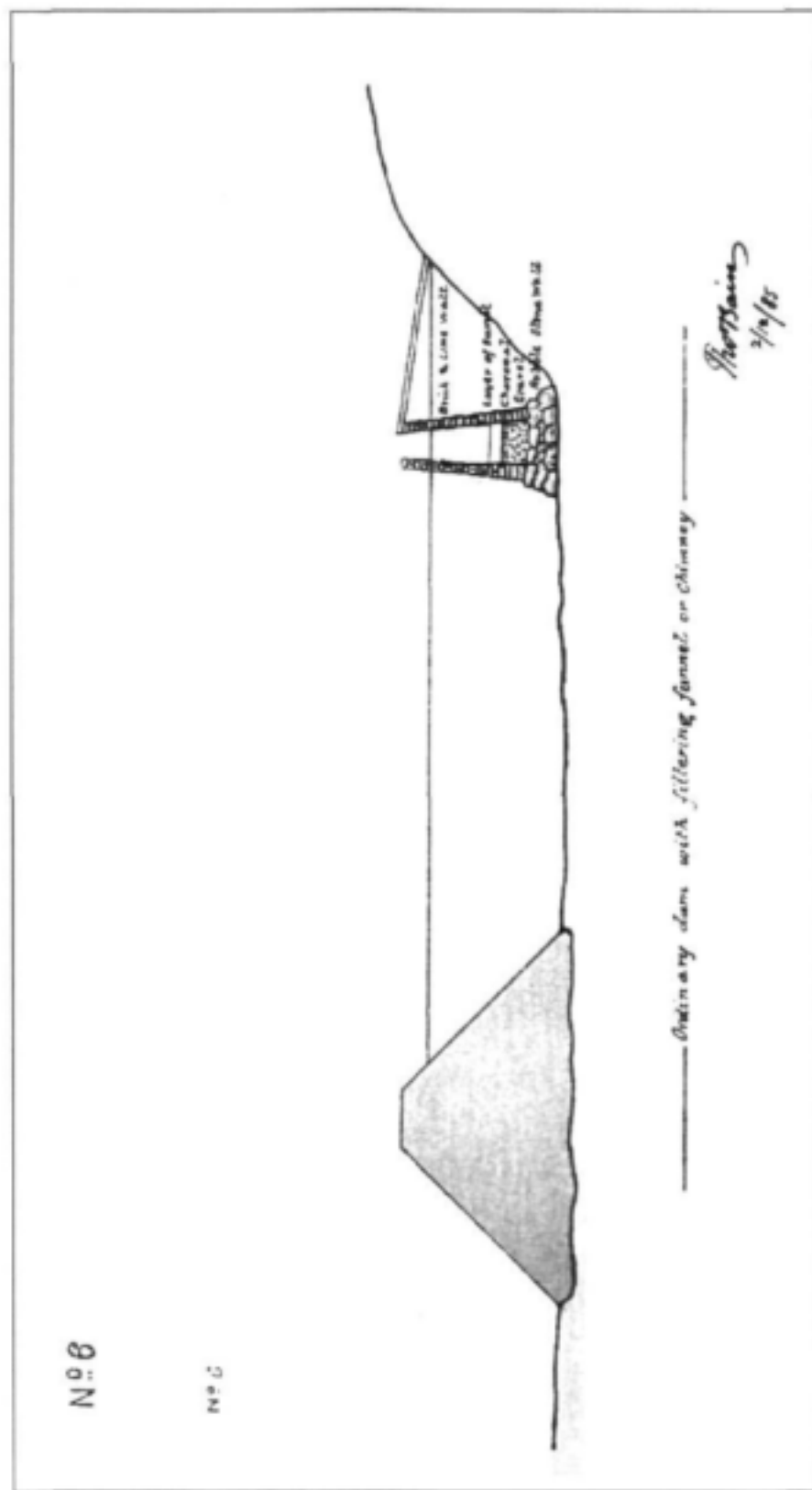


Figure 5d



He said the following regarding dam building:

"Owing to the severe droughts in the Karoo for several consecutive years, much has been done of late in the way of dam-making; but in most cases, apparently for want of advice, costly structures have been misplaced, and erected on such unsound principles that numbers of them are swept away after heavy thunderstorms, which to say the least of it, must be disheartening to the proprietors" (Bain, 1886:8).

His advice to farmers was to avoid large and shallow dams because too much water evaporated from these bodies of water. He also raised the issue of dam siltation. Here he said that a silt dam "a little above the intake" from the main dam should be constructed. After heavy floods, the silt from the silt dam should be removed. He also noted that from 1880 to 1885 the average rainfall of the Karoo was barely above 50 mm. Yet before this period it was more than double that quantity (Bain, 1886:11, 12, 13). There was therefore a need to conserve water during times of drought.

He also spoke about the diversion of rivers for irrigation purposes. He concentrated his writings on the Western Province of the Cape Colony, but said that the "Eastern rivers afford equally good facilities for such undertakings [irrigation]". He noted that there were large numbers of "convicts" in the colony. Convict labour could be employed to implement large irrigation works (Bain, 1886:13). From this it can be deduced that no large irrigation works have been undertaken by government by 1886.

Regarding this, he wrote about an "Italian gentleman" who travelled through the Colony. This Italian remarked that, "the Cape was a strange place; its rivers were allowed to run in their natural courses". Bain said that nature has provided us with facilities on which irrigation works can be constructed, but that these are not utilised. He was of the opinion that "running water is more conducive to the growth of vegetation than standing water; therefore, much as dams and wells are necessary, I am a strong advocate for the diversion of our rivers and mountain streams, for irrigation, before any other system is adopted" (Bain, 1886:13).

Based on this he made the following comments about the Orange River: "First of all, I shall take the Orange River, from any point between the railway crossing, which is 3,509 feet above the sea level, and the village of Prieska. The river, or a portion of it, could be diverted by means of an ordinary aqueduct, the soil being retentive enough to hold water without much loss of absorption, and could be brought with a good fall on to part of the Crown land, which computes to an area of over 5,000 square miles, the half of which extent . . . could be irrigated. The soil is exceedingly rich, especially near the banks of the river, and in the Karoo valleys, and it is capable of producing the best of cereals, fruits, vegetables, wines and brandy in great abundance, and timber might also be grown there to advantage, wood being very valuable in that locality."

"To show how feasible the diversion of the Orange River is, I have been credibly informed that two farmers who have leased some Crown land below Prieska, are now engaged in making an aqueduct from a place called 'Wegdraai' in the river, to irrigate their lands, and they are in a fair way of success; while near 'Upington', an enterprising missionary, with the assistance of some Hottentots, has succeeded in diverting a small portion of the river to their institution."

"Their crops are spoken of as something fabulous; and I believe they nearly recouped themselves in the cost of the aqueduct, out of their first year's harvest" (Bain, 1886:14).

From this, and what was mentioned in the Cape Colony parliament in the early 1880s, it is evident that it was individuals who started the hydraulic mission on the Orange River. Government and the hydraulic engineer played a role in this regard though. Yet it seems, from the debates that were raging in parliament in the late 1870s and early 1880s and the 1877 Irrigation Act, that government, in conjunction with the hydraulic engineer, played an assisting role. It seems, from the accounts of Bain, that this role was not very successful.

From Bain's account, a very interesting piece of information regarding the hydropolitical history of the Orange River emerged. Bain (1886:14) said that: "... I might point out the position of the Van Wyk's Vley Reservoir ... completed about two years ago." The Van Wyk's Vley Reservoir was the first government reservoir to be constructed in the Orange River basin.

He also commented on the scheme to divert water from the Orange River into the Fish River (see Figure 6a). Bain was of the opinion that such a scheme would be feasible. "Everything cannot be done at once, but if convict labour could be applied to this scheme in the East, and to the one along the Orange River in the west, the colony, in a few years, would reap a golden harvest from such undertakings" (see Figures 6b and 6c) (Bain, 1886:17). Bain was therefore convinced that large irrigation schemes would bring economic benefit to the Cape Colony.

Figure 6a
Sketch of Map showing Probable Diversions of the Orange River According to Thomas Bain (1886)

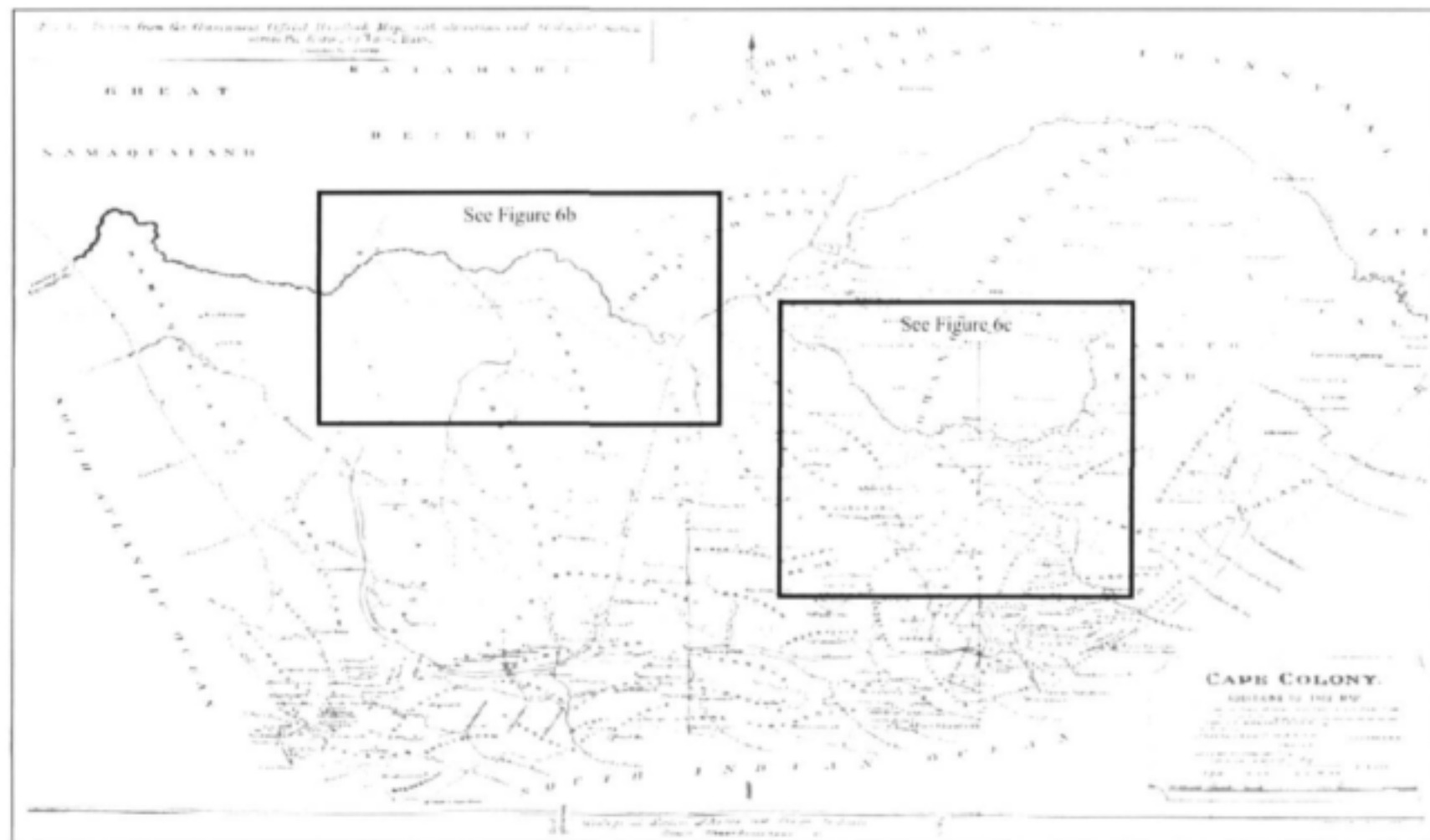
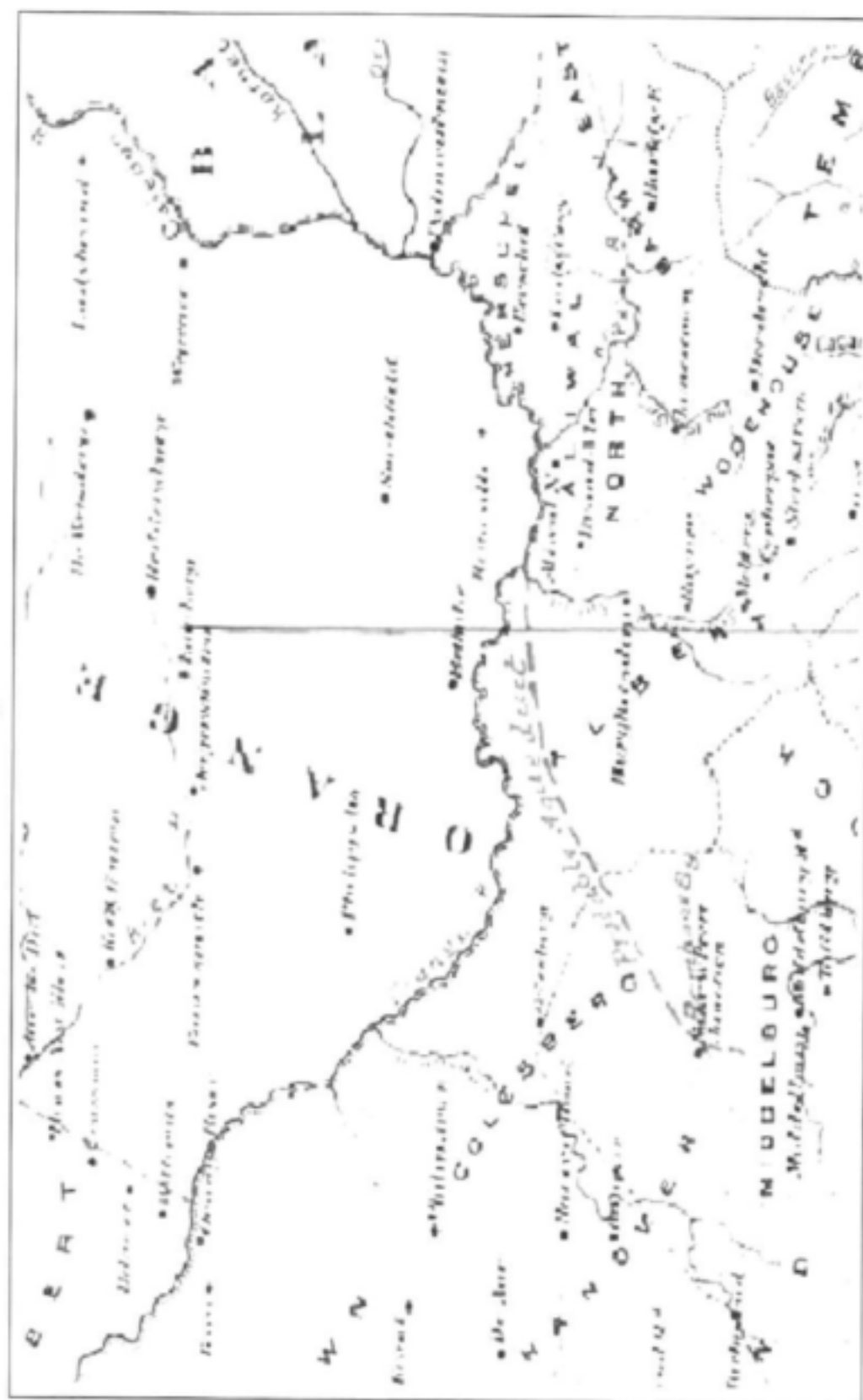


Figure 6c



5.3.19. Prieska Again

The matter of the Prieska irrigation works was not laid to rest by parliament. In 1886, the Commissioner of Crown Lands and Public Works, Col. Schermbrucker, said that "... Government could take no further action until the Municipality [of Prieska] had decided on the necessary steps to be taken". This, after De Villiers asked the government if any steps had been taken during the recess regarding the irrigation works (Cape of Good Hope, 1886:147). Yet in 1887 Sir G. Sprigg, MP, indicated that the matter regarding the irrigation works had not been overlooked by government. The reason why it had not yet received attention, according to Sprigg, was that Bain was "busily engaged on important duties elsewhere, and had not been able to attend to his work. It was hoped, however, that something would shortly be done" (Cape of Good Hope, 1887:23).

In 1889, the matter was again raised in parliament. In 1885 the cost of the Prieska irrigation works was estimated at around £30 000. Yet in 1889, Bain compiled a report on the cost and noted that it would cost about £18 000. The Prieska municipality owned 52 "water-erven" and asked government to give it 1 000 morgen of land. For this the municipality would carry out the works at its own expense. Thus, it only wanted more land, and not money. Theron, MP, proposed "that certain land concessions should be granted either to any company or any individual, who would carry out irrigation works near Prieska for the purpose of developing the agricultural resources of the district". This resolution was supported by the Commissioner of Crown Lands and Public Works. The only objection to it came from Paton, MP, who advocated that the resolution might interfere with larger irrigation schemes (Cape of Good Hope, 1889:394). The reason why the "free land" should have been given was that the government of the Colony had no money for such projects. When this matter was debated in parliament, it was also stated by the Commissioner of Crown Lands and Public Works that there was a great need for irrigation in the Colony. Because of this, "the House would be prepared to discuss the question in a friendly spirit" (Cape of Good Hope, 1889:243-244). This is an indication that government was willing to assist in irrigation works, but not to carry out such projects by itself because of the lack of financial resources.

5.3.20. Irrigation near Upington

In 1891, a similar motion was brought before parliament regarding the irrigation of land on the banks of the Orange River near Upington. This motion called for the granting of 100 000 morgen of land to a joint-stock company or individual who would execute the project. This was based on a report of the Geological and Irrigation Surveyor, Thomas Bain. The land would be leased to the company or individual at a rate of one shilling per morgen. Theron, MP, who laid the resolution before parliament, said, "irrigation would do much to further agriculture in the Cape Colony, and make it a success". He also aired the opinion that there was a need for reservoirs in the Colony to retain precipitation that was only flowing to the sea. Such a reservoir could be constructed at Tigerpoort on the Brak River, a tributary of the Orange. It could contain 681.9 million cubic metres (mcm) of water and 50 500 ha of land could be irrigated from it. If government should construct the reservoir it would cost about £130 000. Theron did not ask government to construct the reservoir. He only wanted the 100 000 morgen of land to be leased to the company or individual who would carry out the work. He also said that when individuals would like to construct irrigation works, government should encourage them (Cape of Good Hope, 1891:165-166).

However, Col. Schermbrucker was opposed to government's direct involvement. He said that if government should construct the reservoir at Tigerpoort, it would be a failure like the one at Van Wyk's Vlei. The government had also planned to implement an irrigation scheme before on the Zak River. This was opposed by the farmers. They stated that if an irrigation scheme were to be built on the Zak River it would lead to a lowering of their agricultural commodities. They were also opposed to it because government wanted to take their land for this purpose. De Vos, MP, maintained that government should take care that Crown land and private property, further away from the river, should not be cut off from the Orange River. Rhodes did not support the resolution because the cost of it would be too high. He declared that he had received permission a few years before 1891 "to claim 50 000 morgen of land near the Vaal River in connection with irrigation, but the cost of the scheme had been found too great". After considerable debate in parliament regarding the Tigerpoort Reservoir, Theron withdrew his resolution and nothing came of the project (Cape of Good Hope, 1891:167, 196-197).

5.3.21. Van Wyk's Vlei

At that time, the only significant irrigation project that had been constructed in the Cape Colony was the one at Van Wyk's Vlei. Yet according to Merriman the Van Wyk's Vlei reservoir was an engineering success, but a commercial failure. The reason, he argued, was that "people had not taken any interest in it". This failure was a general tendency of government works. Le Roex, MP, stated in the case of the Van Wyk's Vlei irrigation works, that it had attracted a number of people and had a negative impact on the security situation of the residents. Many of the newcomers were living on "thieving". He was of the opinion that government should self-implement irrigation projects and land should not be granted to a company. It would only take land from many farmers who were making a living on it (Cape of Good Hope, 1891:166). He was therefore not opposed to irrigation, but to the passive role government was taking in this regard.

5.3.22. Douglas Irrigation Works

In 1893, Tamplin, MP, asked a question in parliament regarding the status of the Douglas irrigation works, and when they should be completed. Sivewright, MP, said that the "furrow was practically completed, and there was only a little blasting required in order to make it uniform. A weir had also to be constructed across that river, and he hoped the works would be completed by about the month of October" (Cape of Good Hope, 1892a:358). The Douglas irrigation works date back to 1882, when Gamble first mooted the possibility of using the Vaal River's water for irrigation purposes. Construction work was started on a weir of loose stones, branches, and sods and a canal nearly 10 km long. This work was carried out by the Department of Agriculture. Shortly after completion, the weir was damaged and in February 1894 completely washed away by floods. A new site was selected, and work on a masonry weir started in August 1894. By May 1896 water was being supplied to about 29 plots at Douglas (Cape of Good Hope, 1899b:2; RSA, 1962a:3).

5.3.23. Buchuberg Irrigation Works

In 1893, Paton, MP, said that government should obtain a professional report on an irrigation scheme on the southern bank of the Orange River. This scheme would have been in the form of a canal "beginning at or near Buchuberg" (Cape of Good Hope, 1893:359). Molteno, MP, noted that before government considered such a project a professional engineer should be appointed to carry out the works (Cape of Good Hope, 1893:364).

The Buchuberg irrigation project was abandoned in the period 1895 to 1896, not only because of a belief that there was not enough land to irrigate, but also because it was too expensive. The canal would have been about 58 km long, the weir 12 feet high and its cost was estimated at £12 600. The entire cost of the canal was estimated at £110 000 or about £40 per acre land irrigated (Cape of Good Hope, 1906).

5.3.24. The Harts River Irrigation Scheme

In the same year, the matter of the Harts River irrigation scheme was raised in parliament. It was asked whether government had the intention to proceed with the irrigation scheme. Replying to the question, Sir G. Sprigg said that if the district of Barkly West should propose such a scheme government was willing to assist in the work. Evidence from records indicated that the scheme was proposed in 1886 (Cape of Good Hope, 1893:357). By 1894, nothing had been done on the scheme, for a want of financial resources. The estimated cost of the Harts River irrigation scheme was between £120 000 and £200 000 (Cape of Good Hope, 1895:463).

In 1895, it was asked in parliament whether the government had the intention to implement the Harts River irrigation scheme. The Secretary of Agriculture, Frost, stated that it would (Cape of Good Hope, 1895:138).

What also became apparent regarding the Harts River irrigation scheme was that natives were displaced from "their locations in the locality of the proposed irrigation scheme in order to make room for the settlers" (Cape of Good Hope, 1895:464). This could have been one of the first examples of the removal of blacks to make way for whites in an irrigation settlement.

5.3.25. Increased Attention on the Orange River

The Orange River received more attention in 1894, regarding the construction of irrigation works, than before. During the first session of the ninth parliament of the Cape of Good Hope in 1894, it became evident that the Prieska irrigation works had not yet commenced. Again, MPs alluded to the fact that the Colony's water resources were flowing to the sea. Also significant during this session was the raising of the issue of poor whites and irrigation projects. One MP, Van Der Vyver, advocated that irrigation colonies for poor whites should be established. He also said that government should not only concentrate on the Orange River. Merriman remarked that irrigation works on the Orange River were difficult because of the low population density and the river being lower than its banks. He was also of the opinion that irrigation projects were one of the means to cope with the poor white problem. It was said that the poor white problem stemmed for the fact that land was scarce and that there

was not enough capital for irrigation works. Another remedy that could have been afforded by irrigation throughout the colony was that of immigration. Every year more people immigrated to the northern parts of South Africa (ZAR and OFS). If irrigation were to be implemented in various parts of the Cape, food would not have to be imported, and this would check immigration (Cape of Good Hope, 1894:304-305).

In addition, from this session it was stated that government had done a lot regarding irrigation works. Irrigation projects had been surveyed and estimated in various parts of the Colony. Yet except for Buchberg, the other irrigation works "were most unsatisfactory". It was suggested that Buchberg be the pilot project to test irrigation works in the Cape Colony. One reason why irrigation works were seen as "unsatisfactory" was that they were far from any market. It was also suggested that the labour of poor whites should be obtained for the construction of irrigation works (Cape of Good Hope, 1894:305).

In 1895, it was asked whether government was likely to make a sum of money available for the construction of a dam at Rooiberg, at Kenhardt (Cape of Good Hope, 1895:232). Again, as with previous debates regarding irrigation works, there were those who advocated the Rooiberg Dam in terms of the good it would do for agriculture in the Colony. Those who supported the dam declared that too much money was spent on railways instead of irrigation works. Some argued that money for the scheme should be made available without any restrictions. Caution was not thrown to the wind, however. Some MPs indicated that a survey should first be made. If the report favoured the construction of the dam, only then would money be made available. The report did favour the building of the dam (Cape of Good Hope, 1895:390, 391).

By advocating irrigation schemes in the Colony, MPs said that these works:

- Should be implemented before railways were built;
- Were of great importance for the vital interest of the colony;
- Would help to solve the poor white problem;
- Were as "good as gold-mines", and would help to increase the agricultural products of the Colony;
- Were expensive, but the money would be well spent (Cape of Good Hope, 1895:464).

In the same year, parliament voted for a sum of £10 260 for surveys on hydraulic works. This came after there had been discussions for a long time regarding the implementation of irrigation works by government. What came forward during this vote was not the issue of the money, but the 1877 Irrigation Act. Many MPs said that it was a failure. One possible reason, put forward by Schreiner, was that farmers were very reluctant to give power to levy a rate to an association which they themselves had elected (Cape of Good Hope, 1895:505-506).

5.3.26. Irrigation under the Irrigation Works Bill

Sir J. Sivewright, MP, stated that the Irrigation Works Bill asked sanction of parliament to the expenditure of a sum of money from the accrued surplus for the purpose of carrying these "works". These "works" were as follows:

1. An irrigation survey, to show the most likely places where irrigation works could be implemented, and the best way of conserving the floodwater of the country. During floods, most of the rivers carried their water, as well as most of the rich topsoil, to the sea. Such a survey could indicate the most likely places for the construction of dams, and would give farmers advice regarding the conservation of water.
2. Deep boring should also be carried out. Some boreholes in the Colony went as deep as 200 feet, but Sivewright envisaged that these boreholes should go down to a depth of 2 000 feet. He said that in Queensland (Australia) deep boring had been a great success (Cape of Good Hope, 1896:470-471,472,473,474,476).

Regarding the first proposal Sivewright moved that an irrigation project should be established at Kenhardt. He stated that at Kenhardt 1 400 acres of land was lying unused, and if an irrigation project were launched it could support a considerable population, and 1 000 acres could be irrigated. Drinking water could also be supplied by such a project. Sivewright was also adamant that such irrigation works could help to relieve the poor white problem. This was supported by other MPs. The issue of food imports was raised in support of the Kenhardt scheme. Immelman, MP, said that it was wrong that a lot of money should go to foreign countries for foodstuffs. It was also felt that large irrigation schemes should be built, like the one proposed at Kenhardt. Yet from the discussions in parliament in 1896 regarding the Irrigation Works Bill, it became evident that the Buchberg irrigation scheme "has not found favour in the eyes of Government". It was moved however that an irrigation scheme at Buchberg should be implemented. Le Roex said that the scheme was not considered by government because a belief existed that there was not enough land to irrigate. He, however, pointed out that 30 000 morgen of land could be brought under irrigation. The issue regarding the Hartz River and Vaal River irrigation schemes was also raised. Schreiner was dismayed at the fact that these schemes had not been considered. He said that both rivers exhibited good year-round flows and were situated near the markets of Kimberley and Johannesburg. No expropriation of land would have been necessary, and Schreiner said that these two schemes would be greater successes than the one proposed for Kenhardt (Cape of Good Hope, 1896:470-471,472,473,474,476).

5.3.27. Le Roex and Litchfield's Report

In 1897, a special report was compiled by A.S. Le Roex and H.C. Litchfield, regarding proposed irrigation works on the Orange River in the district of Kenhardt and Prieska. They stated in their report that: "It is a pity to see and hear of the scarcity of food now experienced here, owing to the distance from the railway and the want of transport on account of heavy drought, and as the beautiful water of the Orange River runs into the sea, and only waits to be diverted over the most fertile tracts of land you [Sir James Sivewright] can find, providing not only bread for thousands of people, but also other necessities of life, as tobacco, fruit &c., &c". Both Le Roex and Litchfield were members of the committee to look into the proposed irrigation schemes on the Orange River (Cape of Good Hope, 1897:1). From this it is clear that Sivewright's plans to get a survey of irrigation works at Kenhardt off the ground, in 1896, came to fruition.

The Buchberg scheme was also investigated by the members of the committee. It was found that the soil was "rich and fertile". The cost of the scheme would rise as blasting through hard

rock was needed to lie out the furrows of the scheme, and that trees would have to be cleared. It was envisaged that tobacco could be cultivated on the rich and fertile soil (Cape of Good Hope, 1897:1). They also investigated a scheme at Upington where land could be brought under irrigation to irrigate vineyards and fruit trees. This scheme found favour with both Le Roex and Litchfield. They proposed that a survey should be conducted as to the layout of the scheme, as soon as the regulations controlling the Rinderpest allowed it. The scheme's cost was estimated to be about £192 000 (Cape of Good Hope, 1897:5-6). The *De Neus* scheme also came under consideration. A block plan for this scheme had already been drawn up in 1891 as part of the Geological and Irrigation Surveyor's yearly report. Le Roex and Litchfield estimated the cost of the *De Neus* scheme to be in the region of £29 000. Nonetheless, the scheme was deemed feasible (Cape of Good Hope, 1897:6-7). Le Roex and Litchfield also looked at the possibility of supplying water to Prieska from the Orange River. The municipality of Prieska had a plan to raise the existing dam by eight feet and to divert the water into the Prieska River and then to the village (Cape of Good Hope, 1897:7). On the Prieska irrigation works, the committee members were adamant that the scheme would not be viable. The scheme envisaged irrigating 1 000 acres by pumping water from the Orange River. No reason for the rejection of the scheme was given (Cape of Good Hope, 1897:8).

Another Orange River irrigation scheme, which envisaged the irrigation of private land of about 3 000 acres on the northern bank of the river near Prieska, was met with caution by the committee, because "the expense of bringing the water on to the land would be very great" (Cape of Good Hope, 1897:8). The scheme at *Kcukendraai* was also met with caution due to the excessive expenditure of building a canal and head works (Cape of Good Hope, 1897:9). From this report regarding the different irrigation schemes on the Orange River, it is evident that the engineer was starting to play a more prominent role in the investigation and implementation of irrigation works. The advice they gave regarding the layout of works and the costs suggests that the engineers had been given some legitimacy and support on the part of government regarding irrigation works. Yet the hydraulic engineer did not always give credible advice with respect to irrigation schemes. This was the case with the Van Wyk's Vlei irrigation works.

This was reported on by Robert Wallace, professor of agriculture and rural economy at the University of Edinburgh. He stated that the *Van Wyk's Vlei* irrigation reservoir (constructed in 1882-83) was a white elephant to the Colony. The reservoir was constructed under the advice of a hydraulic engineer at a cost of about £18 000. Wallace, in his 1896 book on agriculture in the Cape Colony, gave the reasons for the scheme's failure. Firstly, the extent of the water surface of the dam, when filled to capacity, was 30 km, and had an average depth of three metres. Secondly, the rainfall was too meagre. During 1893-95 only 112 mm of rain fell. At least 250 mm of rain, over its catchment area of 400 km², would be required to fill the dam. Thirdly, the annual evaporation loss was in the region of 2.16 metres per annum. Fourthly, there was a tendency of the soil to be covered by salt in certain areas of the Camarvon district. Wallace (1896:426, 427) noted that: "When it was realised that the rainfall was altogether insufficient to maintain a head of water in a shallow dam of the capacity in question, the Camarvon River was diverted in 1888 at an initial cost of £900, and made to throw its water into the dam (emphasis added)". The report of the geological and irrigation surveyor, Thomas Bain, of 1888, stated that the drainage area of the *vlei* (wetland) was insufficient for the enormous capacity of the reservoir. In fact, the surveyor noted that another £500 was needed before the diversion work could be satisfactorily completed. He

also stated that the future success of *Van Wyk's Vlei* depended on the work (Cape of Good Hope, 1888:2).

A small irrigation colony was, in 1896, maintained on a portion of the land, for which the Government paid £3 300 as compensation for cancelling the remainders of the leases of the farms expropriated in 1883. In this regard, Wallace did not discourage the implementation of irrigation works by the Department of Irrigation. He noted that *Van Wyk's Vlei* should be seen as a "valuable object-lesson", and that failures such as these should be avoided (Wallace, 1896:427). It was because of this that he also said: "Although in some instances the practice of irrigation has been carried to great perfection, yet there has been upon the whole a distinct lack of scientific investigation and explanation of the reasons of success and the causes of failures" (Wallace, 1896:409).

In spite of Wallace's arguments, the irrigation schemes proposed by Le Roex and Litchfield were discussed in parliament in 1899; this after Rev. Schröder raised the issue of the cost of the schemes. He said that Le Roex and Litchfield estimated the cost of the Buchberg irrigation project to be in the region of £192 000. He argued that if poor white labour were to be used, at 3 shillings per day, as was the case at the labour colony at Kakamas, it could be done for £60 000 (Cape of Good Hope, 1899a:198-199; Marchand, 1909:44).

Cost was the main impediment to the implementation of such schemes. During the 1880s and 1890s, many proposals were laid before parliament, but because of the huge costs involved in these projects, nothing had been done to introduce irrigation in the Orange River. This was with the exception of the *Van Wyk's Vlei* reservoir, the Douglas irrigation works, the Kenhardt irrigation scheme, the Kakamas irrigation project, and the Olyvenhout Drift irrigation works. The Labour Colonies Committee of the Dutch Reformed Church indicated that poor whites could be employed to implement the Buchberg irrigation scheme at a much lower rate (Cape of Good Hope, 1892b:4,9; Cape of Good Hope, 1899a:559).

5.3.28. The Hartz and Vaal River Irrigation Works

In 1899, the Hartz and Vaal River irrigation schemes were again mentioned in parliament. This was after a petition was received from a W.J. Weideman and 41 other inhabitants of Barkly West on 29 November 1898, regarding the construction of these schemes. Subsequently, the schemes had been referred to the government for inquiry and report (Cape of Good Hope, 1898:364). This indicates that it was not only government officials who were in favour of the establishment of irrigation works. Private citizens also indicated their desire for the implementation of such works.

Yet it was Cecil John Rhodes, MP of Barkly West, who advocated the implementation of these schemes in the strongest way possible. In 1886, he had already carried a motion to get some land between the Hartz and Vaal Rivers for the purposes of irrigation. The land was granted to him by government, but he could not raise the money to implement the irrigation works. The reason why government granted land to Rhodes was that it was not prepared to pay for the irrigation works itself. The House of Assembly stated that: "... as the Financial Condition of the Colony will not warrant the Expenditure of Public Money on the said Works, this House is prepared to recommend a Free Grant of such Crown Lands as are situated between the Hartz and Vaal Rivers to any Joint-Stock Company of Individual who may be

prepared to execute and carry out to the satisfaction of the Government, the Plan No. 2 laid before Parliament by the Hydraulic Engineer for the Irrigation of the said Hartz River Valley, at a cost not exceeding £130 000" (Cape of Good Hope, 1898:471; Union of South Africa, 1934a:1).

That Rhodes was unable, in 1886, to raise the money is strange for someone who had so many interests in the diamond and gold-mining industries, and who was therefore a rich person. Even so, Rhodes said that any speculator would not find favour with such a scheme. He even tried to persuade the government to carry out the works when he was Prime Minister, but this did not succeed. The government said that other parts of the Colony also needed irrigation works. A survey was done of the furrow and reservoir and the cost was estimated to be £200 000 for the entire scheme. At an interest rate of two per cent per annum, the district of Griqualand West would repay £10 000 per year. In order to repay the loan the diamond mines were put up as security. The mines were worth a staggering £22 million. Kimberley and Beaconsfield were worth £1.6 million, the Kimberley mine £250 000 and Wesselton £1 000. All in all, these areas and mines were worth another £2 million. The divisions of Hay, Herbert, and Barkly were worth another £1 million. Thus, everything was worth £25 million pounds, and Rhodes was willing to put this up as security for the irrigation schemes. Thus, the feasibility of schemes hinged on the wealth of the mines (Cape of Good Hope, 1898:471-472). Rhodes said in parliament "that in that enormously wealthy district there was no risk". Rhodes envisaged the construction of a reservoir on the Vaal River, for which he had already put down £70 000 (Cape of Good Hope, 1898:473,472).

His arguments for the schemes were not only based on the ample security for these schemes. He raised the issues of the poor whites and the farmers who had experienced huge losses during the Rinderpest epidemic in 1896. In fact, Rhodes stated that these people had lost everything due to the Rinderpest, and that they were experiencing huge distress. Rhodes debated that they could be used as overseers and that the poor whites and farmers would then receive preference for the water allocated. He argued that the poor whites refused to work in the mines, and would rather farm or be overseers in the mines. "Of course the poor whites could do as much as the miners, but it was the Kafirs who did the work in the mines; the whites were overseers. But there is one thing which the poor white would take to – the irrigation of the soil", Rhodes assured parliament. The poor whites could also be used as cheap labour to implement the schemes (Cape of Good Hope, 1898:472).

Rhodes received both support and rejection from other MPs. This is summarised in Table 5.1 below.

Table 5.1. Members of Parliament either supporting or rejecting Rhodes's Hartz and Vaal River Irrigation schemes.

Member of Parliament	Supportive	Uncertain	Rejection	Reason(s) for Support or Rejection
Mr Sauer			x	Enough land to irrigate. Natives will have to be removed. Poor whites would benefit. Benefits outweighed costs in terms of increasing value of land. However, the De Beers mining company would exert too much influence over the irrigation Board. The land should be kept as a valuable asset and used in another way.
Col. Schermbrucker			x	The land was too valuable to give away to a private consortium.
Mr Oates	X			However, the proposal should be amended, so that the interests of the Colony can be safeguarded.
Mr Schreiner			x	Crown land cannot be given to a private company. Forced removal of natives and compensation are severe problems attached to the scheme.
Mr Merriman		x		Irrigation schemes should be built in flowing rivers, like the Orange. Gauging of the rivers' flow should first be done.
Mr Weeber	x			No reason.
Mr Douglas	x			More land would be irrigated by the amount of water contained by the rivers.
Mr Van Der Walt			x	The involvement of De Beers would do more harm than good.

Source: Cape of Good Hope, 1898:473-476.

Of the eight parliamentarians who responded to Rhodes's proposal only three supported it, with one unsure and four against it. By 1899, the Hartz River and Vaal River irrigation schemes were still not off the ground because of opposition from parliament that land should be handed over to a private enterprise. Proposals for similar schemes and for those of the Hartz and Vaal River schemes were to be laid before parliament during its last session. This was promised by the Commissioner of Public Works (Cape of Good Hope, 1899b:15-16). The Hartz and Vaal River irrigation schemes did not therefore carry the support of the MPs. In any event, the Hartz and Vaal River schemes were not implemented until the first half of the twentieth century. In 1904, it was again asked in the House of Assembly whether government was looking into the Hartz River irrigation schemes. The Commissioner of

Public Works, Dr Smart, said that an inspection had been carried out by the Director of Irrigation, and that the scheme would go ahead depending on the Director's report (Cape of Good Hope, 1904:404).

5.3.29. Near Joint Cooperation between the Cape Colony and the OFS

In 1898, a proposal was laid before parliament for the construction of a dam across the Orange River, where it forms the border between the Cape Colony and the OFS. It was proposed by Joubert, MP, that the government of the Cape Colony should enter into negotiations with the government of the OFS, "with a view to obtaining its [OFS's] sanction to, or cooperation in, the construction of a dam across the Orange River at Odendaal Stroom, and that upon such negotiations being successful a survey should be made, and an estimate framed with a view to the construction of such a dam, and thereupon a report be framed as to the advisability or otherwise for irrigation purposes of such a scheme . . ." The water from the river could also be used to run a factory. Joubert had visited the site of the proposed dam and thought that it was possible to construct it. He envisaged that the dam should not be higher than three metres. He also spoke to the farmers on the Colony's side of the river and they were prepared to sell their farms for the dam (Cape of Good Hope, 1898:224). Nevertheless, just as in the case of the Hartz and Vaal River irrigation schemes, a number of MPs either supported or rejected the proposal.

Issues that were raised by some of the MPs are summarised as follows:

- Work could be undertaken without the cooperation of the OFS;
- Irrigation schemes should be implemented across the entire Cape Colony and not only in certain localities, like Odendaal Stroom;
- The Cape Colony only had a right to the Orange River's water up to the middle of the Orange River's stream (this suggested that the border between the two countries ran through the middle of the river(*thalweg*));
- Was there sufficient arable land to be irrigated by the scheme?;
- A conference should be arranged whereby delegates from the Cape Colony and OFS could meet, with the object of arriving at some basis on which irrigation works on the Orange River might be undertaken in the best interests of both parties;
- Initially, according to the owner of the farm at Odendaal Stroom, the OFS rejected the proposal because the dam would claim water as far as the mid-stream (Cape of Good Hope, 1898:224-225).

Regardless of the issues raised, the joint utilisation scheme proposed by Joubert found favour with the governments of the Cape Colony and the OFS. On 23 May 1899, the Commissioner of Public Works, Sauer, appointed a delegation from the Cape Colony to hold an informal preliminary conference with delegates from the OFS concerning the Odendaal Stroom irrigation project. The Cape Colony delegates were J. Newey, Chief Inspector of Public Works, and W.H. Tooke, Chief Clerk to the Agricultural Department (Cape of Good Hope, 1899a:1, 19). On 3 June 1899, the Government Secretary of the OFS, P.J. Blignaut, issued a certificate stating that J. Grattan Dickson, State Attorney, and G.A. Northcroft, Inspector-General of Public Works, were to be the delegates from the OFS to attend a preliminary and

informal conference at Aliwal North. This conference between the Cape Colony and OFS was held on 5 June 1899 (Cape of Good Hope, 1899a:30; Cape of Good Hope, 1899c:1).

The projects that came under consideration at the conference were the Aliwal North Water Supply Scheme and the Odendaal Stroom Scheme. The Aliwal North Water Supply Scheme envisaged supplying the town with water for domestic purposes. It was not an irrigation scheme, although some of the water would have been used to water garden lots. It was also envisaged that hydroelectric power for the town could be generated by the project (Cape of Good Hope, 1899c:2).

The intentions for the implementation of this scheme had already been communicated to the OFS by the town clerk, G. Griffiths, of Aliwal North on 4 November 1898. Griffiths stated in a letter to Blignaut on that day that: "It is the intention of the Council to adopt a Water Scheme for the town, and in connection therewith it will be necessary to construct a weir across the river to obtain the necessary power to work a set of turbines. I am further directed to ask you if, in the event of the middle of the river being the boundary between the Colony and Free State, your government will grant a perpetual right to construct the weir across the river. The height of the proposed weir will be six feet". Blignaut replied in a letter on 10 November 1898 that: "Sir, - With reference to your letter on the 4th inst., I have the honour to inform you that our Government [OFS] agreed with the Government of the Cape Colony some years ago that the centre of the bed of the Orange River should be the boundary line between this State and the Colony. His Honour the State President, would thus rather see that the correspondence regarding the damming up of the river should be conducted through the Government of the Cape Colony" (Cape of Good Hope, 1899c:32). In this letter there is a strong sense of sovereignty to be detected. The OFS did not wish to deal with a local governmental entity, but rather with the government of the Cape Colony concerning the Aliwal North Water Supply Scheme.

The boundary demarcation Blignaut was talking about was the setting of the boundary between the Cape Colony and the OFS in 1854, when the OFS gained independence from the Cape Colony. The negotiations became known as the Sand River Convention (the Convention had nothing to do with water, but was to establish the sovereignty of the OFS). At this point, it would be useful to elaborate a little on the demarcation of the border in 1854, because it had an influence on the implementation of the proposed Aliwal North Water Supply and Odendaal Stroom projects. During the negotiations for the sovereign establishment of the OFS and the Cape Colony, the boundary between the two territories "was fixed as the *medium filum aquae*". The boundary between the two entities was therefore delineated as the middle of the Orange River stream (Cape of Good Hope, 1899c:15).

As regards the Odendaal Stroom Scheme, it was envisaged that this would be implemented at Odendaal Stroom, some 40 km downstream from Aliwal North. The project was originally started by the owner of the farm *Zyverfontein*, Odendaal. In 1893 he constructed a weir across the river, and a furrow, on the Cape Colony side, for irrigation purposes. By 1899, Odendaal had already surveyed irrigable plots of land, which he sold for a "good price under the promise of the delivery of irrigation water to each erf". These sales took place in May and July 1894. Odendaal was, however, unable to carry out his agreement. Legal proceedings were initiated by the buyers, but were stopped, on condition that Odendaal buy back the plots (Cape of Good Hope, 1899c:2-3). The case of Odendaal being unable to deliver the irrigation water, for whatever reason, is an indication of the inability of the individual, in this case, to

enter into agreements with others for the delivery of water. It is not certain, and the evidence is not readily available, but it could be that the state came in to play the role of custodian of providing water to farmers in the case of the Odendaal Stroom Scheme.

The rationale behind the Odendaal Stroom Scheme was that the winter rainfall was too low for the irrigation of winter crops. It was therefore necessary to implement it in order to deliver a year-round crop in the locality of Odendaal Stroom and Aliwal North. The scheme did not envisage the storage of water. The land at Odendaal Stroom, as stated by the government report of 1899, belonged to "well-to-do farmers". They acquired the land between the period 1837 and 1850, "on quitrent tenure, under the condition of Sir John Cradock's Proclamation of 1813, and contained a clause requiring the owner to bring his land into such cultivation as it is capable of". In any event, the site for the weir was about nine kilometres upstream from Odendaal Stroom. It was proposed to construct a "masonry weir" about six metres high above the surface of the rock, and 435 m long. It was estimated that it would bring about 540 ha of land under irrigation. The furrow would have had a length of about 12 km. There was also the possibility of extending the scheme downstream to Bethulie (where Col. Gordon had named the Orange River in 1777 for the first time) (Cape of Good Hope, 1899c:3-4).

The response of the OFS delegates after the inspection of the site of the weir was as follows: "Mr Northcroft considered that it would be a good thing to have a proper survey made of the land that would be dominated by a canal from the weir on the Orange Free State side, and he would be prepared to advise his Government to ascertain this; but he did not expect that his Government would be prepared to undertake such a survey until they had some idea from the Cape Government of the approximate cost of the weir, and stated that their action would probably be governed by the amount of the estimate" (Cape of Good Hope, 1899c:4).

Thus, in principle, the OFS was not against the plan, and sound reasoning from Northcroft dictated that the entire project's cost and a survey of it on the OFS should first be ascertained. This sound reasoning was further exemplified by the fact that the OFS delegates wanted to know what damage inundation would do to land. The Cape Colony delegates stated in the 1899 report that the OFS would not have any objection to the plan, because the OFS would benefit as much from the project as would the Cape Colony. Furthermore, from the report it is clear that no irrigated land existed on the OFS side of the Orange River (Cape of Good Hope, 1899c:4).

A number of draft legal proposals were also laid down during the conference. They are as follows:

1. That the rights of riparian owners on either bank of the Orange River where it forms the common boundary of the Cape Colony and the Orange Free States shall be governed by the common law as at present subsisting in the Cape Colony, provided always that sufficient water shall at all times be allowed to flow as will secure the rights on this basis of lower riparian owners and maintain the river in a sanitary condition.
2. That a hydrographical survey of that part of the Orange River forming the common boundary between the Cape Colony and the Orange Free State, and its tributaries and catchment area, with river gaugings, be undertaken by the Governments of the Cape Colony and the Orange Free State; the cost to be equally shared by the respective

Governments. The river gaugings were to be taken at the nearest point below the confluence of any important tributary on either side.

3. That pending the completion of this survey, the Governments of the Cape Colony and the Orange Free State and their respective inhabitants, being riparian owners, shall have the right to the "extraordinary use" of all surplus water in excess of that required for ordinary use, in proportions to be mutually agreed upon; the basis of such agreement, however, to be the relative proportion of water contributed by the tributaries passing respectively through the Orange Free State and British Territory.
4. That the provisions of the Cape Colony Act, No. 26 of 1882, known as the "Right of Water Passage Act" be made applicable to riparian farms on both banks of the river, and that in section 7 of this Act the term "Government" shall be held to include the Governments of the Cape Colony and the Orange Free State.
5. That in the case of private properties the riparian owner may claim, and must if required cede a right of abutment, provided that in the latter case he may claim such compensation as may be decided by agreement, or, failing this, be adjudged by arbitration.
6. That in the case of Crown or State lands the rights of abutment shall, as between the two Governments, be free, mutual and reciprocal; provided that, in the case of irrigation works being undertaken by either Government, due and satisfactory precaution shall be taken to provide against damage to the opposite bank, but that any damage shall be compensated for as decided by agreement, or, failing which, adjudged by arbitration.
7. That in the event of either Government undertaking irrigation works involving construction on both banks of the river, due notice of its intention shall be communicated to the other Government with a view to enable it to participate in the scheme, and such other Government shall, within a prescribed period, notify its wish to so participate or otherwise. In the event of its participation at any time before the hydrographical survey referred to in proposal 2 being completed, the cost of the works in the river shall be shared by the two Governments on the basis set forth in proposal 3 (Cape of Good Hope, 1899c:5-6).

Both government delegations pledged to lay these proposals to their respective governments (Cape of Good Hope, 1899c:6). How did the delegates arrive at these proposals? One might feel inclined, at first glance, to think that the Cape Colony had overplayed its hand during the negotiations at the conference. For instance, in proposal 1 it is stated that the common law of the Cape Colony would prevail regarding individual riparian owner rights. However, the common law in the Cape Colony was the same as the common law that existed in the OFS, which was based on Roman common law (Cape of Good Hope, 1899c:16).

That being the case, the issue of water distribution laid the basis for proposal 2. Initially, a number of ways of water distribution presented themselves. These are as follows: half shares of the water; water to be distributed in proportion to the size of the respective catchment areas; water to be distributed in proportion to the quantity furnished by the tributaries passing through the respective states; and water to be distributed in proportion to the amount actually required. The first three distribution methods were rejected. The fourth method would be fair, "but labours under the practical disadvantage that the proportion is *undeterminable until the last irrigation scheme has been carried into effect*, and even then, as the irrigation area extends, as we understand it frequently does, by the rise of water level, it will require future readjustment" (emphasis added). It was for this reason that a hydrographical survey would be conducted to ascertain the river flow (Cape of Good Hope, 1899c:17).

Concerning proposal 3, the Cape Colony Delegates were convinced that the Irrigation Law of the Cape Colony was defective. It did not give any rights to enable a private riparian owner to construct "a weir across a public stream to abut on the opposite owner's bank without making an agreement with such owner ...". Furthermore, and because the statute law of the Cape Colony and the OFS was the same, the Cape Colony's Act No. 26 of 1882 was adopted. Proposals 5 and 6 were drafted because there was no provision in an act of parliament for an international river. They would therefore only be applicable to the Orange River. Proposal 7 was also drafted because of the possibility of future cooperation that the hydrographical survey might identify, and that both states could "share in any proposal initiated or undertaken by one Government and which could be adapted to serve the other Government ..." (Cape of Good Hope, 1899c:16-19).

The conference was conducted in a very friendly manner. In the report it is stated that: "Before leaving this branch of their report, your [Sauer] representatives would wish to express in cordial terms their sense of the friendly and courteous attitude in which they were met in all deliberations and discussions by the representatives of the Orange Free State, and their hope that, whatever the conclusions arrived at by the Conference, they will only serve to knit more closely the bonds of friendship subsisting between the Colony and the State, and that the Orange River, the subject of their proceedings, may be a means not of dividing, but of linking the two territories for their mutual benefit in joint permanent prosperity" (Cape of Good Hope, 1899c:5).

This was however not to be. At 17H00 on 9 October 1899, the ZAR Secretary of State, F.W. Reitz, send an ultimatum to the British agent in Pretoria. Two days later, the allied republics, OFS and ZAR, were formally at war with Great Britain, which controlled the Cape Colony (Pakenham, 1986:200). Ironically, before the conference on the schemes was held on the 5 June 1899, another conference between Pres. Paul Kruger from the ZAR and Lord Milner, representative of Great Britain, was at an end, and a huge failure. This conference was held in the OFS capital, Bloemfontein, between 31 May and 5 June 1899. Pres. Steyn from the OFS was appointed by Great Britain and the ZAR as mediator between the two sides. The main aim of the conference was to avert a war between the ZAR and Great Britain (*Die Huisgenoot*, 5 June 1953:48-51). The report on the proposed international projects was published on 7 July 1899. The delegate from the Cape Colony, writing about the fostering of relationships between the Cape Colony and the OFS through the Aliwal North Water Supply Scheme and the Odendaal Stroom Scheme, could have had the pending war in mind.

In spite of this, the Odendaal Stroom Scheme continued to be discussed in the Cape parliament between 14 July and 12 October 1899. During this time a report by the engineer in the Department of Public Works was compiled (Cape of Good Hope, 1899b:87). The records of the debates in parliament for the period October to December could not be located. The researchers were therefore unable to ascertain what the exact impact of the Anglo-Boer War on the Aliwal North Water Supply Scheme and the Odendaal Stroom Scheme was. However, it can be assumed that, because of the war, the two projects were not implemented.

5.3.30. Irrigation Projects Underway

In contrast to the Aliwal North Water Supply Scheme and the Odendaal Stroom Scheme, by 1899, a number of projects in the Cape Colony were either under consideration or already completed, in the Orange River basin. These are summarised in Table 5.2.

Table 5.2. Completed and Proposed Irrigation Projects on the Orange River in 1899.

Project Name (Principal River Basin)	Proposed (Completion Date of Survey)	Completed (Date)	Purpose	Description/Remarks
Van Wyk's Vlei (Hartebeest)		x (1883)	Irrigation Storage	Reservoir – Earth Dam, Height $\approx$ 9 metres
Sutherland Water Supply (Hartebeest)	x (June 1894)		Water Supply	Raising of the municipality reservoir. It was deemed that this would not be safe. Before 1899 the dam burst, owing to bad construction.
Buchberg (Orange)	x (Oct. 1896)		Irrigation	Weir – Masonry, Length 366 m. Canal: Length 116 km
De Neus Project (Orange)	x (Oct. 1896)		Irrigation Canal	Canal: Length 38 km
Kenhardt Project	(March 1897)	1899 Still in Progress	Irrigation Storage	Reservoir – Earth Dam, Height 6 m. Canal: Length 9 km
Rietfontein Project (Hartebeest)	x (Sept. 1897)		Irrigation Storage	Reservoir – Earth Dam with concrete core, Height 15 m Canal: Length 13 km
Lange Kuilen Project (Hartebeest)	x (Oct. 1897)		Irrigation Storage	Reservoir. Canal: Length 16 km It was recommended that the project should not proceed.
Smartt Syndicate, <i>Houwater</i> (Brak)	(Dec. 1898)	x (March 1899)	Irrigation Storage	Reservoir – Earth Dam, Height 6 m Reservoir completed at a cost of £8 000.
Burghersdorp Project (Orange)	(March 1897)	In progress (1899)	Water Supply	Various works.
Dordrecht Project (Orange)	x (May 1898)		Water Supply	Reservoir – Earth Dam, Height 13 m
Douglas Project (Vaal)		x (September 1895)	Irrigation	Weir, Height 2 m Canal: Length 12 km Weir at Whinstone, Height 2 m Canal: Length 15 km
Waterfall Vaal River Project (Orange)	x (Jan. 1898)		Irrigation Pumping	Weir across Vaal River Canal: Length, 3 km Pump 75 Horse Power (HP)
Geluk and Putpan Project (Hartz River)	x (Nov. 1898)		Irrigation Pumping	Steam Pump with 300 HP 2 Service reservoirs Main and distribution canals

Source: Cape of Good Hope, 1899d.

One would expect that the war had a disruptive impact on the implementation of water development projects, especially irrigation schemes. This was however not the case in the Orange River basin. In March 1900, Litchfield reported on the Dutch Reformed Church Labour Colonies Irrigation Works at the Orange River. This report referred to the Kakamas North Scheme. What is significant of the report was the reference made to labour and the cost of digging the furrow. At the time when the report was written Litchfield said that the furrow had been completed for 2 300 yards. The labour on this section of the furrow was done by "Bastards", working at a cost of two shillings 6d per day each. Plots of land were also to be allocated to them at the "lower end of the scheme" (Cape of Good Hope, 1900a:1). "Bastards" were a stereotypical connotation given to people with mixed ancestry. They were not considered white or black and did not have the rights of a white person. The reason why these people may have received plots of land was that labour was in short supply, because of the war. The "Bastards'" individual rights are also a manifestation of the fact that they received plots of land at the lower end of the scheme. They were therefore placed in a position as the lower riparian users on the Kakamas Irrigation works relative to that of whites and would receive water last.

What is also significant in the report is the mention that an irrigation scheme should be constructed at Buchuberg. The report stated: "... there is practically no cultivation within a radius of 100 miles from Buchuberg, and an irrigation scheme is urgently required there for the development of a backward part of the country" (Cape of Good Hope, 1900a). From this it can be deduced that, by 1900, the Buchuberg scheme had not yet been implemented. Furthermore, the discourse in which the rationale of the scheme had been written is that of bringing development to a "backward" part of the Colony. Thus, socio-economic development played a significant role in advancing the Buchuberg and other irrigation schemes.

In August 1900, the Hartz River irrigation scheme was again raised in the House of Assembly. A question was put to the Commissioner of Public Works, Smartt, on whether the scheme was being "contemplated", and whether Parliament would provide funds for its implementation. The Commissioner said that if the scheme were to be implemented it would entail a large sum of money, £343 000. Even a modified scheme, irrigating 16 000 to 25 000 acres, would cost around £190 000. He also stated that the "estimate" never covered the cost, and the result of irrigation was not satisfactory. Smartt also contended that: "Careful consideration would have to be given to the question of storage reservoirs, because in October and November, when the cereal crops most needed water, the Vaal River was so low that it could not be used" (Cape of Good Hope, 1900b:317).

Against the backdrop of the cost of the Hartz River irrigation scheme (£343 000), it was stated in 1902 that, under the Irrigation Act No. 8 of 1877, which was amended by Act No. 7 of 1880, £228 904 have been advanced to 47 approved applications to implement irrigation works in the entire Cape Colony. Of this amount £171 844 was still outstanding because the periods of the loans had not yet expired by 1902. The sum of £21 516 had been repaid and £5 027 had been written off "... as irrecoverable of security". Reasons for the write-offs were the following:

1. Faulty construction of irrigation works, but in many cases the works had not being satisfactorily completed.

2. The insufficiency of security was due to the fact that during the period ending 1885, when all the abortive works were undertaken, the government lent money on security of farms held on quitrent tenure, of which the quitrent was unredeemed (Cape of Good Hope, 1902:175).

Of the total amount of £228 904, £170 654 was advanced to municipalities, and £52 250 to private individuals or parties (Cape of Good Hope, 1902:175). Thus, municipalities were taking the lead in implementing irrigation works. However, the opinion was raised in the Legislative Council that individual farmers should get more help from government than municipalities, because the municipalities "can help themselves" (Cape of Good Hope, 1902:180).

This was the opinion raised by the Secretary of Agriculture, Neethling. Other members were supportive of this. It was said that government should put more resources into the drilling of boreholes, than investing money for the construction of large dams. This was after the Thebus Irrigation Bill was introduced for the construction of a large dam (the Thebus Dam). This was supported by the fact that the Beaufort West dam was empty in 1902. Many MPs said that individual farmers should be helped to improve the supply of water on their farms instead of investing a lot of money on grand schemes. In order to advance irrigation and water resource management, it was proposed that a proper hydraulic department should be established. Other members also expressed the view that a lot of government land could be made productive by irrigation (Cape of Good Hope, 1902:179-180).

5.3.31. The Vluitjes Kraal Irrigation Works

In 1903, it was proposed in the House of Assembly that an irrigation project on the Orange River be implemented on the farm Vluitjes Kraal in the district Hopetown. The proposer of the scheme, Du Toit (MP), said that this scheme would be much better than any other on the Orange River. The reasons for this were as follows:

1. The river's steep gradient (slope) (over a distance of 100 yards it descends by six feet).
2. The bottom of the river was rocky, not sandy, making it suitable for the construction of a weir across the river.
3. Water could be brought out on both sides of the river, which was not the case elsewhere (Cape of Good Hope, 1903a:153).

5.3.32. The Rooiberg Dam

In addition, in 1903, a report of the select committee on the Rooiberg Dam near Kenhardt was published. The report started with a warning. It stated that: "This scheme [Rooiberg Dam], which is a melancholy warning of the difficulties and uncertainties that attend schemes of irrigation by means of dams, apparently had its origin in a report by the late Mr Thos. Bain, dated 16 July 1891, presented to Parliament in 1892". Bain's report of 1891 said that the site for the construction of a dam at Rooiberg was suitable for the purpose. Bain also estimated the cost of the construction works at £6 460 (Cape of Good Hope, 1903b:iii).

Following the estimates of Bain, the Legislative Council passed a motion by majority, on 7 July, 1892, to the effect: "That, in the opinion of the Council, it is highly necessary and desirable that a dam be constructed by the Government at Rooiberg above Kenhardt" (Cape of Good Hope, 1903b:iii). In 1896 a sum of £20 000 was set aside for the construction of the Rooiberg Dam. Yet on 11 May 1897, the Chief Inspector of Public Works submitted enlarged plans and designs, which would raise the cost of the dam to £40 000. He also suggested that Act 33 of 1896 should be amended to allow the construction of the Rooiberg Dam. This was granted by Parliament. Tenders went out in November 1897, and Roux's tender of £36 500 was accepted (Cape of Good Hope, 1903b:iv-v).

However, Schröder warned the government of the dangers of the high salinity of the water. This warning was repeated by Dr Hahn. The work on the dam was completed on 15 January 1900. On 26 March 1900 a flood occurred, which caused the dam to burst and, according to Merriman, Chairman of the Select Committee, "... rendered it perfectly useless" (Cape of Good Hope, 1903b:vi).

The Select Committee blamed the failing of the dam on the "... imperfect treatment of the material, and possibly to careless construction" (Cape of Good Hope, 1903b:vi). The Committee also expressed its doubts about the estimated cost of the scheme and its benefits. The estimated cost was too high, and the returns too low, because of the following:

1. The saline nature of the soil both above the dam and of the irrigated area.
2. The large volumes of water that would evaporate from the dam's surface (Cape of Good Hope, 1903b:vi).

The cost of repairing the dam, together with the costs of laying the channel to convey the water to the irrigated area, would have raised the total cost of the dam to £60 000. Based on this, the Committee expressed the opinion that this sum of money would make it hopeless "... to expect any return upon a commercial basis" (Cape of Good Hope, 1903b:vi).

It was recommended by the Select Committee on the Rooiberg Dam that the reconstruction of the dam should be transferred to a "public body who would be prepared to undertake the responsibility of reconstruction, and that if this fails, that they should be prepared to treat with private individuals or companies who would under guarantees take over the works and secure their proper utilization, reporting the results to Parliament for its approval at its next session, and that immediate steps should be taken to this end" (Cape of Good Hope, 1903b:vii).

The Committee also stated that the Rooiberg Dam had been planned and constructed with insufficient information in hand, and that the expenditure of public monies (nearly £50 000) was a total waste (Cape of Good Hope, 1903b:vii).

5.3.33. Utilisation of Groundwater

By 1904, the drilling of boreholes was taking on a new dimension. A report by the Select Committee on Water Bores gave a number of conclusions as to the sinking of boreholes:

1. That the drilling of boreholes should be subsidised, so that a larger number of farmers could have holes drilled on their farms, and therefore be relieved from their difficulties due to drought.
2. That the Department of Public Works should expand their operations by acquiring more machines.
3. That deep boreholes should be drilled in the dry districts of the Colony.
4. By drilling boreholes, more land could be irrigated on a much simpler scale. A system of surface water irrigation projects would cost millions, because they would be incomplete without a large railway scheme (Cape of Good Hope, 1904:613).

Thus, South Africa entered the era of sinking large numbers of boreholes at around 1904. This does not mean that large irrigation projects were seen as outdated. South Africa was only now, at the beginning of the twentieth century, about to start with the mobilisation of water resources on a grand scale. The fact that the decision-makers were also looking towards groundwater resources attests to this.

5.3.34. Cooperation: The Vaal River

In 1905, inter-state cooperation between the different Colonies was again mooted, as in 1899 between the Cape Colony and the OFS. This time it involved the joint utilisation by the Cape Colony and the colony of Transvaal of the Vaal River for irrigation purposes. Investigations had been carried out into the implementation of such a scheme. Records from parliament in Cape Town in 1905 indicate that communications were taking place for such a scheme. These communications were also looking at some arrangement whereby the water supply of Kimberley would be protected (Cape of Good Hope, 1905:89).

The first report to be published on the Vaal River Development Scheme was in 1905. This was by the Transvaal Irrigation Department, after a reconnaissance of the Vaal River had been undertaken. The conclusions arrived at from this reconnaissance and others carried out in the Orange River Colony and Cape Colony were as follows:

1. That irrigation works on the Vaal River required storage;
2. That the two outstanding sites for storage from a national point of view were one in the neighbourhood of the junction of the Vaal and Wilge Rivers (where the Vaal Dam was eventually built) and the other above Christiana (where the Bloemhof Dam was to be built);
3. That the large irrigable areas do not lie in the valley of the Vaal but in the valleys of its tributaries, separated from it by high ridges;
4. That the two outstanding valleys that could be irrigated were the Renoster Valley in the Free State and the Hartz Valley in the Cape; and
5. That a large river, such as the Vaal River, required large and expensive works and that these could not easily be commenced on a small scale and subsequently be enlarged (Union of South Africa, 1934a:1-2).

Before the reconnaissance mission in 1905, Gordon, Director of Irrigation, reviewed the previous proposals regarding the Vaal Hartz Scheme. He concluded that the necessity for storage had not been sufficiently recognised in previous proposals for this scheme and that the area previously proposed for irrigation should be enlarged. He recommended (1) further

surveys, (2) that the Agricultural Department be asked to report on the value of the lands to be irrigated and the value and nature of crops to be grown, and (3) that the Transvaal and Orange River Colonies be asked to supply all information regarding likely development higher up the Vaal River so as to see how much water would be available for the lower scheme (Union of South Africa, 1934a:2).

Surveys were conducted, and a report was published. In this report Gordon concluded that, although the soil was of a light type that would require manure, it should be possible to find 100 000 suitable acres to be brought under irrigation. He also concluded that it would be better to link this scheme with the one at Christiana but that it would be better to start with the project from the Fourteen Streams side. Gordon furthermore made a rough design of the scheme, costing £1 150 000. In this regard, he pointed out the difficulty of the bigger schemes higher up the river and to the difficulty that the better half of the irrigable land lay in a native reserve. He therefore concluded that: "I do not know, nor do I think we are likely to discover, another tract in the Colony in which even 100 000 acres – not a large area in a country nearly 300 000 square miles – can be placed under irrigation in one fairly compact block at any reasonable outlay" (Union of South Africa, 1934a:2).

The scheme was reviewed in 1908 by Kanthack, who did not view with favour the encouragement of so large a scheme at that time. He thought that the limited resources of the Colony should rather be devoted to the encouragement of a large number of smaller schemes throughout the country, which, by 1934, had been done. The reason for this was as follows: the policy of subsidising irrigation was not an accepted one nor was the employment of poor whites on a large scale on irrigation works (Union of South Africa, 1934a:2). The opposite was the case in the early 1930s.

Similarly, in 1906, Gordon inspected the Orange River between Hopetown and Petrusville and between Prieska and Kakamas. The purpose of the inspection tour was to ascertain whether it would be possible to construct an irrigation project near Petrusville at Van der Kloof. At the same time, another inspection party was looking at the desirability of constructing an irrigation scheme at Buchberg (Cape of Good Hope, 1906:69).

With respect to the Van der Kloof scheme, contour plans were drawn up as well as the estimated cost of the project was £957 392. The project would irrigate the alluvial pockets on the left bank of the river between Petrusville and Hopetown (in other words, irrigating land downstream from Van der Kloof). The canal that would be required for this purpose would have been about 104 km long and would only irrigate about 7 700 ha. In other words, the estimate was £50 per acre (Cape of Good Hope, 1906:69).

Doubts were raised as to whether the scheme would have been productive. Gordon noted that: "The acreage cost of the canal would no doubt be reduced if it could be made to command a larger area by extending it to Prieska, as proposed by Sir William Willcocks in his report on 'Irrigation in South Africa'" (Cape of Good Hope, 1906:69). However, Gordon was "informed by more than one authority that in this area the extent of alluvial land is very limited, and that the upland is covered with the same thin coating of soil that I have myself seen in the neighbourhood of Petrusville, Hope Town and Prieska, and along the line of country between Prieska and Kakamas" (Cape of Good Hope, 1906:69).

Gordon concluded in his report thus: "This absence of a sufficient area of suitable land within reasonable distance, and at a sufficiently low level, will always prove a serious obstacle to any scheme, large or small, for the utilisation of the Orange River within the boundaries of the Colony" (Cape of Good Hope, 1906:69). He gave a number of other, related, reasons for his conclusion:

1. The alluvial lands are confined to pockets or narrow strips, which are very limited in extent, especially above the flood level of the river.
2. The average slope of the river between Petrusville and Prieska is only three feet per mile. This is also the same from Prieska to Kakamas. According to the slope of the river, the canal would only be able to deliver water after 32 km, or it must "take off" from above a high weir.
3. A rapid, such as the one at Buchuberg, was very rare along this tract of the Orange River. Such a rapid would have reduced the length of the canal and increased the height of the weir.
4. The quality of the land, although it was in large quantity, was not sufficient to pay for the cost of the irrigation project. The underlying rock would give rise to saline soil. Gordon noted that this was so regarding the whole length of the Orange River from Petrusville to its mouth (Cape of Good Hope, 1906:69-70).

He said that it was only in a limited number of places that an irrigation project such as the one proposed at Van der Kloof would be practical. These were Kakamas, Buchuberg, and the larger islands below Upington (Kanon Island). Gordon also noted that the land between Prieska and Kenhardt and Upington to Pella, where Willcocks proposed to lay canals, was not suitable of irrigation either. He drew the same conclusion regarding the land in Griqualand West. The same was said about the construction of large irrigation works in the "country" below Kakamas and on towards Pella (Cape of Good Hope, 1906:70).

Notwithstanding these conclusions about irrigation works along the middle reaches of the Orange River, Gordon was convinced that a canal (320 km in length, costing £3-4 million) could be constructed, in future, from the Orange River to the Brak River in the Britstown District. This could also be done by linking the Vaal River to the Hartz River by a canal. This could only be accomplished after the population of the country had increased to sufficient levels. In this regard, Gordon noted thus, "But with the population, resources and requirements of the Colony as they are at present, or as they are likely to be for another generation, it would be useless to contemplate a scheme of this magnitude or to spend money on making surveys in connection with it" (Cape of Good Hope, 1906:70-71).

Therefore, the Orange River was not viewed favourably as a source of irrigation water in the early twentieth century, except for a few places such as Kakamas and Buchuberg. The Vaal River, on the other hand, was seen in better terms. Gordon's report is an indication that, without suitable land, irrigation would be a failure.

5.3.35. The Buchuberg Irrigation Scheme Finally Abandoned

In fact, in 1906 Gordon proposed that the Buchuberg irrigation project be brought back on line. However, this time it would be a scaled-down version of the original project that was laid before the Cape Parliament in 1906. Gordon proposed the construction of a smaller canal

to irrigate 1 400 acres at a cost of about £20 per acre. The canal would be about 27 km long, instead of 58 km as originally planned. A weir would not be needed because the inlet of the canal would be above the rapids. The entire project would cost £34 000 (Cape of Good Hope, 1906).

Work on the Buchuberg irrigation project started in September 1906. Labour on the project was provided by "boys" (black men), and a number of them had to be turned away on a daily basis, a report said (Cape of Good Hope, 1907a). However, on 10 September 1907 it was indicated in parliament that work on the project had been abandoned. Dr Smartt, Commissioner of Irrigation, said that £7 500 had already been spent on the works. He also stated that: "As soon as the financial position of the country improved, it was the intention of Government to resume operations". A financial depression in South Africa had therefore led to the temporary abandonment of the project (Cape of Good Hope, 1907a:537; Union of South Africa, 1917a:33).

By 1908, the financial position of the country had still not improved. Small irrigation Bills were advanced by the Commissioner of Irrigation, Merriman, instead of Bills for large irrigation works. However, the hope was expressed by the Commissioner that the financial situation of South Africa would improve to such an extent that government could start with the implementation of larger irrigation projects, Buchuberg included. The "irrigation staff" in the Public Works department had also been reduced (Cape of Good Hope, 1908:749).

A few years after the temporary abandonment of the Buchuberg scheme, the project was abandoned altogether. At the time of total abandonment, the scheme was situated about 130 km from a railway line and the construction costs were extremely high. The reasons for the extremely high cost of the scheme are as follows:

1. The cost for irrigating a *morgen* of land, for the works alone, stood at £44. To this, £15 to £30 for the levelling of land should be added;
2. The cost increased because of the waste of money due to the closing of works in 1907 and restarting them;
3. The cost of the entire scheme was grossly underestimated in 1906 (Union of South Africa, 1917a:33).

The Union government therefore felt that the Buchuberg irrigation scheme was premature. After its total abandonment some time after 1907, it was decided to undertake surveys and investigations of the Buchuberg irrigation works in 1917. It was proposed that the project should irrigate more land, especially land owned by the government. It was also planned to raise the height of the weir and to make the canal longer than originally planned. It was also stated in reports of various irrigation projects that the scheme at Buchuberg was the most difficult one on the Orange River. It was therefore concluded that more detailed surveys be done before a feasible and economically viable project could be prepared (Union of South Africa, 1917a:33).

In light of the difficulty of the Buchuberg scheme, it was stated in reports in 1917 that government should rather concentrate on the implementation of irrigation projects between Upington and the Kakamas labour colony. The reasons for this were that the river was much wider than at Buchuberg and that it formed numerous islands that could be irrigated (Union of South Africa, 1917a:33).

5.4. The First Irrigation Congress

On 18 May 1909, the first Irrigation Congress in South Africa was held in Robertson in the Cape Colony. The intention of such a congress was stated on 6 November 1908 by Teubes, Secretary of the Breede River Irrigation Board in Robertson. He asked the government whether it would consider organising such a congress, to establish a permanent union of irrigators in South Africa. Teubes also asked that the government do everything in its power to support and promote the establishment of irrigation (Cape of Good Hope, 1909:1).

Representatives at the congress included government officials and agricultural unions in the Cape Colony, the Orange River Colony (formerly known as the OFS), Transvaal (formerly known as the ZAR), and Rhodesia (now Zimbabwe). Other non-governmental professional persons were invited to deliver papers at the congress. Eight governmental representatives from the Cape Colony, 26 from agricultural unions, 19 from irrigation boards and 30 interested parties (including professionals in the field of irrigation) attended the congress. Together with these, seven representatives from the Transvaal, seven from the Orange River Colony (ORC), one representative from the Natal agricultural union and one from the Rhodesian agricultural union also attended. The chair of the congress was the Prime Minister, Malan (Cape of Good Hope, 1909:1-2).

At the end of the congress, the Prime Minister (PM) stated that the establishment and promotion of irrigation in South Africa were strong arguments for the establishment of the Union of South Africa (Cape of Good Hope, 1909:104). This was also reiterated in his opening speech, when he noted that one of the most knowledgeable irrigators in the Cape Colony, Dr Smartt, was involved in the establishment of the Union. The PM also stated that irrigation would be a necessary factor in the future of South Africa (Cape of Good Hope, 1909:13-14).

The reason for irrigation being a necessary factor was that the country had fertile soil, but not enough water. A large volume of water flowed into the sea, taking with it some of the fertile soil. Consequently, the purpose of the congress was to discuss and to come up with methods to conserve water and to use these for the development of the country. The PM also referred to the agricultural potential of South Africa. It had the most fertile soil, and the products from the agricultural sector could compete with those from other countries on an equal footing. One of the most crippling factors in South Africa's agricultural sector was drought. To find ways to fight the scourge of drought, through irrigation, was also a purpose of the congress. Another dangerous factor in the development of South Africa, according to Malan, was the fact that the Europeans in South Africa had to compete with a very powerful indigenous people (the Bantus) (Cape of Good Hope, 1909:14).

One of the most bizarre twists in the PM's speech at the congress was that he stated that the mineral wealth of South Africa was not only a blessing but a curse. He noted that this mineral wealth had led to the building of railways and the opening of markets. However, it also led to a culture of gambling in gold shares. This inhibited the cultivation of the rich soil of South Africa, and led people astray in their pursuit to use the "gifts of nature" in a much more productive manner. He was also of the opinion that the mineral wealth of South Africa had a negative effect on agricultural development. He argued that once £1 000 were taken out of a mine, the same amount could never be put back into the land. Yet if £1 000 were taken out of the land through agriculture, the land would then be better off than before. In this regard he

stated that, "The time would come when there would no more mines, but agriculture would be a permanent fixture of the South African economy" (translated from Dutch) (Cape of Good Hope, 1909:14, 15).

The PM also maintained that for the past 16 years, similar congresses were held in the USA. People from all around the world attended these congresses, to exchange ideas on how to promote irrigation in that country (Cape of Good Hope, 1909:14). South Africa, therefore, lagged behind the rest of the world as regards the promotion and establishment of irrigation. In the USA, water was so plentiful that farmers had to drain their land. In South Africa, the reverse was the case. Farmers had to bring water to their farms, and not lead it away. This leading away of water was seen by the PM as a misuse of a valuable natural resource (Cape of Good Hope, 1909:14).

The PM also raised the issue of pumping groundwater. He used the example of farmers in Texas, where they pumped water from groundwater reserves to irrigate rice. He also noted that Texas had a similar climate to that of South Africa. Most important, for the PM, was not what could be done by pumping groundwater, but what it prevented. It prevented disputes between farmers, in that they did not share a common surface water resource, which gave rise to such disputes (Cape of Good Hope, 1909:14).

The export of foodstuffs from South Africa to the rest of world was also touched upon by the PM. He noted that farmers should not only produce lucerne, but also other foodstuffs such as raisins, nuts, and beans. South Africa had the potential to export one million bags of oats and two million bags of maize, while fruit also had large export potential.

The speech of the Commissioner of Public Works from the ORC, C.H. Wessels, was also interesting regarding the trade in agricultural produce between the ORC and the Cape Colony. Wessels stated that the production of butter in the ORC had reached such a high level that imports of this product from Belgium had ceased. He expressed the wish that trade could be established between the ORC and the Cape Colony, where the ORC would provide butter to the Cape Colony in exchange for wine, on condition that the wine should be the same quality as the butter. The rationale behind this move was to promote self-reliance in such products, trade between the two colonies and fewer imports from other parts of the world. The export of agricultural commodities should also be promoted. Wessels furthermore expressed the opinion that some parts of the Cape Colony were over-populated, which was not the case in many regions of the ORC. He said that people from the Cape Colony were welcome to populate some of these under-populated regions in the ORC for the purpose of stimulating agriculture (Cape of Good Hope, 1909:15).

Dr Smartt stated at the congress that the development of irrigation in the Cape Colony was not always met with financial success. He noted that experiments in irrigation should be conducted that would only contribute to the national interest of South Africa. For this reason he had personally expanded the engineering staff of the Department of Public Works to promote and establish irrigation in the Cape Colony. In sum, he claimed that every drop in South Africa's rivers should be used for irrigation purposes (Cape of Good Hope, 1909:15).

The secretary of agriculture, F.S. Malan, said, in this regard, that agriculture and irrigation can be seen as mother and daughter. He raised the hope that a sum in each of the four colonies of South Africa (Cape Colony, ORC, Transvaal, and Natal) would be placed on their respective

budgets for the publication of irrigation congress reports. , regarding agriculture in South Africa, he also observed that, two issues should always be taken into consideration: (1) the history of the nation and (2) the natural circumstances of the country (Cape of Good Hope, 1909:15-16).

With respect to the history of the nation, three aspects of importance:

1. The *Voortrekkers* that trekked over the land;
2. They demarcated the land and started to farm on it; and
3. They lived on the land and worked "in" the land.

The country's farmers could be classified into these three classes of farmers. In parts of Bechuanaland (later Botswana), the first class of farmer can be found. On the Highveld, the second class of farmer and along the coast of South Africa the third class of farmer (those who can be considered mixed farmers) can be found (Cape of Good Hope, 1909:16).

Regarding natural circumstances, Malan was of the opinion that South Africa can also be demarcated into three regions:

1. A winter-rainfall area;
2. The Eastern Province, large parts of the ORC and Transvaal, where it rained in summer; and
3. The Karoo, where rainfall was uncertain and erratic (Cape of Good Hope, 1909:16).

He stated that agriculture would only be possible in the winter-rainfall region. In the summer-rainfall region mixed-agriculture, that is stock farming and crop production, should be practised. Maize was the main crop in the summer-rainfall region. The Karoo, on the other hand, had very fertile soil with the full production thereof to be exploited if irrigation were established. Malan expressed the view that during the congress these factors would be taken into consideration in connection with the promotion of irrigation (Cape of Good Hope, 1909:16).

A summary of some of the papers delivered at the congress would shed some light on a number of aspects regarding irrigation development in South Africa, for instance the low level of irrigation development and the reasons for it.

Kanthack, whose ambition it was to promote irrigation, was involved in the establishment of irrigation in India, before his appointment of Director of Irrigation in the Cape Colony in 1906 (Kanthack, 1909:26). He was of the opinion that South Africa was a land only suitable for stock farming. However, he was also of the opinion that two reasons were responsible for the low level of land development in South Africa. These were as follows:

1. The large tracts of land and the small population to work the land; and
2. The discovery of minerals.

The first reason should also be seen together with other demographic factors, other than the small population size. Kanthack stated that there was a degradation of the land and its people. The degradation of the people was due to the increasing number of poor whites, because of the "easy way of living" on farms and "the curse of a black workforce". By the "easy way of

living" on farms, Kanthack meant that nature provided the farmers with everything, and they therefore felt that there was no need to farm more intensively. This changed when nature could not provide for the needs of the farmers anymore (drought), and they moved to greener pastures. New ideas from the farms were not forthcoming, for they could not explain the degradation of the wealthy living standard of their forebears two generations earlier. A spirit of laziness therefore developed. The "apostle" of agriculture has to contend with this laziness and lack of ambition on the part of the farmers. These factors led to a very simple (poor) lifestyle (Kanthack, 1909:26, 27).

Irrigation engineers and their work were seen as the enemy by many farmers. This was because there was no sense of workmanship among the farmers, according to Kanthack (1909:27). Many farmers also saw it as a sin to change the course of God's rivers. However, Kanthack stated that any person who saw irrigation as a sin, should read Genesis 2:10. Herein it is stated that: "A river rose in Eden to water the garden, and from there it divided and became four rivers". Thus, God's intention was to irrigate the Garden of Eden. How could this lack of ambition and laziness be dealt with? Educating the farmers and the *trekboers* would "work wonders" in turning the situation around. However, this would take more than a generation to accomplish (Kanthack, 1909:27).

The second reason (discovery of minerals), Kanthack (1909:27) contended, was of a later origin than the first, but had a very negative effect on the population and the development of agriculture. This was the speculation or gambling spirit the PM referred to earlier that was created by the gold mines and other "booms", having a negative effect on the character of the average South African (Kanthack, 1909:27).

Many landowners lived with the expectation that riches would fall into their laps. This also led to laziness because many farmers did not want to work one day to make a living. Transport to the gold and diamond fields also had a demoralising impact on the average South African. Thousands of farmers took to transport riding instead of working their land. Some farmers also saw the potential of irrigation in the same light as the presence of mineral wealth on his land. Consequently, irrigation speculation occurred while the farmer should make use of it himself, according to Kanthack (1909:27). Thus, it seems as if many farmers speculated with irrigation rights.

Regarding the present (1909) development of the Cape Colony, Kanthack said that the Colony was still in its "kindergarten" period regarding irrigation development. Because of this a lot of work was needed to ameliorate the degradation caused by the previous generation and before genuine development could take place. Agricultural development would really start to make progress when farmers started to learn what work is; how to rehabilitate their degraded farms; to learn how to make use of their chances and natural resources; and to learn the secret of healthy and honest cooperation (Kanthack, 1909:28).

In order to achieve agricultural development, the following criteria, as proposed by Kanthack should be followed:

1. A powerful education drive to promote the general moral and intellectual prosperity of the nation, to show people the necessity of agricultural development and the methods for this development (the Colony's excellent education system would come in handy in this regard);

2. A systematic investigation into the possibility of large- and small-scale irrigation works (the Irrigation Act of 1906 and regulations approved by Parliament in 1908 would be the machinery with respect to this criterion); and
3. The establishment of an industry, which would necessitate and stimulate irrigation (the ostrich industry would be the main driver for this, because it was so dependent on lucerne) (Kanthack, 1909:28).

According to Kanthack, (1909:28) irrigation was mainly limited to the Breede River Valley in the southwest, and the Great Fish and Sundays Rivers of the Cape Colony. To promote irrigation across the entire Colony the following aspects should be taken into consideration:

1. The quantity of rainfall in the Colony for the impoundment to promote irrigation;
2. The MAR of rivers that can be used for irrigation purposes; and
3. The area suitable for irrigation.

In light of this, how should irrigation be promoted and developed, according to Kanthack? Government should firstly know what is possible, and this does not mean the implementation of large irrigation schemes. Investigations should first be made regarding the MAR of the Colony's rivers, how it can be increased, where and how it can be impounded, where all the land for irrigation is situated, to find the best means for implementing irrigation works, and how much it would cost to irrigate the land. Such an investigation would highlight where and to what extent large irrigation works would be implemented. In this regard, Kanthack referred to the Reclamation Act of the USA. This act stipulated that the sale of public land should fund a Reclamation Fund, to be used for such investigations, surveying, building and maintenance of irrigation works, for the impoundment, irrigation and development of semi-arid and arid regions in the USA. Something similar should also be established in South Africa, because not much Crown land was still available, and most land was in private hands. Because of this, Kanthack reiterated the need for such a fund before it was too late (Kanthack, 1909:28-31).

In this respect, government and government departments had an important role to play. The Departments of Agriculture and Irrigation should teach farmers the appropriate methods of farming and how and where irrigation works should be used. The government's Hydrographic Department should investigate where dams should be built, where to irrigate land, give farmers professional advice and help them to get access to loans, to undertake irrigation and agricultural experiments, to show better farming methods and general education of farmers (Kanthack, 1909:31).

This is not where the role of government should stop. Government should also build large and difficult irrigation schemes and dams, to get a larger population density. Government should also maintain and administrate these schemes. The rationale behind this was that the increase of national wealth would be greater than the costs involved. Yet the farmer should feel that he is a partner in such a scheme, but all responsibility should lie with government to build, maintain, and administer such schemes (Kanthack, 1909:31).

The rationale for implementing such large schemes should be considered in relation to the following financial considerations:

1. The capital cost to irrigate land and how much it would cost to prepare the land for an irrigation project;
2. The capital value of the land before it was irrigated;
3. Labour costs, which should be as low as possible through proper management; and
4. Markets for the produce should also be made available. Transportation of foodstuffs would play an important role in this regard (Kanthack, 1909:32-33).

After the Kanthack paper was delivered, it was stated that the number of engineers in the Department of Irrigation should be enlarged, in order to help farmers with the implementation of smaller irrigation works. The high price of cement was also said to be an inhibiting factor for farmers in building irrigation works on the land. One of the representatives from the ORC also stated that his government was considering the establishment of an irrigation colony for poor whites. Irrigation would help to place poor whites on land that was lying unused. There was also the issue of a dispute between the Transvaal and Warrenton. A plot of land (50 morgen in size) was settled by a large population. However, according to an Adams from Warrenton, Transvaal used too much water from the Vaal River, and, on top of this, the river had not much water in it for the past three years (thus there was a drought during the period 1906-1909). A weir was built by the Transvaal using sandbags, and the owners of the plot of land disputed this. The issue was then laid before the Supreme Court (Cape of Good Hope, 1909:35).

Notwithstanding this dispute, until 1909 no attempt was made to establish irrigation works in the Transvaal. Three dams, of significant capacity had been built in the Transvaal by 1909. Only two of these had been constructed in Transvaal's portion of the Orange River basin, under government supervision. One dam was built on the farm Leeuwdoorn ('lion thorn'), near the town of Wolmaranstad. The capacity of it was seven million cubic feet and from it 30 morgen of land was irrigated. The other dam was constructed in 1896-97 on the Makwasispruit, also near Wolmaranstad. However, because of a misunderstanding between the municipality and farmers regarding the cost of water, the irrigation project was never used. A third dam was supposed to be built on the Hartz River in 1899 near the town of Schweizer-Reneke, but the outbreak of the Anglo-Boer War put an end to this plan (Hurley, 1909:92, 98).

What were the reasons for this low level of irrigation development in the Transvaal? Firstly, the population density was too low, and did not justify the construction of large irrigation schemes. Secondly, there was no law to make the construction of cooperative schemes possible. The law regarding the use of rivers and streams was based on common Roman-Dutch law. In many situations where farmers had "robbed" their downstream neighbours of water, the only thing the downstream farmer could do was to come up with better ways to restore his volume of water or to insult his upstream neighbour. It was only in 1902 that an attempt was made to officially promote and establish irrigation in Transvaal. This was after Strange came to South Africa from India, in 1903, to establish an irrigation department. However, practical work by this department was inhibited by a number of factors:

1. No reliable data on rainfall and the volume of water in rivers and streams. Without such information no plans for irrigation could even be contemplated;
2. The absence of a law regarding the use and regulation of surface water resources; and
3. In 1901, Sir William Wilcocks published a report on irrigation in South Africa. In his report, he stated that the state should start getting more involved in the establishment of

irrigation works. He also said that the state should become more involved in the rights of water users. Every attempt by the Transvaal government to start irrigation works was seen by farmers as a way of implementing the recommendation of the report, and was met with strong resistance by them (Hurley, 1909:93).

Therefore, according to Hurley (1909:93), the only way to start with the development of irrigation in the Transvaal was to do the following:

1. To start with the collection of rainfall and MAR data;
2. To construct irrigation works and to take other steps for the development of irrigation in Transvaal, without violating private water rights;
3. To implement one law regarding the control of water and the construction of irrigation works that would be of value to the public at large.

Yet this does not mean that no land was irrigated from surface and groundwater resources in the Transvaal Colony before 1910 (see Table 5.3).

Table 5.3. Rough Estimates of Irrigated Areas in the Orange River Basin in 1907 in the Transvaal Colony

Name of District and River Basin	Areas of Irrigation in Hectares from:				Total
	Fountains	Wells and Boreholes	Rivers and Streams	Small Reservoirs	
Heidelberg (Vaal)	650	138	323	916	2 028
Krugersdorp (Vaal Limpopo)	569	16	64	116	766
Potchefstroom including Klerksdorp (Vaal)	436	27	5 444	318	6 224
Standerton (Vaal)	11	-	6	106	76
Witwatersrand (Vaal Limpopo)	149	64	349	285	847
Wolmaranstad (Vaal)	35	72	354	312	772
Grand Total					10 713

Source: Hurley (1909:92)

The largest tract of land was irrigated in the region of Potchefstroom and Klerksdorp. The reason for this was that an irrigation project had been constructed before 1909, to water land utilising the water resources of the Mooi River (Hurley, 1909:97).

In the Transvaal Colony any government irrigation projects that were under construction were temporarily halted in 1908. The reason for this was that an irrigation law had to be passed before construction could begin. This law allowed for better investigation of MAR of many rivers and streams regarding the possibility of irrigation works on these surface water bodies. Many schemes were proposed, but a hydrological investigation showed that the MAR of a large number of the rivers and stream was too small to justify these schemes. Hence, many schemes were changed and scaled down. After the hydrological investigation, the government of the Transvaal Colony could start with a new programme for the

implementation of irrigation works. There were still a number of obstacles towards the establishment of a proper irrigation development strategy:

1. The soil was not fertile;
2. Labour was expensive;
3. Markets for irrigated produce were too small;
4. The export of foodstuffs was hampered by the sheer distance of harbours from arable land (Hurley, 1909:97).

Immediately after the passing of the Transvaal Irrigation Bill, in 1908, construction work started on a dam on the Mooi River near Potchefstroom. The purpose of the reservoir, like any other, was to "conserve" water for irrigation. The cost of the project was £20 000 and was completed in July 1909 (Hurley, 1909:98). Despite the passing of the 1908 Transvaal Irrigation Act, irrigation in the Colony did not greatly improve. The position was similar in the OFS, which contained, especially in its southern regions, considerable irrigation possibilities. This was due to the total absence of a water law, which hindered irrigation development in the Colony (Union of South Africa, 1917b:377). Until now the report has described the history of irrigation in the Orange River basin. What is also need is to allude to the history of domestic water use.

5.5. A Tale of Two Cities

In this section of the report the history of the water supply of two cities is described. They are Johannesburg and Kimberley. These two urban centres were chosen because of the similarity in their origin. Kimberley and Johannesburg came to being after the discovery of diamonds in 1867 and gold in 1886, respectively. To give a temporal perspective of the two cities' hydropolitical history, it is useful to refer briefly to the origin of London's hydropolitical history. The city of London received its first piped water supply in 1615. Sir Hugh Myddleton surveyed and constructed a canal to bring water from springs about 30 kilometres north of the city. A company was established and was called the New River Company (Rutherford, 1997:516). The fact that London already had piped water in 1615 is an indication of the slow development of water resources management in South Africa, which was colonised as far back as 1652.

5.5.1. Kimberley

Kimberley gets its water supply from the Vaal River. In 1872 a few plots of land were bought to establish a pleasure resort at Riverton, on the banks of the river. Soon afterwards waterworks were established at Riverton for supplying water to Kimberley. To be sure, in the early days of the diamond diggings, the supply of water for domestic purposes posed a serious health risk. Water from wells and dams was often contaminated and caused illness among the population. For instance, in September 1871, Dr Guybon Atherstone, who visited the diamond fields, wrote in a private letter the following: "Just fancy the organic debris of 20 000 persons with their belongings – canine, equine, asinine and bovine – deposited on the edge of a pan without outlet, and, by the blessing of Heaven (i.e. rain) filtering through the porous soil and rotten rock down to the level of the underground reservoir of the pan or basin, whence the diluted soluble matter is drawn up again from eighteen wells to re-enter the

systems of the said innocent 20 000 individuals, too much obsessed with the pursuit of wealth to see or taste what they are pouring down their throats. Verily, verily, I say unto you, a pestilence will arise that will spread its deadly influence far and wide . . ." Furthermore, water brought in by ox-wagon from Alexanderfontein was expensive (Olivier, 1997:122).

Atherstone's estimate of Kimberley's population could have been a bit exaggerated. In 1877, six years after the dry diggings had started, Kimberley was the second largest town in South Africa, with a population of 18 000 people (Roberts, 1976).

In 1880, the municipality entered into agreement with Thomas Lynch's newly founded Griqualand West Railway and Water Company Limited to supply water to Kimberley. The contract period was 25 years. Lynch's original idea was the construction of a railway line between the town and the Vaal River, the purpose of which was to bring blue ground (diamond-bearing ore) to the town for further processing. This idea was abandoned after he realised that it would be more practical to bring water to the mines, and, at the same time, supply water to the township. The rights ceded to the Griqualand West Railway and Water Company were transferred to the Kimberley Waterworks Company Limited in 1881 (Olivier, 1997:122).

A contract for the construction of a pipeline was awarded to a London company, and on 19 May 1881 (almost ten years after Atherstone's forecast of a pestilence), work on the pipeline started. The Kimberley Waterworks Company wanted the work to be completed within fifteen months. A pumping station was constructed on the Vaal River at Riverton, from where water was to be pumped to the Newton Works in Kimberley. The pumping equipment was steam-driven and had the capacity to deliver 27 000 litres per day. The first trial pump took place on 25 October 1882, and water was successfully pumped to Kimberley on 21 December 1882. The mining companies received their water first, on 3 January 1883, followed by the town on 3 March that same year (Olivier, 1997: 122).

Also of significance as regards Kimberley's water supply was that the Boer forces during the Anglo-Boer War tried to cut the water off at Riverton and to shell the Newton water tower. This was after they had realised the strategic importance and vulnerability of the water supply to Kimberley. They did not succeed, though (Olivier, 1997:122).

In October 1921, the Kimberley municipality took over the assets and operations of the Kimberley Waterworks Company for an amount of £228 000. The responsibility of supplying freshwater to Kimberley therefore fell on the municipality. This is an indication that the Kimberley Waterworks Company had successfully supplied the town with water for just over 40 years. This was not the case with private water companies supplying water to Johannesburg. In the 1940s, the water plant was modernised and all pumps were converted from steam to electricity. Kimberley is still receiving its water from Riverton (Olivier, 1997:122).

5.5.2. Johannesburg

In any case, with the discovery of gold in 1886 on the Witwatersrand, people flocked to the region in their thousands, at what was later to become Johannesburg (Tyack, 1970:206). As early as 1886, the importance of a constant and healthy water supply was realised by the

diggers committee. This importance was linked to the health risks an unhealthy water supply posed to the diggers. In November 1886, W.P. Fraser, a member of the diggers committee, said at one of its meetings that: "Because of the importance of a pure drinking water supply and of sanitary conditions, and because the people living in Ferreira's camp are using water they obtain from outside the proclaimed gold field, it is the opinion of this committee that *this* water should be bought by government for the above mentioned purposes, and asked the mine commissioner to inform the President of this decision" (emphasis added) (Shorten, 1970:95).

The water Fraser was referring to was a stream that originated in the present Braamfontein area. During rainstorms, the town's garbage was washed away by this stream, and caused subsequent pollution. During droughts, the situation became precarious for the population of early Johannesburg. The stream became a mere trickle or dried up completely. This happened in 1886. In 1887, good rains fell, but most of the water flowed away, unused. The people therefore had to rely on wells, which were dug on every conceivable spot (Shorten, 1970:95).

Not even the water abstracted from these wells was drinkable, and had to be cooked to purify it. For instance, in 1893 Capt. Bleksley, head of the health inspectorate, said in a report to the Health Committee that: "From numerous investigations I conducted, it seems as if the wells are heavily polluted with organic and inorganic pollutants making the water completely undrinkable as well as unfit for household purposes. I can only warn the people about this, but they do not want to stop using the water . . . It is a pity that the wells cannot be filled up. There should be no wells in the highly populated town". The water supply of these wells was also erratic. In 1887, Von Brandis wrote a telegram to the state secretary of the ZAR government informing him that: "What about waterworks for Johannesburg? The wells are dry" (Shorten, 1970:95, 169).

A few months before the request for waterworks, the Sanitary Committee of Johannesburg asked Von Brandis to obtain information from the owner of the Braamfontein stream regarding the conditions that he would be willing to relegate his rights to the water supply. Nothing came of this request either. The government continued with its policy of giving the responsibility of public services to concession holders, which were a constant source of trouble (Shorten, 1970:95-96).

In 1887, Sir James Sivewright received a concession to lay pipes in the streets of Johannesburg, to supply the town with water. In September 1888, Mrs Von Brandis laid a foundation stone for a dam at Doornfontein, with a capacity to hold 225 million litres of water. In the 1970s, the dam was still in use. A water company, the Johannesburg Waterworks, Estate and Exploration Company (JWEEC), was eventually established in 1888, under the auspices of Sivewright. Piped water was laid from its dam in Doornfontein to the town (Shorten, 1970:96, 166-167; Palestrant, 1986:44).

Of additional significance regarding Johannesburg's water supply was that in 1888 engineers had already started to investigate other water resources in a radius of about 65 km around Johannesburg. They investigated Olifantsvlei, Vierfontein, Klip River, Wonderfontein, Klipspruit, Weltevreden and Steenkopjes. This investigation came two years after the discovery of gold, and indicated the rapid population increase of the town. In 1889, Vierfontein and Klip River were seen as the most viable sources of water. Calculations regarding dams, pump stations, filtration capacity and coal requirements were completed.

The water scheme and health committees also discussed two schemes in May 1890. However, the pressing need for water had the result that nothing happened concerning the implementation of these, and other, schemes (Shorten, 1970:167). The schemes that were not implemented are as follows:

- The Braamfontein scheme (1892 and 1893);
- The scheme of the Vierfontein syndicate, to supply water from the Klip River at a cost of 4s per 4 500 litres (early 1890s);
- The Klipspruit scheme, 20 km outside Johannesburg, to supply about 7 million litres of water per day, at an estimated cost of £80 000;
- The possibility of supplying about 10 million litres of water from Kromdraai, 40 km from Johannesburg, at an estimated cost of £238 000;
- The Weltevreden scheme, about 14 km outside town, with a capacity to deliver around 9 million litres of water per day;
- The Wonderfontein scheme, at a cost of £461 730, 75 km outside Johannesburg, which would have supplied 117 million litres of water per day. The people of Potchefstroom complained about the scheme because the Mooi River, Schoonspruit and Klip River's source originated in the area where the scheme would have been implemented (Shorten, 1970:168).

Later, the JWEEC obtained water from Weltevreden and Steenkopjes and started to supplement the water supply of Doornfontein. However, the ZAR's state secretary told the Company that it was not allowed to pump water from these sources because it did not have the right. These streams were in public hands and the rights of the riparian owners had to be protected (Shorten, 1970:168).

The Braamfontein Estate Company also supplied water from a well 75 feet deep, dug in the Hospital Hill Shales in Auckland Park. The JWEEC was not financially viable and was later taken over by Barney Barnato's Johannesburg Consolidated Investment Company (JCI). The tariffs of the JWEEC were extremely high. For instance, 450 litres water were sold for 1s 6d and 4 500 litres for 10s. Not even this high tariff could make the company financially successful. The first balance sheet of the company indicated that it was in debt to the amount of £18 645, with only £10 in its bank account. Furthermore, when there was a fault with one of the pumps, the town simply had to go without water. In January 1890 the Waterworks Company was forced to cut back on its water supply, and the ore crushers of some of the mines only worked once in while (Shorten, 1970:96, 166-167; Palestrant, 1986:44).

The reason for Barney Barnato's take-over of the JWEEC was that he realised that if the company went bankrupt, Johannesburg would be without water. Plans were put in place for the acquisition of much-needed pumps and pipes, and for the construction of more reservoirs (Shorten, 1970:167).

The incorporation of the Waterworks Company into the JCI in October 1895 had brought an improvement in the delivery of water to the town, but not enough to satisfy its requirements. The water shortage of 1895-96 was an incentive to the Johannesburg's Sanitary Board (later to become the town council in 1897) to obtain control over the town's water supply. On 1 December 1897, the Johannesburg town council decided to negotiate with the JCI, with the view to taking over the water supply itself. Initially the Company was not interested. Yet

when the council said that it would open its own waterworks the JCI agreed to meet the council and discuss the proposal. However, the murder of Woolf Joel, the JCI chair, caused the negotiations to be cancelled (Appelgryn, 1985:124).

One of the hindrances in the taking over of Johannesburg's waterworks was the town council's perilous financial position. On 17 June 1898 the council's bank account was already overdrawn by £99 542. The debt increased to £104 891 in June 1899. Temporary relief came from a ZAR government loan of £50 000. An annual subsidy was also approved by the First Volksraad (Appelgryn, 1985:124). This is an indication of the importance of second-order resources, which are needed to supply water to the population of a town.

After the Anglo-Boer War (1899-1902), the municipality of Johannesburg took over the estate of the JWEEC (Shorten, 1970:168). In 1901, the Transvaal government appointed the Witwatersrand Water Supply Commission to inquire into the available sources of water supply. The objectives of this were to formulate a scheme for the adequate supply of water to the local authorities and mines on the Witwatersrand, and to consider the organisation of a public body to carry out that scheme (Union of South Africa, 1929a:381).

Because of the investigations of the Commission, the Rand Water Board (RWB, later just Rand Water (RW)) was established, under Ordinance No. 32 of 1903 (Transvaal). The main objective of RWB was to supply bulk water to municipalities, and water in bulk and retail to the gold-producing mines situated within the RWB's "limits of supply". These "limits of supply" initially included the magisterial districts of Johannesburg, Boksburg, Germiston, Krugersdorp, Benoni and Springs. This was later expanded to include all magisterial districts on the Witwatersrand (Union of South Africa, 1930a:368; Bath, 1999; Turton & Meissner, 2002:41).

The RWB was later empowered (by Act No. 18 of 1914) to supply bulk water and in retail to the South African Railway Administration within the "limits of supply". Before this, and under the Ordinance of 1904 (Transvaal), the water undertakings of the JWEEC, the Vierfontein Syndicate, and the Braamfontein Company, were transferred to and vested in the RWB on 31 March 1905. The total supply of water available to the RWB, from the concerns mentioned above, was about 11.25 million litres per day. This volume of water was insufficient to supply the domestic requirements of the inhabitants of Johannesburg and Germiston, and of the mines on the Central Rand. Almost the entire supply was drawn from boreholes and shafts sunk on the farm Zuurbekom, situated about 30 km to the south of Johannesburg (Union of South Africa, 1930a:368).

From 1905 onwards the RWB developed a further underground water supply in the Klip River Valley. This was done by means of boreholes sunk on its farm Zwartkopjes and on some of the upstream farms, about 8 km from Zwartkopjes. The Board extended its distribution system east and west along the Witwatersrand. The supply from Zwartkopjes was brought into service in 1908. For a time this supply and the one from Zuurbekom was sufficient to meet demand. After 1910, the Zuurbekom supply was further developed. This supply was increased from 11 million litres per day to 33 million litres per day and the steam-driven pumps at Zuurbekom were replaced by electrically driven ones (Union of South Africa, 1930a:368).

In 1911, the demand for water from the RWB had increased to such an extent that the Board instructed its chief engineer to investigate and report to it regarding the matter of obtaining a large permanent water supply from a river. As result of the chief engineer's investigations, and based on his recommendations, the Board, in September 1913, adopted a scheme involving the construction of a barrage across the Vaal River. This barrage was to supply 90 million litres of water per day, and the installation of plant and mains to deliver a first instalment of 45 million litres per day to the Witwatersrand. Powers for the construction of the scheme were granted by the Union parliament in June 1914. However, the outbreak of the First World War rendered the commencement of the work impossible for a couple of years (Union of South Africa, 1930a:368).

It was in early 1916 that the RWB decided to proceed with work on the barrage. The barrage was completed in October 1922, and had a storage capacity of 61 348 million litres of water. However, not all this water was to be used by the RWB. Of the total amount, 7 020 million litres was impounded for use by the riparian owners of the Vaal River, living in the area of the reservoir. The Act No. 18 of 1914 stipulated this regulation. After allowing for evaporation and absorption, and the quantity lying in the riverbed below the level of the suction pipes at the River "intake" pumping station, a balance of 32 850 million litres, was available for the use of the RWB. This was equivalent to 90 million litres per day (Union of South Africa, 1930a:368-369).

The water was abstracted at Vereeniging, where the RWB had installed pumping and purification plants capable of dealing with 45 million litres per day. After the water was purified, it was pumped uphill against a head of 480 feet to the pumping station at Zwartkopjes and allowed to mix with the underground water collected at that station. Only then was it pumped into service (Union of South Africa, 1930a:369).

The majority of these urban centres are situated in the Witwatersrand area, where the gold-mining industry dominated the economy. In 1930 Brakpan, also in the Witwatersrand area, joined the list of urban centres receiving water from the Rand Water Board (Union of South Africa, 1930b:366).

In July 1931, RWB decided to proceed with the installation of "plant and mains", necessary to increase the volume of water abstracted from the Vaal River from 45 million litres per day to 67.5 million litres per day. At the end of 1932, this scheme was nearing completion. In March 1933, RWB was authorised by government to abstract 90 million litres per day. The works necessary for this expansion of abstraction were completed in 1934. During the same year, RWB had a capacity of 135 million litres per day available for distribution among its consumers. This included the 90 million litres per day it was authorised to abstract from the Vaal River, plus an additional 45 million litres per day it withdrew from boreholes and shafts in the Klip River Valley (Union of South Africa, 1933:347; Union of South Africa, 1934b:363).

The abstraction rate of water from the Vaal River was bound to increase during the next few years. The reason for this was the implementation of the Vaal River Development Scheme, consisting of the construction of the Vaalbank Dam and the Vaal-Hartz Irrigation Project. In pursuance of this scheme, and the agreement between government and RWB, the Board had been granted the right to abstract 270 million litres per day from the Vaal River. This volume of water was in addition to the 90 million litres per day authorised by the 1914 Act. Act No.

38 of 1934, regarding the Vaal River Development Scheme, stipulated that RWB shall pay government a sum of £240 000 towards the cost of the Vaalbank Dam (estimated cost £900 000), to be constructed by government (Union of South Africa, 1935a:382).

In addition, Act No. 4 of 1937 conferred on RWB the right to increase its abstraction rate of water, from the Vaal River, to 675 million litres per day. In June 1935, and December 1936, RWB authorised the carrying out of extension schemes designed to increase the supply to be drawn from the Vaal River from 90 to 171 million litres per day. These extension schemes were undertaken due to the increasing demand for water, owing to municipal, mining, and industrial expansion taking place on the Witwatersrand. This was especially the case after 1933 (when the drought and depression ended). What drove this growth was South Africa's departure from the gold standard in 1932. Estimates, in the late 1930s, of the future water requirements of consumers indicated that normal monthly consumption averaging 202.5 million litres per day would have to be met by 1938. By 1941, the consumption of 256.5 million litres per day, on average, would be experienced, according to the estimates (Union of South Africa, 1937a:715; Union of South Africa, 1940a:688; Union of South Africa, 1957:521).

After 1944, the RWB was given further rights to abstract an additional 292.5 million litres per day. The Board, therefore, had the right to take 967.5 million litres of water per day from the Vaal River, and 45 million litres from groundwater resources. Of this right RWB sold rights to 165 487.5 million litres per day of non-potable water to industrial undertakings in the Vereeniging area. This left a supply of 802 012.5 million litres per day from the Vaal River, plus the 45 million litres per day from its wells and boreholes in the Klip River Valley. By 1957, RWB's plant was capable of supplying about 675 million litres of potable water per day (Union of South Africa, 1957:521). Thus, the volume of water abstracted and supplied by the RWB increased as the urban population of the Witwatersrand needed more water.

The supply of water to Rand Water's customers grew over the years as more urban areas, industries and mines received water from its supply network. For instance, from 1996 to 1998 1.2 million consumers had been provided with water from the utility. Today Rand Water is South Africa's biggest water utility. "It serves 25% of the population [of South Africa] and forms a critical part of an intricate, complex and changing water supply and value chain that delivers affordable water and sanitation services" (Internet: [Financial Mail](#), 1998).

On 3 January 2003, Rand Water pumped a total volume of 3.3 mcm for the 24-hour period ending at midnight. Currently the water utility supplies Johannesburg, Pretoria, Boksburg, and Vereeniging. These are RW's major consumers. Other areas include the entire Witwatersrand, the Carltonville mines, Mabopani (north of Pretoria), Bethel, to the east, Rustenburg in the Northwest Province and the town of Heilbron in the northern Free State Province (Pearson, 2003). Thus, since its Proclamation on 3 January 1903, RW has not only increased the pumped volume of water to its customers, but the area that it covered by its operations has also increased significantly.

5.6. Water Resources Development after the Establishment of the Union of South Africa

Before the establishment of the Union of South Africa, irrigation development in the Cape Colony, Transvaal and OFS portions of the Orange River "was a trifling affair". Except in the

Oudtshoorn district of the Cape Colony, irrigation development was well under way. After Union, irrigation development in many parts of the Cape Province took off at an astounding rate, and even overtook pioneering irrigation works such as those at Oudtshoorn, Worcester, and Stellenbosch (all situated outside the Orange River basin) (Union of South Africa, 1919:481).

The promotion of the development of irrigation in the Union was made possible by the establishment of irrigation boards, especially in the Cape Province. On 31 March 1920, there were 80 of these boards already established. Of these, 66 were in the Cape, one in Natal, 10 in Transvaal and three in the OFS. Of the proposed irrigation works 41 were completed, 16 were being constructed and 23 were being investigated as of March 1920. The cost of the completed works was estimated at £747 530, those under construction at £1 250 000 and those under investigation at £1 333 000 (Union of South Africa, 1920:517).

The table below gives an indication of the irrigation works that were being implemented in the Orange River basin.

Table 5.4. List of waterworks being constructed or considered in the Orange River basin at the end of March 1920.

Name of Scheme, District and Province	Capacity (In million cubic feet)	Real or Estimated Cost of the Works
Klipdrift, Potchefstroom, Transvaal	443	£61 000
Klerksdorp, Klerksdorp, Transvaal	200	£20 000
Upper Modder River, Thaba 'Ncu and Boshoff, OFS	2 225	£305 000
Kopies, Vredefort, OFS	542	£60 000

Source: Union of South Africa (1920:517).

The number of irrigation districts established by the end of March 1920 will give an indication of the rate of irrigation development in the Orange River basin. This is summarised in the table below.

Table 5.5. Irrigation districts established by the end of March 1920 in the Orange River Basin.

Name and District	Source of Water	Cost of Works	Works Completed or Otherwise
Louisvale, Kenhardt	Orange River	-	Control of existing works
Lower Seacow River, Colesberg	Zeekoe River	£9,800	Completed
Windsorton, Barkly West	Vaal River	-	Prepared
Klerksdorp, Potchefstroom	Schoonspruit	£26,600	Completed
Modder River, Bloemfontein	Modder River	£59 000	Prepared
Hartebeestfontein, Potchefstroom	Fountain	-	Prepared
Upper Modder River, Thaba 'Ncu and Boshof	Modder River	£415 000	Prepared
Zoutpansdrift, Boshof	Vaal River	£850	Control of existing works.

Source: Union of South Africa (1920:518-519).

The table above shows that a total of eight irrigation districts had already been established, with four irrigation works completed and four either under investigation or being prepared. By 1930, the number of irrigation districts in the Orange River basin had risen to 16 (Union of South Africa, 1930b:360-361). This represents an increase in the irrigation districts of 100% during the period 1920 to 1930.

By 1920, the number of major waterworks to supply municipalities with water in the Orange River basin stood at nine. This included the Rand Water Board. Urban water-supply waterworks had already been implemented in Kimberley, Benoni, Boksburg, Germiston, Johannesburg, Krugersdorp, Roodepoort-Maraiburg, and Springs. Except for Kimberley, all other urban centres' water was supplied by the Rand Water Board (Union of South Africa, 1920:520).

5.7. National Schemes

By 1910, with the establishment of the Union of South Africa, nothing had been done about the Vaal River Development Scheme. However, the establishment of the Union swept away "unnatural divisions of the river system and made possible a comprehensive survey of the whole of the Vaal and Orange Rivers, but other rivers claimed first attention" (Union of South Africa, 1934a:2).

In 1920, the two big schemes on the Vaal River were referred to a Select Committee. The Committee recommended that "the Christiana (Koppieskraal) scheme should be further investigated". Consequently, in 1921 reconnaissance parties began work on the Vaal River. The investigations up to 1923 dealt with the Vaal-Renoster scheme, particularly regarding the national storage site near the junction of the Vaal and Wilge Rivers. The results of the surveys proved this to be a good site (Union of South Africa, 1934a:2).

In 1924-1925, the lower Vaal-Hartz area was investigated and preliminary investigations into the soils of that area were made. A large number of holes were drilled to test the depth of the soil. In the soil report by Dr Stead, some of the adverse features of the sandy loams, mentioned by Dr Nobbs in 1906, were regarded as less important. Stead recommended that only deep soils be selected and that the canals be lined and be designed for rapid irrigation. Subsequent investigations were made along these lines (Union of South Africa, 1934a:2).

In 1924, a survey of the proposed Vaal-Hartz irrigation project was undertaken by the Irrigation Department. The Director of Irrigation stated in his report for the period 1924-1925 that: "A great deal remains to be done in the way of soil surveys before an intelligent decision can be made regarding the selection of the areas most suitable for irrigation; as the total irrigable area lying under the command of the proposed lines of canals is much in excess of the area for which sufficient water to irrigate it can be obtained from the Vaal River, it is of the utmost importance that the most suitable areas should be selected". He also stated that the merits of the Vaal-Hartz irrigation scheme should also be weighed against those of the Parys scheme (also known as the Vaal-Renoster irrigation project) (Union of South Africa, 1926:7).

The proposed Parys scheme involved the construction of a reservoir at the confluence of the Vaal and Wilge Rivers, near the town of Frankfort in the eastern part of the OFS. It was also

proposed to construct a diversion weir on the farm Palmietfontein near Parys. This scheme would irrigate the entire Renoster River valley as well as a considerable portion of the Vaal River valley (Union of South Africa, 1926:7-8; Union of South Africa, 1931a:62). The Vaal-Hartz and the Parys irrigation projects were known in the late 1920s as "national schemes". A third "national scheme" was envisaged during this period.

This was the Van der Kloof Irrigation Project on the Orange and Brak Rivers. The Irrigation Commission visited the site of the project in May 1929. It was proposed that the scheme, together with the two others, should harness the water resources of the Orange and Vaal Rivers. The intention with the Van der Kloof project was to construct a "concrete storage reservoir" in the Orange River on the farm Van der Kloof near Petrusville. The rationale behind the reservoir was that the poort at Van der Kloof would make possible the storage of water in a very narrow and deep valley. From the reservoir a canal would be built along the north bank in the OFS, to the farm Rama, to irrigate small, isolated areas of "good alluvial soil". The principal object of the project was to irrigate land in the Brak River valley. The Brak River valley canal would cross the Cape Town-to-Johannesburg railway line and enter the Brak River valley on the farm Rooirand, about 65 km north of De Aar. Two problems were foreseen, however. Firstly, the canals would have been very long, increasing the cost of the project. Secondly, there was also the presence of brackish soil, which was not irrigable (Union of South Africa, 1931a:63).

Of the three "national schemes" the Irrigation Commission decided that the Vaal-Hartz Irrigation Project was the most promising. It recommended further investigation into the project by engineers and soil surveyors. Yet in 1930 the Commission also recommended that not one of the three "national schemes" should be constructed. The Commission stated that: "They are, having regard to present markets and availability of qualified irrigators, too gigantic" (Union of South Africa, 1931a:58). This was in line with the view of A.D. Lewis, a year before the Commission's recommendations.

5.8. Lewis's Caution

In 1929, the Director of Irrigation, A.D. Lewis, cautioned against the implementation of large water resources development schemes in the Orange River. By large schemes, he meant a project that was capable of irrigating about 40 000 ha of land. He stated that, because of the steep gradient of the Orange River and the magnitude of the floods, storage works for the purpose of irrigation would be "very expensive". He said that big schemes should rather be implemented in the tributaries of the Orange, instead of across the main stream of the river. The tributaries Lewis accentuated in his report were the Hartbeest, Brak, Molopo, and Vaal Rivers (Union of South Africa, 1930b:24-25).

Lewis discounted public demand for large schemes following a severe drought during the period 1927 to 1928. Demands were not only made by the public at large, but also in parliament, at congresses of farmers and irrigators, in the press and various other fora. The arguments put forward for large irrigation schemes were as follows:

1. There is a never-failing supply of perennial water in the Orange River;
2. There are vast tracts of fertile land within easy reach of the river; and

3. An irrigation department with vision and enterprise could easily irrigate these tracts of land with water from the Orange. This, so that no single drop of water need be lost to the ocean (Union of South Africa, 1930b:24).

Lewis also made mention of the possibility of transferring water from the Orange to the Sundays River in the Eastern Cape. He also referred to possible schemes involving water transfers from Basutoland (Lesotho) to the Karina River west of Matatiele; from the Caledon River to the Modder River; and a scheme at the mouth of the Orange River to supply Alexander Bay with water (Union of South Africa, 1930b:28).

He said, however, that these schemes "are not very promising", for they are not in accordance with the optimistic views held by Sir William Willcocks in 1901 and 1903. Lewis's arguments against such schemes were that there was not enough fertile land close to the river. If there were, an impossibly long canal would have to be built, making the venture too expensive. It was not as though Lewis was against the construction of large schemes, however. He wrote that: "Notwithstanding the disappointments of the past, the Department [of Irrigation], so far as lies in its power, will continue to search for a big scheme and to appreciate any suggestions from any source which might lead to a promising line of reconnaissance. The first essential is to find a large area of good deep soil reasonably near and low in relation to the river" (Union of South Africa, 1930b:29).

Because of the pessimism regarding large irrigation schemes, Lewis said in his report that: "... it remains to see whether we can find some medium-sized schemes for the alluvial lands along the river". By "medium-sized" Lewis meant schemes that would irrigate less than 40 000 ha – in the region of 4 000 to 6 000 ha. "Apart from the Van der Kloof-Hopetown Scheme ... and the Augrabies Falls Hydroelectric scheme ... only three continuous schemes of medium size have so far [by 1929] been discovered". In 1929 these possible projects were:

1. The Caledon-Bethulie scheme;
2. The Confluence-Prieska scheme; and
3. The Buchberg Gravity project (Union of South Africa, 1930b:29-30).

Regarding the last two projects, Lewis was of the opinion that two factors should not be overlooked when considering storage schemes in the lower Orange River: large floods and the siltation of such facilities. The only factor that would make a hydroelectric scheme at Augrabies viable was large deposits of minerals being found within a 320 km radius of the falls (Union of South Africa, 1930b:34).

Lewis summarised his position regarding large and medium-sized development projects on the Orange River as follows:

- No large irrigation scheme on the Orange River exceeding 40 000 is likely to be economically viable.
- The only encouraging scheme, during the late 1920s, appears to be the Orange-Brak project. This scheme might be further investigated, providing that the report on the soils in the Brak River valley is sufficiently encouraging.
- No other big schemes would ever be discovered which could be compared with the large project on the Vaal River, namely the Vaal-Renoster and the Vaal-Hartz schemes.

- If South Africa were to embark on any large project, it should select the very best, which would lie on the Vaal River and not the Orange. The scope for extensive irrigation from the Orange River appeared to be limited. Lewis's reason for this was that: "The maximum development from the Orange can at best touch a mere fringe of land". Later in the report he said that: "We have to face the fact that South Africa will never be a great irrigation country".
- The medium-sized projects would not be cheap, because they would require the construction of storage facilities. Regarding these projects, a soil report should first be obtained for the Van der Kloof-Hopetown schemes; more work (investigation) should be done on the Caledon-Bethulie project; the possibility of mining activities should be investigated for the Augrabies Falls hydroelectric project; and the Buchberg scheme would be "exceedingly expensive on account of the great length of the furrow compared with the limited extent of irrigable land and the necessity for storage provision".
- Small schemes by means of furrows and pumps should be encouraged. These should be implemented in areas other than that where the Vaal River schemes and the Van der Kloof-Hopetown and Confluence-Prieska projects were planned during the late 1920s.
- Regarding these small schemes, three factors should be kept in mind:
 - Because all the low-water flow comes from the upper reaches of the Orange, and most of it from across South Africa's borders, while the bulk of existing development is in the lower reaches, any schemes upstream from existing developments will decrease the low-water supply to the existing schemes. This will be the case especially during the spring months, unless storage is provided.
 - Caution should be taken to encourage schemes where the likelihood exists that future reservoirs will flood the lands. This is particularly relevant for the area 80 km above Van der Kloof, and 65 km above the confluence of the Caledon and Orange Rivers.
 - High floods will pose a grave danger to lands and irrigation works. In retrospect, Lewis mentioned the high floods of 1874, 1881 and 1894 on the Orange River as a caution.
- The Orange River will never provide a solution to the problem of water conservation, because large storage facilities will be subjected to siltation (Union of South Africa, 1930b:35-36).

In 1929 work was again renewed on the reconnaissance of the Vaal-Hartz area. This was coupled with aerial photography. Detailed soil surveys were also taken. Subsequent soil surveys indicated that land along the southern portion of the Hartz Valley was very "brak" (saline) and unsuitable for irrigation. Within the Vaal River Valley, the extent of deep and suitable soil did not appear to justify further investigation of large canals on either bank. Thus, the future of the scheme seemed to rest largely on the sandy soils in the northern part of the Hartz River Valley (Union of South Africa, 1934a:2).

5.9. Sudden Instructions: Irrigation Projects as Relief Works

The Director of Irrigation received "sudden instructions", in 1930, to organise and start with the construction of irrigation works at Buchberg, Oukloof, and Kalkspruit. Regarding the Buchberg scheme, his instructions were, to start "construction as soon as possible to provide employment for white people who were suffering from the effects of drought". The urgency

with which the scheme was started is exemplified in Lewis's report of 1929: "As there had been no previous indication that a work at Buchberg would be suddenly embarked upon, no preparation or design for any particular scheme in this neighbourhood has been made since the rough preliminary investigation which led to the outline of the possibilities as related in Appendix I of my last Annual Report, pages 31-33 and 36 [summarised above]" (Union of South Africa, 1931b:19).

In addition, during the two years before 1934, more detailed were carried out in the northern part of the Hartz Valley. Lewis states in his report of 1934 that: "The information at our disposal, was considerable when a sub-committee of the Cabinet further considered the matter and decided to recommend that the scheme be proceeded with. This recommendation was approved by the Government, subject to Parliamentary authority being obtained, and Treasury was requested to sanction an expenditure of £20 000 in order to make certain preliminary preparations which would be immediately required if Parliament passed the scheme and in order to meet the pressing demands of unemployment" (Union of South Africa, 1934a:3).

Other water resources development projects were also called for in the Orange River basin as a means of relieving unemployment. The Vaal River Development Scheme commenced in 1933. This project was situated near the junction of three provinces and several railways. This meant that the project could supply labour to a wide area (Union of South Africa, 1935b:23). This project was one of the three so-called "national schemes", along with the Vaal-Hartz Irrigation Project, that were rejected by Lewis. The estimated cost of the project was £3.5 million. The Scheme was to be South Africa's first multi-objective water project, with the RWB making a substantial financial contribution (Union of South Africa, 1935c:99; Midgley, 1978:231).

The Vaal River Development Scheme consisted of two components. The first was the Vaalbank Dam (later known as the Vaal Dam). This dam is a concrete gravity storage dam below the confluence of the Vaal and Wilge Rivers. The estimated cost of the dam in 1934 was £900 000. The most uncertain item of its budget was the price to be paid for subsequent submerged land (Union of South Africa, 1936:33).

As indicated, the relief of unemployment was an important consideration for the dam's construction. Lewis stated in his annual report for 1934-35 that: "In furtherance of the policy of employing European labour only, this work is also being carried out by means of white labourers . . ." These labourers were between the age of 18 and 45 and unmarried. The pay was two shillings per day, with a bonus of one-shilling 6d per day worked. Interestingly enough, their bonuses were paid into a Post Office Savings Bank account and they were only allowed to draw the money after they left the work. Money could be paid, *via* a stop order, to dependants. About 800 men worked on the construction of the dam (Union of South Africa, 1936:33). Notwithstanding this, in 1935 the Department of Labour found it impossible to keep the white labour force "up to the required strength, and it became necessary to employ natives on certain sections of the work". The reason for this, according to Lewis, was "the increased prosperity of the country and the consequent demand for labour" (Union of South Africa, 1937b:28).

The second component of the Vaal River Development Scheme was the Vaal-Hartz Distribution Works. Manual labour was used, and, as in the case of the Vaalbank Dam, only single white males were employed. Modern machinery was also employed due to the

extensive nature of this component (Union of South Africa, 1936:34). By the end of 1937, the Department of Lands settled 30 "settlers" on the scheme to work the land (Union of South Africa, 1939:31). This number increased to 126, an increase of 96 over a one-year period from 1937 to 1938 (Union of South Africa, 1940b:27). On 31 March 1940, there were 304 settlers on the scheme. This represents an increase of 178 from the previous year (Union of South Africa, 1941:29).

In 1938, work on the superstructure of the Vaalbank Dam was completed, and a superintendent and small staff were appointed for maintenance purposes. On 13 December 1938, the Vaalbank Dam overflowed for the first time. The Director of Irrigation noted in his report for the period 1938-39 that: "The dam's usefulness as a regulator of the Vaal River flow has now been amply demonstrated and, although the year was admittedly a good one as regards water supply, it is clear that the reach between the dam and the Vaal-Hartz weir will be vastly improved both in the increase of the winter minimum flow, and the reduction in the magnitude of floods" (Union of South Africa, 1940b:27). Thus, the Vaal River was a "tamed" river, in its section between the Vaalbank Dam and the Vaal-Hartz irrigation schemes, for the first time in its history.

Other projects to provide work for whites were also commenced upon after the drought and depression. In 1934, work started on the Vioolsdrift and Beenbreek irrigation projects. The idea of these two schemes on the Orange River was to provide labour to whites who had been employed on the roads but had been laid off. The Minister of Irrigation inspected the sites for the proposed projects and instructed his department to start with work immediately after his inspection. Lewis states in his report for 1934-35 that the Vioolsdrift irrigation project is "possibly one of the best schemes in the lower reaches of the Orange River". Both white and coloured labourers were employed on the two schemes. White labourers received four shillings 8d per day and colour workers 2s 6d per day. Lewis also notes that: "Europeans and coloureds are kept strictly apart and work in separate gangs. Generally the coloureds are made to camp on one side of the river and the Europeans on the opposite side" (Union of South Africa, 1936:38).

During the period 1935-36, the Department of Irrigation considered the construction of an irrigation project in the southern OFS. It decided that a dam would be constructed on the Riet River, at a site that was known as Kalkfontein. The Kalkfontein Dam was to be situated 40 km northwest of Fauresmith. A rock-fill dam was built at this site and a system of canals irrigated some 11 000 morgen of land between the dam and the junction of the Riet and Modder Rivers. Work on the project started in July 1935 and was completed in 1938 (Union of South Africa, 1937c:29; Union of South Africa, 1940a:29).

The start of construction was not without obstacles, though. There was a shortage of "quality" labour. Lewis blamed this, as in the case with the Vaalbank Dam, on the economic prosperity South Africa was experiencing. Many white labourers sought employment in the industries and mines. He also stated that if white labourers could not be recruited, "native" labour would be used (Union of South Africa, 1937c:30). Throughout 1938, "native" labour was employed at an increasing rate, and the small force of white labourers was employed in semi-skilled positions (Union of South Africa, 1940b:29).

The government also decided, during 1935-36, to implement an irrigation scheme situated at the upper end of Cannon Island in the Orange River. Some of the settlers of the island

constructed an irrigation project on the lower end of the island, but government decided that a "better" scheme was needed. Investigations into the scheme revealed that the existing canal of the Louisvale Irrigation Board should be enlarged and extended. Government entered into negotiations with the Board regarding this plan and the Board gave its consent. Construction of the works started at the beginning of 1936. The work consisted of the construction of a "syphon" through the Orange River to Cannon Island and the building of a new weir and intake. The work was initially hampered by unseasonable floods in the Orange River, but was successfully completed (Union of South Africa, 1937c:30).

By 1937, the Director of Irrigation reported that the Union government was undertaking major irrigation works. In 1936-1937, the total sum of money for such projects was £13.8 million. This amount excluded boring operations. The schemes that were promoted had the capacity to settle 4 500 families on irrigated land. This land covered an area of about 450 km² in various parts of Transvaal and the OFS. The majority of schemes, for this purpose, were situated in the Orange River basin. They are the Vaal Dam, the Vaal-Hartz, the Kalkfontein Dam, and the Egmont Dam. The other scheme was the Loskop Dam, situated in the Limpopo River basin. On the Vaal-Hartz irrigation project, 3 000 families alone would be settled on irrigable land. With the completion of these schemes, there would be 28 major state irrigation schemes in the Union. These schemes had the capacity to irrigate 300 000 morgen of land. With the introduction of these new schemes, the productivity level of all the schemes increased from £8 million to £10 million (Keesing's, 2 April 1938:3007). Depression and drought therefore had a positive impact on the implementation of South Africa's hydraulic mission.

5.10. The Orange-Fish Project

In 1947, the Orange-Fish river project was proposed by the Irrigation Department. The scheme would consist of a diversion barrage at Doornpoort near Venterstad. The purpose of the barrage was to divert water through a canal about 8 km long that would eventually discharge into a tunnel. On emerging from the tunnel, some of the water would then be taken off in a canal to irrigate land in the direction of Conway. The rest of the water would flow down the Thebus spruit into the Great Brak River and then to the Grassridge Dam in the Eastern Cape. It was intended that the height of the dam would be increased to receive the extra water. At the headwaters of the dam a by-pass canal was to be constructed to carry as much silt-laden water as possible round the dam (Union of South Africa, 1947:1).

From Grassridge Dam the intention was to allow the water down the river "to be picked up as required by the various canals". The water for the Sundays River would also have passed down the Fish River and picked up near the Klipfontein weir. It would then have been conveyed *via* the Little Fish River to the head of the Schoenmakers Spruit to Lake Mentz where it would have been stored until required in the Sundays River Valley. The scheme was designed to divert 1 000 000 acre-feet of water annually into the Fish River Valley, from the Orange River (Union of South Africa, 1947:1).

On 10 January 1947, the Minister of Agriculture, Senator Conroy, opened the sixth Annual Congress of the Cape Midlands Area Development Association. He went into a discussion of the matters pertaining to the Orange-Fish River scheme. In his speech, he referred to the precarious position of the irrigators in the Fish River valley. The position was due to the

shortage of water. The minister stated that he fully realised that unless something were done for the people in the valley, the entire amount already spent by government on the project would be wasted and the farmers ruined (GFRIB, 1947:1).

The minister considered the Fish River valley as one of the most valuable in the country, in terms of agricultural production. The valley had therefore been "made secure from an irrigation point of view". Only 50% of the land scheduled by the Great Fish River Irrigation Board was under irrigation. This was due to the silting of dams and the other 50% being in a precarious state. Conroy told the Congress that improvements to the state of affairs were made, but as soon as these were completed, the silt problem increased (GFRIB, 1947:1).

He also said that preliminary work on the Orange River Scheme was proceeding as fast as possible and that it would take 2-3 years before construction would start. A lack of human resources (manpower) was the biggest drawback to the start of the scheme. He furthermore alluded to some amendments of the irrigation acts. These amendments suggested that the entire problem of water supply be dealt with in a regional manner and the second was that the Act, should not only consider the "preliminary interests of the rural population, but also the urban areas" (GFRIB, 1947:1).

Regarding the rural population, the Act had raised the subsidy to farmers for the construction of dams on their farms to a maximum of £300. This amount was nearly double what it had been. Municipalities could obtain subsidies on water schemes up to a maximum of £10 000 (GFRIB, 1947:1).

The Great Fish River Irrigation Board argued at the Congress that the scheme should be fast-tracked by putting it out to contract, even if it meant importing men from overseas. It was furthermore suggested that more dams should be built in the rivers of the Eastern Cape, because of the silting problem in the two dams the Board was controlling. Nearly 50% of the volume of the dams consisted of silt (GFRIB, 1947:1-2). The Orange-Fish Project, then the ORP, would only be implemented 13 years later, as part of South Africa's "aggressive" hydraulic mission.

5.11. Large Schemes, Small Schemes, the Raising of Dams and Betterments

5.11.1. The Sand-Vet Government Waterworks

Work on the Allemanskraal Dam, part of the Sand-Vet Government Waterworks, also started in 1947. However, work stopped because of difficulties over mining rights. It was resumed in 1955 and completed in 1960, at a total cost of about £1 900 000. It is situated in the Sand River. The dam and surrounding farms were proclaimed the Willem Pretorius Game Reserve (SESA, 1973:488).

The dam consists of a concrete gravity wall 755 m long and 37 m high. The initial capacity of the dam was 213 mcm. This large capacity is needed because of the high siltation rate. Provision had also been made in the design for future raising of the wall (SESA, 1973:488).

The Erfenis Dam, situated on the Vet River, also part of the scheme, was completed in 1960 at a cost of £1 587 000. It consists of a concrete gravity overspill wall 468 m long, with an overspill of 183 m. The maximum height of the dam above the dolerite foundations is 45 m. Provision was also made for the raising of the dam, due to the high siltation rate. The dam had an initial capacity of 237 mcm. Historically, due to the absence of local sand suitable for conventional concrete, the mortar intrusion process was used on a big dam for the first time in South Africa (SESA, 1973:488).

From these two dams, there is an extended system of concrete-lined canals to supply irrigation water to about 14 550 ha of land. Part of this land is owned by private individual farmers and another part by the state, with settlers placed on the state-owned land. The canals were constructed at a cost of about R10 million (SESA, 1973:488).

An interesting aspect of the development of the Sand-Vet basin was the possibility of diverting water into it from the Caledon River. This could be done by means of a tunnel near Ficksburg into a tributary of the Sand River. Alternatively, a tunnel near Clocolan could also deliver water into a tributary of the Vet River from the Caledon. This possibility was carefully surveyed and at one time seemed to have considerable backing. The merits of the possibility lay in the fact that there is very little arable soil along the Caledon River. The shortage of water in the Vaal River system was also seen as a contributing aspect to the possible scheme. Water from the Caledon could be supplied to the Vaal-Harts irrigation settlement and for the ongoing industrial development on the Witwatersrand. It is physically feasible, because the Vet River joins the Vaal above the Vaal-Harts diversion weir (SESA, 1973:488).

5.11.2. The Douglas Irrigable Areas Board Water Scheme

In March 1960, the Department of Water Affairs (DWA), acting on behalf of the Douglas Irrigable Areas Board, completed a programme of betterments consisting of the lining of the Board's canal. The canal runs through the Douglas Township, the Douglas Irrigation Plots and the Bucklands Irrigation Settlement. For the programme, an irrigation loan of R137 200 had been granted to the Board. Actual expenditure amounted to R134 521.42. In 1962, the Board applied for an additional loan of R19 000 and a subsidy for carrying out further betterments (RSA, 1962a:2).

The history of the Douglas Irrigation works dates back to the early 1890s. In 1911, the Union Government bought the four farms Bucklands, Buccleugh, Nottingham and Stratford, situated in the "fork" between the Orange and Vaal Rivers. This was to extend the scheme. Work on the extension of the canals to bring 1 300 morgen under irrigation was started in 1913. The Bucklands area was subsequently subdivided into 10 morgen plots and these were allocated to settlers in 1920. The scheme remained under Government control until 1938, when the Douglas Irrigable Areas Board was established under Act No. 18 of 1937. All responsibilities were then taken over by the newly formed Board, which has continued to administer the Board up to 1962 (RSA, 1962a:3).

The weir and canals comprising the scheme required constant attention, betterments, and repairs. These were continuously in progress. The weir was only satisfactorily completed in 1947. Since then, it has served as a river flow gauging station and a diversion weir. The

condition of the canals remained unsatisfactorily and in 1946 the Board applied to the Irrigation Department for an investigation (RSA, 1962a:3).

Under the Irrigation Act, No. 8 of 1912, which was at that time still in force, the usual loan and subsidy facilities applicable to irrigation boards constituted under the Act could not be extended to other Boards. This was the case of the Douglas Irrigable Areas Board. The Board found itself unable to finance the scheme without state assistance (RSA, 1962a:3).

The Water Act of 1956 altered the situation. Facilities for loans and subsidies could then be made available to such Boards and provision was accordingly made on the 1958/59 Parliamentary Estimates for a loan of R137 200. This money was made available for the concrete lining of the portion of the main canal located downstream of the boundary between Douglas Township and the farm Backhouse. This work was completed in March 1960 at a cost of R134 521 (RSA, 1962a:3). In other words, the work was completed well within budget.

After completion of this work, it became evident that an increased carrying capacity for the canals would be desirable for the efficient irrigation of the scheduled area. The DWA therefore proposed in 1962 to raise the lining of the existing concrete canal, the building up of portions of the banks of the existing earth canal between the intake and the town of Douglas and the construction of betterments to minor structures of the scheme (RSA, 1962a:3).

5.11.3. The Hardap Dam

The Hardap Dam, on the Fish River (a tributary of the Orange) in Namibia was built during 1961 to 1962 at a cost of R9 million and was at the time of completion the third-largest storage dam in Southern Africa. The dam is situated 24 km northwest of the town of Mariental, District of Gibeon (SESA, 1972:435-436; Bloemhoff, 1974:5).

The history of the Hardap Dam dates back as far as 1897. In this year, Prof. Rehbock, from Germany, saw the potential of a storage dam for irrigation purposes at Hardap. During the period of German colonialism in SWA, four sites for storage dams were considered. In 1913, the German parliament gave funds for intensive geological, hydrographical, and agricultural research and surveys for the entire Fish River basin. It was during the period 1908 to 1914 that planning was started for a dam on the farms Hardap and Komatsas. At first, the Komatsas site was investigated (Stengel, 1963:261; Bloemhoff, 1974:5).

Yet new knowledge regarding the planning of dams showed that a dam with the same dimensions on the farm Hardap would have a much larger capacity. The dam was identified in 1960 and the Hardap Dam was completed in 1963 (Stengel, 1963:262; Bloemhoff, 1974:5).

The dam has a capacity of 252 030 million litres, of which some 40 000 million litres are used annually for irrigation purposes, and 4 000 million litres are purified for domestic purposes, mainly for the town of Mariental. It provides water for a total area of 2 094 ha of irrigated land. This land comprises 150 smallholdings of about 15 ha each. Immediately after completion of the dam, the SWA Administration intended to establish a rehabilitation farm at Hardap where non-white prisoners were to receive intensive training in agriculture. A hydroelectric turbine, which can deliver 460 kW of electricity, was installed. Other

developments around the dam included a primary school at the settlement. The Hardap Dam also has a number of other functions, apart from irrigation. These include flood control, hydroelectric power generation, provision of urban water, and recreation (Stengel, 1963:257; SESA, 1972:436).

In 1971, the drainage and other betterment works on the Hardap Settlement were continued. A start was also made on work on the further expansion of the irrigation scheme. On 16 March 1972, the biggest flood in living memory struck the settlement. This flood caused extensive damage to the betterment works as well as to the waterworks and the land. During the financial year 1971/1972 R1 065 183 was spent on the scheme, which brought the total expenditure to that date to R11 453 481 (DWA, 1972:147).

5.11.4. The Naute Dam

In 1961, the Water Affairs Branch of the SWA Administration recommended the construction of a scheme on the Löwen River (a tributary of the Fish River in SWA) for the supply of water to the Municipality of Keetmanshoop and for a pilot irrigation scheme on the Seeheim plain. The scheme was also to supply water to the J.G. van der Wath Airport near Keetmanshoop (DWA, 1970:68; DWA, 1971:75; Olivier, 1976:132).

The scheme consists of a storage dam (the Naute Dam), a water purification plant near the dam, pumping stations, pipelines and a terminal reservoir at Keetmanshoop, and a 44 km high-tension power line between Keetmanshoop and the dam. Work on the pipeline started during March 1969 and by 1970 it was already 60% complete. The terminal reservoir at Keetmanshoop has a capacity to store 3 000 m³ of water (DWA, 1970:68; DWA, 1971:75; DWA, 1972:147; Olivier, 1976:132).

In 1964, the Executive Committee of the South West African Legislative Assembly appointed Consulting Engineers to carry out the design work for the proposed scheme. In the same year, the first contract was awarded for diamond drilling and the geological investigation of the foundation materials at the two possible dam sites. In 1966 the construction of the access road, and extension to the Jürgen Railway Siding, was commenced. The works for the establishment of housing facilities, potable and construction water supply and power generation were commenced in 1967. It was only in 1968 that work on the Naute Dam started. Work on the purification works, pump stations, pipelines and reservoirs started in 1969. The last major contract, awarded in 1970, was for the construction of the power lines and transformers (Olivier, 1976:123-133).

The history of the Naute dam dates back further than 1961. The construction of a storage dam in the Löwen River, as a permanent source of water, was first investigated by the privately owned *Syndicate for Irrigation Schemes in German South West Africa*. This investigation was done in conjunction with the German Colonial Government in the period 1897 to 1902 (Olivier, 1976:132).

During the 1950s, the need for an additional or completely new water supply scheme for Keetmanshoop became apparent. This was after it was realised that the existing sources consisting of boreholes and the Van Rhyn Dam could no longer meet the ever-increasing demand (Olivier, 1976:132).

The Naute Dam was completed in 1971 and the first flood waters to be retained by the dam were during the 1970/71 rainy season. Water was delivered to Keetmanshoop from the dam during the second half of 1972. This was after the extensions to the Keetmanshoop Municipal Power Station, from where the entire scheme is fed with electricity, had been connected. During the financial year, 1971/1972 R1 147 172 was spent on the scheme, which brought the total expenditure to that date to R7 459 032 (DWA, 1972:148; Olivier, 1976:133).

5.11.5. The Klerksdorp Irrigation Board Betterment Works

The Klerksdorp Irrigation District was established in terms of Proclamation No. 130 of 1913. In January 1914 a loan of R40 000 was granted to the Board for constructing the Johan Naser Dam in the Schoonspruit. A consulting engineer who was employed by the Board did the work. During construction, it was decided to raise the height of the dam wall by five feet. Because of the increased storage capacity the length of the canal could be extended. This increased the irrigable area from 240 morgen to 582 morgen. The initial amount of R40 000 was insufficient. Further loans amounting to R13 200 were raised by the Board to complete the project (Union of South Africa, 1961a:4).

The Klerksdorp Irrigation District's irrigable land lies within the municipal boundary of the town. The water supply is derived from the Johan Naser Dam. The catchment area of the dam is 3 419 km² in extent. The mean annual yield from the dam was in 1961 25 300 morgen-feet. Yet the Schoonspruit Irrigation Board made extensive use of this volume of water in the upper catchment of the Schoonspruit. Despite this extensive use, the run-off reaching the dam was subject to wide fluctuations and occasional water shortages were experienced. The total scheduled area that was irrigated by the Klerksdorp Irrigation Board was 852 morgen. Of this amount 130 morgen consisted of residential plots, and a further 300 morgen of agricultural plots (Union of South Africa, 1961a:3-4).

In 1927, a loan of R4 200 was granted to the Board to finance certain repairs to the dam's embankment. The Board had difficulty in meeting its loan repayments, due to a number of poor harvests and locusts. In 1929 amounts of R7 681, capital, and R11 822, accumulated interest, were written off with the approval of parliament, in respect of the original loans of R53 200. After the severe drought of the early 1930s, a further sum of R35 794 principal and R6 472 interest on the original loans, and the entire R4 200 principal of and R 1 345 interest on the 1927 loan were similarly written off (Union of South Africa, 1961a:4).

It is clear that the Board was unable to pay off its loans. In 1941, the balance of the original loan, amounting to R4 325 of capital and R54 interest, was also written off, relieving the Board of the whole of its debt to the government. Of the original loans totalling R57 400, the Board repaid R5 397, while an amount of R52 003 was written off at various times (Union of South Africa, 1961a:5).

In 1949, the Board decided to replace the high-level furrow from the dam with a new concrete-line canal. It negotiated new government loans totalling R17 000 for this purpose. Finally, in 1956, the Board was constrained to undertake essential repairs to ensure the safety of the Johan Naser Dam, and raised a loan of R60 000 to finance this work (Union of South Africa, 1961a:5).

In 1961, the DWA completed certain betterment works on the Johan Naser Dam, which was constructed in the years 1915 to 1961. These works were done in agreement with the Klerksdorp Irrigation Board. The works were originally estimated to cost R60 000 and an irrigation loan to that sum was granted to the Board. However, the work amounted to R63 000, and the Board applied for a R3 000 loan to make up the deficit (Union of South Africa, 1961a:3, 4).

5.11.6. Reconstruction of the Smartt Irrigation Board Dam

In 1961, the DWA proposed the repair and reconstruction "to a safe standard" of the Smartt Syndicate dam in the Britstown District. This dam was nearly washed away in the floods of March 1961. The dam was, by 1961, the only source of water supply for the 2 113 morgen of land, which was scheduled under the Smartt Irrigation Board, and had a height of 64 feet. The DWA considered the repair of the dam a matter of great urgency, because of the size of the irrigable lands, and the fact that the farmers irrigating their land had already suffered due to severe droughts. They therefore found themselves "in poor economic circumstance" (RSA, 1961a:3, 4).

A company known as the Smartt Syndicate Ltd originally constructed the scheme consisting of the dam and canals over the period 1908 to 1912 at a cost of R280 000. The company raised the dam wall several times since then. This was to replace the lost capacity because of siltation. The principal crops grown under the scheme are lucerne and other fodder crops and wheat (RSA, 1961a:3).

The scheme was not as profitable as was originally envisaged, due to a shortage of water. In 1954, the company went into voluntary liquidation. The irrigable land under the dam was offered for sale to the public and was disposed of based on an undertaking that a statutory body would be established to administer the dam and the distribution of water (RSA, 1961a:3).

After this, it was decided to proclaim the area and Irrigation District in accordance with the requirements of the Irrigation and Water Conservation Act No. 8 of 1912. Proclamation No. 289 of 1955 accordingly established the Smartt Irrigation District, and an Irrigation Board was elected. After certain difficulties regarding the transfer of the dam, the Board and the Smartt Syndicate Company confirmed the transfer of the dam and other assets by an agreement on 4 March 1961 (RSA, 1961a:3).

In 1961, the land entitled to be irrigated was 2 113 morgen. Twenty-seven owners held the scheduled area. The assets of the Board amounted to R7 081 in June 1960. The dam, canals and land were valued at R200 000. Heavy and continuous rains occurred during the last week in March 1961 over a large portion of the Karoo and North-west Cape. The Ongers River came down in a heavy flood, due to the precipitation. As a consequence of weaknesses in the foundations resting on shale, the central spillway of the three concrete spillways was the first portion to be washed away. Even this was not enough, and on 28 March 1961 the main earth embankment collapsed because of seepage near the crest. The breaching of the dam did not cause much damage, because the land below the dam was already under water. No loss of life

was reported either, because all the inhabitants living downstream from the dam had already been evacuated (RSA, 1961a:4).

After the flood, the most urgent need of the irrigators was the repair of the dam to enable them to conserve water as soon as possible to save their existing lucerne lands and to commence production again. The dam was repaired by the DWA at a total cost of R553 000 (RSA, 1961a:4, 6).

5.11.7. The Schoonspruit Irrigation Board Scheme

In 1962, the DWA proposed the extension of certain additional betterments to the irrigation works serving the Schoonspruit Irrigation District, near Klerksdorp. To do this the Schoonspruit Irrigation Board sought an irrigation subsidy of R100 000 to cover the cost of the work (RSA, 1962b:2).

Historically, the Voortrekkers settled along this stream as far back as 1850 because of the abundance of water found in the stream at that time. Proclamation No. 194 of 1931 established the Schoonspruit Irrigation District. This was to improve the existing works and to provide more effective control over them. Later the boundaries of the district were extended by Proclamation No. 59 of 1936 and the district was sub-divided into three wards by a further Proclamation, No. 101 of 1936 (RSA, 1962b:2).

By 1936, there were about 10 furrow systems in existence along the stream, fed by about seven independent weirs. The furrows were only able to command limited areas of low-lying land of relatively poor quality. The number of weirs and difficulty of control resulted in frequent water shortages (RSA, 1962b:3).

After the establishment of the Irrigation District in 1931, various proposals for alleviating the water shortages were considered by the Board. These proposals led to the construction, during the period 1938 to 1940, of a storage dam of 1 050 morgen-feet capacity on the Rietspruit. Further general improvements were subsequently found to be necessary. In 1954 an extensive programme of betterment works was started. By 1962, these works were nearing completion (RSA, 1962b:3).

These works, which were intended to promote improved use of water and to irrigate new land, included the following:

- The construction of a concrete intake weir across the Schoonspruit at a point immediately upstream of Ventersdorp;
- The enlargement of the Rietspruit Dam to a capacity of 3 050 morgen-feet;
- The construction, on the left bank, of concrete-lined main canals extending from the weir and from Rietspruit Dam, at an elevation higher than those of the old canals; and
- The provision of subsidiary distribution canals and pipelines to feed lands on the right bank (RSA, 1962b:3).

To implement these works, R550 000 was made available to the Board in 1957. Nonetheless, the actual cost of the betterment works proved to be more than was expected and the entire

matter was reconsidered in 1957. The amount to complete the work was estimated at R260 000, bringing the total estimated cost of the work to R810 000. The revised estimate of R810 000 for reconstructing the Schoonspruit scheme was approved by Parliament in 1958. Of this amount R590 000 was to be a subsidy and R220 000 a repayable loan to the Schoonspruit Irrigation Board (RSA, 1962b:3, 4).

Additional works, estimated to cost R100 000, were proposed in 1962 by the DWA. These consisted of the following:

- Improvement to plot off-takes;
- Additional stormwater drainage works; and
- Construction of additional control and regulation works in the main canal, with reject canals (RSA, 1962b:4).

In 1967, the Schoonspruit Irrigation Board requested additional betterments to the irrigation works. The rationale behind the additional works was that a wetland between the springs and its weir caused high transpiration losses. The wetland's basin was also silting up, and this encouraged the growth of more aquatic plants. Consequently the Board wished to construct a lined canal on the right bank of the river from a small gauging weir just downstream of the lowest spring and to divert the water into their upper furrow on the left bank by means of a siphon through the Schoonspruit. This would eliminate the evaporation and transpiration losses in the river's channel. The proposed canal was to have a screened lining, with a carrying capacity of 30 cusecs and was to be 19 000 feet long. The estimated cost of the additional work was R152 000. Because the Board controlled and administered the scheme, it had to repay the loan of R152 000. This loan was, however, subsidised by government at a rate of 33.3% (RSA, 1967a:2, 4).

5.11.8. Lower Riet River Government Waterworks

In 1962, the DWA proposed the construction of three weirs in the lower Riet River. The sites of these weirs were to be situated within the Modder and Lower Riet River irrigation districts and between the Modder-Riet confluence and the Riet-Vaal confluence (RSA, 1962c:3).

The area to be served by the weirs was situated on both banks of the Lower Riet River and stretched for over 86 km from the western boundary of the town Ritchie to a point 12 km upstream of the Riet-Vaal confluence. The main crop under irrigation was lucerne. The farmers grew it as a cash crop or for local use. Vegetables and fruit were also grown (RSA, 1962c:3).

Historically, irrigation of the lower part of the Riet River commenced at the beginning of the twentieth century. Because of the high and exceptionally steep banks of the river and its comparatively flat gradient, diversion weir furrows were not constructed but pumps used instead. During the course of the century, several storage weirs were constructed in the Modder and Lower Riet Rivers to improve the water supply. In 1962, there were six dams between the Modder-Riet confluence and the Riet-Vaal confluence (RSA, 1962c:3).

Several dams had also been constructed in the upper reaches of the Modder and Riet Rivers. Among them were the Tygerspoort Dam (with a capacity of 15 514 morgen-feet completed in 1923), the Kraaipoot or Kalkfontein Dam (149 900 morgen-feet in 1938) and the Rustfontein Dam (30 010 morgen-feet in 1955) (RSA, 1962c:4).

During times of extreme water shortage, water was released from these dams to feed the Lower Riet River. However, such releases were not advisable because the dams were normally required for those consumers scheduled under them. Because of the water shortage during the early 1960s, a petition by the farmers of the Lower Riet River was presented to parliament. After a statutory enquiry, Proclamation No. 54 of 1961 proclaimed the Modder and Lower Riet River Irrigation District. The intention of this was to control and distribute the available water fairly and to augment the water supply (RSA, 1962c:4).

By 1962, there was already 1 554 morgen of land under irrigation. Some 4 300 morgen was estimated as being suitable for irrigation, if sufficient water should be made available, which was not possible in 1962 (RSA, 1962c:4).

Furthermore, in 1962, not all the farmland bordered the weirs. The weirs had no sluice gates and could therefore not release water. Consequently, these farmers had to rely on pools in the river to draw their water from, especially during the early summer months (RSA, 1962c:5).

To improve the regulation and to make better use of the available water in the river, it was proposed by the DWA to construct one new weir on each of the farms Koedoesberg, Aucampshoop and Blaauwboschfontein. On Aucampshoop, the aim was to enlarge the existing weir. It was planned that the total capacity of these new reservoirs would be 1 824 morgen-feet and all three were to be provided by large flood sluices (RSA, 1962c:5).

The three weirs were to be built at an estimated cost of R150 000, or a capital investment of R120 per morgen. After completion, it was hoped that the scheme would be handed over to the Modder and Lower Riet River Irrigation Board for administration and maintenance. The weirs were completed during 1963-1964 (RSA, 1962c:5).

In 1965, a supplementary report, W.P. L-'65, which dealt with the revised design of the weirs and a revised estimate of cost to the amount of R550 000, was submitted to parliament. The 1965 works consisted of the following:

- The Koedoesberg Weir;
- The Aucampshoop Weir; and
- The Blaauwboschfontein Weir (RSA, 1968a:3).

Even so, in 1968, the Modder and Lower Riet River Irrigation Board made the following presentation:

1. That the existing Ritchie Weir be reconstructed and raised;
2. That the Aucampshoop Weir not be reconstructed; and
3. That a new storage weir at Abrahamoosfontein be included in the programme (RSA, 1968a:3).

The DWA decided to go ahead with the request and asked parliament to approve these works. This was to meet the wishes of the Modder and Lower Riet River Irrigation Board. The overall additional cost involved in the 1968 programme was R300 000 and the total revised cost of the programme of works therefore amounted to R850 000 (RSA, 1968a:3).

The system of weirs, after construction, was able to irrigate 1 554 morgen of scheduled land. It was also estimated by the DWA that, after probable evaporation and distribution losses, there were about 12 inches of irrigation water during the hot summer months (RSA, 1968a:5).

On account of increasing water, the Lower Riet River Scheme was linked to the Orange River Project in 1987. This was after the drought of the early 1980s (1982-1984) and the dwindling water supply of the Kalkfontein Dam reached crisis proportions on the Riet River Settlement. This resulted in the government deciding to construct the Orange-Riet canal. This canal supplied water not only to the 117 irrigators on the Riet River Government Scheme, but provided water also to considerably expand irrigation land along the Lower Riet River. The municipalities of Luckhoff, Jacobsdal and Ritchie also got an assured supply of water from the canal. The construction of the canal was announced in 1983, in spite of a lack of funds (The Civil Engineering Contractor, August 1987:16).

The design of the Orange-Riet Canal made provision for expansion of a possible second phase of 24 m³/s in future. This meant the development of more land near the canal and the possibility of more water for Kimberley. The estimated cost of the works was R26.5 million at March 1986 price levels and R39 million if a cost escalation of 15% per year during the construction period was assumed. Regarding environmental impacts, the DWA states in its 1986 report that: "Most of the work involved comprises the enlargement of existing works with limited intrusion on virgin areas. The few proposed new works are not located in an environmentally sensitive area. However, measures will be taken to ensure that the impact on the environment is kept at a minimum" (RSA, 1986a:3, 11; The Civil Engineering Contractor, August 1987:16).

5.11.9. The Orange River Project

On 23 March 1962, the Minister of Water Affairs, P.M.K. Le Roux, announced in parliament the commencement of the construction of the Orange River Project (ORP). In June the same year, the House of Assembly authorised the expenditure of a sum of R85 million for the first phase of the project (RSA, 1964a:3).

In 1959, Le Roux, when he was appointed to the portfolio of water affairs, instructed his staff to speed up investigations of the necessary survey work for the ORP. Three dam sites were selected – at Ruigte Valley, Van der Kloof and Tourquay, which formed the basis of this large undertaking. During his announcement, Le Roux said that: "The Government has therefore decided to undertake the biggest, most important and most spectacular water supply project ever initiated in the history of our country's water affairs. Not only is it the biggest in Africa, when seen as a whole, but it will be one of the biggest projects of its kind in the world". Le Roux furthermore declared that: "In the history of all young civilised countries the time arrives when big and imaginative water development projects must be launched to promote the growth of areas of development, the formation of industries and the generation of electric power, and to create a means of coping with the future population increase, so as to maintain

the rate of progress for the country as a whole. That is the principal aim of the Orange River Project" (RSA, 1962d:3).

Regarding the project's size and economic and political importance, Le Roux also likened the ORP to some other major dam-building projects across the world. Most notable was the Boulder Dam, coupled with the "All-American" canal system on the Colorado River, in the USA. This project was constructed in the 1930s at a cost of R146 million. Le Roux also referred to the Kariba Dam in the Zambezi River, the first stage of which was completed before his speech by the Federation of Rhodesia and Nyasaland at a cost of about R150 million and a final cost of some R225 million. Regarding these projects, Le Roux said that: "The Government feels that the time has now come for the Republic of South Africa also to initiate a giant water supply project in order to create conditions in which development can take a big stride forward, and timeously and systematically provide for the country's future requirements in the sphere of agricultural, industrial and urban [water] use" (RSA, 1962d:4). South Africa was therefore following the global trend of implementing massive water resources development projects.

Regarding benefits, of a more ideological sort, Le Roux stated in parliament that: "The project will change the face of South Africa. ... The Orange River Project will transform the desert into a paradise". The grandiosity of the project was furthermore explained when Le Roux said that: "Based on certain comparable statistics, the Orange River Project is much bigger than the already proven Tennessee Valley Authority project which was started in the 1930s. The course of the Orange River, which has development potential, is 950 miles long in comparison with the Tennessee River's course of 650 miles. The total storage capacity of the nine T.V.A. dams is 10.4 million morgen-feet in comparison with 17.5 million morgen-feet in a foreseeable period of only three of the dams on the Orange River – the Ruigte Valley, Van der Kloof and Torquay dams. The total storage capacity is much bigger still – about 50 million morgen-feet. The 328 000 square mile total catchment area of the Orange River is eight times bigger than that of the Tennessee River and its tributaries". Le Roux also compared the Orange River to the Volta River Project in Ghana, stating statistics to show how important the ORP would eventually be (RSA, 1962d:9-10).

Also, the ORP was proposed for the socio-economic development of South Africa. The extent of land that was to be irrigated from the huge project was in the order of 360 000 morgen, of which 247 000 morgen of existing (1962) and new development is situated within the Orange River basin. About 113 000 morgen was to be irrigated outside the river basin. The ORP would also provide for an initial water supply of 450 million litres of water per day for domestic and industrial purposes. In this regard, Le Roux said that: "This supply may, however, be increased to whatever degree may be required, by eventually placing less land under irrigation". Hydroelectric power, in a considerable quantity, was also to be generated as a by-product of the ORP. It was envisaged that this power would be supplied to urban and rural communities and to industries, as well as to the South African Railways Administration. The hydroelectric power was to take the place of a substantial quantity of electricity produced by ESCOM's coal-fired power stations in the Eastern Transvaal (now Mpumalanga) (RSA, 1962d:4).

Thus, the project planned to increase irrigated land in South Africa by 40%. It was also to supply water to the hinterland of the Eastern Cape (Simons, 1968:133-136). In this regard, Simons (1968:141) states: "The white platteland [rural areas] is largely the pivot of western

civilization ... [a strong farming community] is a prerequisite to the continued existence of Christian civilization in our country".

From Le Roux's speech, it is firstly clear that the ORP was to be an inter-basin transfer scheme, and a huge one at that, judging from the amount of land and the volume of water it would command. Secondly, there was a greater emphasis on industrial and domestic water use from the project, because South Africa was in 1962 still in the euphoric grip of the "long economic boom", and irrigation therefore played a less significant role. One of the arguments from academics was that the project must bring more technological advances to a comparatively underdeveloped area (the Lower Orange River area), as well as agricultural reorganisation, industrialisation and urbanisation. This was particularly important seen in light of the socio-economic circumstances in which the coloured population of the area lived. Their social and economic well-being, housing and health were poor. Their agricultural holdings were small and the gross yield was not more than about R200 per morgen (Jooste, 1965:114, 115). Thus, and although OFS and the Eastern Cape would get the lion's share of benefits from the ORP, the main emphasis in the Lower Orange River was more on the socio-economic development of whites, and to a lesser extent coloureds, with blacks coming in last, or being ignored entirely.

To conclude, Le Roux said that: "Among the development projects with a great potential impact on South Africa's future, the Orange River Development Project ... can be considered the greatest action programme yet initiated by the authorities in the Republic. In the firm conviction that the project is essential to ensure our future, the Government has decided to undertake the first phase with the greatest energy and drive. It has resolved to bring the project to completion within the shortest possible time in the interests of the people of South Africa" (RSA, 1962d:10).

The general outline of the ORP is as follows:

1. The Orange River Sector.

- i. A main storage dam at Ruigtevallei (later renamed the Hendrik Verwoerd Dam and after 1994 the Gariep Dam) to regulate the Orange River and provide sufficient storage capacity for silt deposits.
- ii. A high diversion dam at Van der Kloof to obtain gravity command over irrigable land in the Van der Kloof area, and in the Brak River, Carnarvon "leegte", Sak River and Witsand areas.
- iii. A left bank and right bank canal system from the Van der Kloof Dam.
- iv. A pumping project, to supply supplementary water to the Riet River Government Water Scheme.
- v. A further extension of the aforementioned pumping project to serve certain land near Luckhoff.
- vi. Water supplies to Bloemfontein, Kimberley and De Aar.
- vii. A high diversion dam at Torquay, together with a canal system to serve 27 000 morgen of land of the Confluence-Prieska Project.
- viii. The development of 3 000 morgen of land at Warmsand and Kakamas.
- ix. A diversion dam and canal system for the Marten and Krapohl Island Project.
- x. The irrigation of 5 000 morgen of land in the Richtersveld and Alexander Bay areas.

2. Fish-Sundays River sector.

- i. The Orange-Fish tunnel.
- ii. The Klipfontein canal.
- iii. The Conway canal and Wapadsberg tunnel.
- iv. The Hofmeyer canal (RSA, 1962d:9-10).

The Verwoerd Dam was by world standards not an exceptional engineering feat. The double-curvature area is 280 feet (ft) high, and has a crest length of 2 970 ft. This dam is the main storage unit for the system of dams, tunnels, and canals. The shoreline of the reservoir formed by the dam, at full capacity, is 528 km long. The average width of the reservoir is 3.5 km, and at one place it is 19 km wide. The surface area of the body of water covers 372 km² and inundates about 40 000 ha. The dam wall itself is 85 m high and 905.9 m long. It has the capacity to store 5,950 million m³ of water (Keesing's, April 2 - 8, 1969:4384; Venter, 1970:208).

The Orange-Fish tunnel, on the other hand, is an engineering task of "unique proportions and character". This tunnel has a length of 82 km from the Orange River a few kilometres above the Gariep Dam wall to the southern edge of the central massif. This tunnel was built in sections by three international consortiums (French, Italian, and South African). The tunnel is 17 ft. 6 inches (in) in diameter - wide enough to accommodate a train. The cost of the tunnel alone was R56.2 million with a provisional R20 million for the ancillary canals and pipelines (Keesing's, April 2 - 8, 1969:4384; Venter, 1970:208).

The entire project was divided into six phases, and was implemented over a period of 30 years. On completion, it would consist of twelve dams and weirs. Apart from the three new storage dams, weirs were also planned at Grens and at Beenbreek, both situated between the Augrabies Falls and Onseepkans, as well as at Koemkoem, between Pella and Goodhouse, and in the Richtersveld on the Orange River. The weir at Vioolsdrift and the storage dams at Buchuberg, Grassridge, Mentz Lake, and Van Ryneveld's Pass were to be incorporated into the project, with or without raising their walls (RSA, 1962d:4).

A number of benefits of the projects were outlined. One of the most interesting, given South Africa's apartheid milieu, was that of settlement possibilities to be afforded to white farmers. In the 1962 report on the proposed project the DWA stated that: "There are large areas of land which can be developed as White settlements by the Department of Lands in terms of the Land Settlement Act . . . In order to develop this land [230 000 morgen out of a total of 360 000] under closer settlement a sum of R60 000 000, spread over a construction period of approximately thirty years, will be required . . . It is expected that, in addition to land which is allocated to White settlement, some 4 000 morgen can be developed as irrigation settlements for Coloureds, which will make it possible to accommodate 600 Coloured families" (RSA, 1962d:26-27). To repeat, white farmers got the lion's share of the land to be settled, with coloureds only a fraction and blacks and Indians not a single hectare.

Nevertheless, what financial resources were planned for to implement such a huge project? The DWA report states that: "The estimated total capital expenditure in respect of the water control works for the Orange River Project, excluding the cost of power development installations and power line networks as well as the purchase of land, which is largely recoverable or can be written off against the recreational assets created, amounts to R300 000

000. The value of the assets which will be created in the form of urban water supplies is put at R40 000 000 and can be credited to the above-mentioned capital sum leaving an amount of R260 000 000 to be allocated to irrigation. The hydroelectric power development undertakings, as mentioned previously, show however a net credit gain of R36 000 000 and since these undertakings are not called upon to make any contribution towards the capital costs of the dams and other waterworks and no charge is to be made for the water passed through the turbines, it is considered equitable to credit the foregoing sum against the remaining capital amount of R260 000 000, leaving a balance of R224 000 000 in respect of the area of 360 000 morgen, which is equivalent to a unit cost of R620 per morgen" (RSA, 1962d:36) (emphasis added).

Furthermore, and regarding irrigation projects: "All irrigation schemes in the Republic, as well as in other countries, are subsidised to a greater or lesser extent on the score that not only the irrigator but all sections of the population derive benefit from the undertaking, and it is therefore not envisaged that the irrigators under the Orange River Development Project should repay the full cost of the undertaking". The financing of the project was to be done by South Africa alone, although use was made of temporary financial assistance from abroad. The government intended to finance part of the project "by means of cash payments, and to a great extent by the contractors themselves" (RSA, 1962d:36, 4).

Work on the Gariep Dam and the Orange-Fish Tunnel started in 1966. In 1977 the first phase of the project was completed, when the late B.J. Vorster opened the R93.3 million P.K. le Roux Dam. The dam wall took six years to construct, and was at that time the highest (108 m) in South Africa. It provides water, has an installed capacity to generate 240 Mw, and is an important recreation facility. At the opening ceremony of the dam, Vorster stated that: "Water is too scarce in our country ever to be cheap and water tariffs must be high enough to make everybody realise this and to encourage users of water to do so sparingly . . . In this way the scarcity value of water in our country will be brought home to all consumers" (*Keesing's*, 24 – 31 December, 1977:8808).

1.1.1.1. Verwoerd's Involvement

In 1965, Dr Hendrik Verwoerd visited the site of the construction of the Hendrik Verwoerd Dam near Petrusville. In a speech, he stated that there were plans for five dams on the Orange and the Pongola (now Maputo) Rivers. Committees were appointed to report on the comparative values of the Orange and Pongola River Schemes. These Committees stated that the Pongola Scheme should have priority as a sugar producing area. However, Verwoerd stated in his speech that he was dissatisfied with certain aspects of the Pongola scheme "as a unifier of the North and of the South industrial complexes and felt strongly that the bare midriff of the country should have some covering, not only as a [sic] agricultural scheme, but as an industrial one as well" (RSA, 1965a:3).

Because of this, he appointed a further committee to examine the Orange River Project as a means of harnessing the river's potential in its entirety. This entire development of the river's water resources was to promote business and industry throughout the area, and to conserve water for agricultural purposes. A workable scheme was developed, and Verwoerd decided to go ahead with the Pongola River Scheme at a decelerated pace whilst proceeding with the Orange River Scheme more energetically (RSA, 1965a:3).

In his speech, he also indicated that the entire area could look forward to vast industrialisation complete with power from coal, water and "more modern methods of power production". It is speculated in *The Orange River Development Project and Progress Report*, of 1965, that these "modern methods of power production" meant nuclear power plants. Verwoerd also said that the entire scheme stood as a symbol of the determination of white civilisation in Southern Africa to stay as such in the African continent, and was a heritage to be passed onto our children. The report also notes that Verwoerd had personal determination to see that the scheme is a success (RSA, 1965a:3).

Thus, Verwoerd made it clear that the Orange River Project was not only there for industrial and agricultural development, but also to foster the presence of white people in the sub-continent. This was typical of the Verwoerdian style of politics. He was determined to see that every aspect of South African society, its natural resources included, worked for the good of white people and was part of his greater apartheid scheme.

1.1.1.2. Economic opportunities and External Relations

Verwoerd was not the only person who saw the economic opportunities of the ORP. In 1963, J.L. Stallebrass, Deputy Secretary of Water Affairs, told members of the Chartered Institute of Secretaries that the ORP would boost economic development throughout the Republic of South Africa. In 1965, the Bloemfontein city council sent its Public Relations Officer, A.W. Hibbert, to Europe on an extended tour of the United Kingdom and the Continent. He was to advise entrepreneurs on the opportunities presented by the ORP and the ensuing "boom" being experienced in the district and city of Bloemfontein. He also invited them to participate in the prosperity that was envisaged regarding the socio-economic development attached to the ORP (Keesing's, 7-13 December 1963:1486; RSA, 1965a:7).

Thus, the ORP was being implemented for two purposes: (1) to further stimulate economic growth throughout South Africa, and (2) as an ideological symbol to foster the government's apartheid policy.

1.1.1.3. Emergency Schemes under the ORP

1.1.1.3.a. The Orange-Douglas Scheme

In 1986, the DWA proposed that another three schemes be implemented under the existing ORP. These schemes were as follows: the Lower Sundays River Government Water Scheme, the Lower Fish River Government Water Scheme and the Orange-Douglas Government Water Scheme. The last two schemes were proposals that had not been mentioned before in White Papers on the ORP (RSA, 1986a:3).

The DWA stated in its 1986 report on the three schemes that: "For various reasons, such as unemployment relief, the implementation of all three schemes has been drastically advanced by the Department of Water Affairs" (RSA, 1986a:3).

Because the first two schemes are not located in the Orange River basin, only the Orange-Douglas Scheme will be discussed. Due to the shortage of water because of the drought, the Douglas Cooperative constructed an emergency scheme to supply water from the Orange River to the Douglas Weir. It was proposed, in 1986, that the state should take over the emergency scheme and expand it. This expansion was to serve an additional 4 000 ha of irrigable land near Douglas. The development of the scheme by the state was to remove the crippling debt incurred by the cooperative in constructing it. The estimated cost of the Orange-Douglas Scheme was R48 million at March 1986 prices and it was scheduled to be completed in 1992 (RSA, 1986a:4).

This was not a sudden relief plan, however. For several years, the DWA had been investigating the possibility of the development of an additional irrigable area near Douglas by means of a local scheme drawing water from the Orange River. Some of the schemes investigated also envisaged the supply of Orange River water to the scheduled areas that were dependent on supplies from the Bloemhof and Vaal Dams. The intention of this was to relieve the heavy demands on the Vaal River's water resources. By 1986, the Vaal River's water resources were already supplemented by supplies pumped at considerable cost from the Tugela River in Natal. Another reason was to improve poor socio-economic conditions at the existing Bucklands and Douglas settlements. A number of schemes were investigated and were found to be cost-effective. However, they were not immediately implemented. This was because of a lack of funds and other schemes under the ORP being given a higher priority (RSA, 1986a:18).

In the mid-1980s irrigation farmers were experiencing increased difficulties. This was firstly due to a deteriorating water quality. Secondly, water restrictions were introduced during the severe droughts of the early to mid-1980s. To overcome these difficulties the Douglas irrigators requested early in 1984 that the implementation of the proposed government scheme to supply Orange River Water to the area be expedited. Government funds were already at that time fully committed for other more crucial emergency schemes to safeguard urban and industrial supplies. The Douglas Cooperative then offered to finance an emergency scheme. This offer was based on the understanding that the costs would be repaid by means of an additional levy on the irrigators. The result was the so-called Orange-Vaal Emergency Scheme. This scheme conveyed water from the Orange River at Marksdrift to the Douglas Weir in the Vaal River. It was constructed in 6 months and commissioned in October 1984. It cost R6.6 million and was financed by the Douglas Cooperative, and partly by means of a Land Bank loan of R5.5 million (RSA, 1986a:18, 23).

This emergency scheme consists of a pumping station on the Orange River to supply water to a 22 km-long unlined canal. It had a peak capacity of six m³/s. The DWA investigated the scheme with the view to taking it over and turning it into a permanent one. The transfer of a larger area of scheduled land from the Vaal River to the Orange River supplies was possible. The water quality was also to be improved because of the Orange River's higher quality water as opposed to that of the Vaal River. Taking over the Orange-Vaal Emergency Scheme from the Douglas cooperative and the additional proposed works would cost R48 million at March 1986 prices (RSA, 1986a:18-19).

Regarding environmental impacts of the scheme, the DWA states in its 1986 report that: "The new irrigation areas that may be developed are located on fine sedimentary soils that have been deposited in the past as dune formations and have subsequently stabilised as a result of

the establishment of natural vegetation. The removal of this vegetation is likely to lead initially to increased wind erosion. Once crops are established under irrigation, this may remain a problem only in fallow areas or when lands are prepared for planting. In view of past experience in the district this is not expected to be a serious long-term problem" (RSA, 1986a:25).

1.1.1.3.b. Drought in the Eastern Cape

During 1989, Port Elizabeth like the rest of the country suffered a major drought. This drought was so severe that the return period was estimated at 200 years. The level of the main supply reservoir of the city became critical, with subsequent water restrictions imposed by the municipality. Because of this, the supply of Orange River water for the city became the last resort and an emergency scheme was designed to get water to the city in the shortest possible time. This was significant, for the ORP was to supply water to Port Elizabeth only in 1996/97 (Municipal Engineer, September 1990:53).

However, towards the end of 1989 heavy rains broke the drought with the consequence that the urgent need for an additional water supply was no longer there. Because Port Elizabeth receives much of its water from the Paul Sauer Dam (now Kouga Dam), which also serves the Gamtoos Irrigation Scheme, an agreement was reached to reduce the supply from Paul Sauer by 37 million litres per day, and to replace this shortfall from the Scheepersvlakte Dam. Port Elizabeth is the main beneficiary of water from the Scheepersvlakte Dam, part of the ORP. From the Scheepersvlakte Dam water flows to the treatment works at Nooitgedagt. A rising main conveys the water from Nooitgedagt to the Grassridge supply reservoir, and finally, by gravity from Grassridge to the Motherwell reservoir. This scheme is to supply water to Port Elizabeth until 2005; this is, if the water demand grows by 3% per year (Municipal Engineer, September 1990:53, 57).

If the city expands northwards into the Kouga Valley, the additional water demands could be met by implementing further phases of the treatment works at Nooitgedagt. It would also then be necessary to construct a low-lift scheme consisting of a second pump station at Nooitgedagt, a pipeline and service reservoir (Municipal Engineer, September 1990:53, 57). This future growth of the city into the Kouga Valley is a likely possibility, because of the development of the Kouga deep-water port.

5.11.10. The Northern Free State Water Board Scheme

In 1963, the DWA proposed the supplying of water for urban, industrial and agricultural use within the Sasolburg Magisterial District in the northern OFS. The town of Sasolburg forms the economic centre to be supplied from of the proposed scheme. Sasolburg was established when the "oil for coal" undertaking was established in the area by SASOL. Due to the development of further industries in the area, which utilise the by-products of the "oil from coal" plant, the town showed a phenomenal growth rate from 1955 to 1963 (RSA, 1963a:3).

Since its inception SASOL has drawn its water supply from the Vaal River, purifying a portion thereof for its own requirements and for use by the Sasolburg Village Board of Management.

This body was responsible for the reticulation of water to the domestic and industrial consumers in the municipal area. With the expansion of SASOL's activities, the demand for water by the factory itself has gradually increased. In 1961 Sasolburg was advised by SASOL that the Corporation would require for its own use the full capacity of its existing water supply installation during the year 1964 onwards (RSA, 1963a:3).

Under these circumstances, Sasolburg was compelled to seek an alternative source of water. The potential of the area for further industrial development was, according to DWA, in 1963, great, due to the large supplies of coal and abundant power. Investigations led to the conclusion that a regional water supply scheme, to serve the needs of both Sasolburg and the surrounding industrial area, would offer substantial advantages. The Water Act, No. 54 of 1956, provided for the establishment of statutory bodies to construct and administer such scheme and it was decided to take advantage thereof (RSA, 1963a:3).

To this end discussions between interested parties and the DWA took place in the second half of 1961 and early 1962. As a result, Proclamation No. 14 established the Northern Free State Water Board in terms of Section 108 of the Water Act of 1956. The purpose of the Board was to undertake a regional scheme of water supply for the area of the Sasolburg Magisterial District. The necessary funds to cover the Board's preliminary operations were provided by means of a loan (RSA, 1963a:3).

After consultations with the DWA, the Board approached a firm of consulting engineers to investigate a suitable project. The consulting engineers concluded that the peak water requirements of the area by 1974 would amount to 37.125 million litres per day. The Vaal River, it was concluded, would be the obvious source of supply (RSA, 1963a:4).

A scheme that was submitted for consideration by the DWA and approval by the Minister had been designed to meet the needs of the area of supply up to 1972. By extending the purification and pumping plants, it was possible to increase the capacity to 40.5 million litres per day. This would ensure an adequate supply until 1978. Afterwards, duplication of the pipelines and extensions to the purification and pumping installations would be required (RSA, 1963a:4).

The proposed scheme in 1963 comprised the following components:

- 1) Intake works, capable of abstracting 27 million litres per day from the Vaal River, and situated about 12 km downstream from the Vaal Dam and above the inflow of the Suikerbosrand River.
- 2) A 68 centimetre- (cm) diameter-pumping main to deliver raw water into a purification plant.
- 3) A purification plant capable of treating the 27 million litres of water per day.
- 4) A pump station to deliver purified water from the purification plant into the pumping main leading to the Sasolburg storage reservoir.
- 5) A 68 cm diameter-pumping main, capable of delivering 40.5 million litres of purified water per day into the storage reservoirs.
- 6) Ponds for the treatment of backwash water and sludge prior to return to the river.
- 7) The necessary buildings required for administration and operating purposes (RSA, 1963a:4).

The estimated cost of the initial scheme in 1963 was R1 461 500 and was estimated that the works were to be completed by October 1964 (RSA, 1963a:4).

5.11.11. The Krugersdrif Dam

In 1963, the DWA proposed the construction of a storage dam on the Modder River at the site known as the Krugersdrif dam site, in the district of Bloemfontein. The purpose of the dam was to stabilise the flow of the Modder River, and to provide an increased and more assured water supply to all the riparian farms along the Modder River between Krugersdrif and the confluence of the Modder and Riet Rivers. Water was also to be supplied to all riparian farms along the Lower Riet River between the Modder and Riet confluence and the inflow of the Riet to the Vaal River (RSA, 1963b:3).

Historically, the Modder River played an important role in the history of the OFS. In 1896 it became, amongst other things, Bloemfontein's source of water when a weir was built at Sannaspos and the water pumped from there to Bloemfontein. In 1904 when this waterwork could no longer cope with the demand, a weir was constructed at Mazelspoort and in 1913 the Mockes Dam was built to supplement the water supply. From time to time, these two dams were enlarged until in 1955 the government built the Rustfontein Dam on the Modder River. The purpose of this dam was to provide Bloemfontein with an assured water supply (RSA, 1963b:3).

During the period 1913 to 1917, intensive surveys were conducted on the Modder River with the view to the construction of storage dams. A superficial soil survey in 1924 brought to light that there was more irrigable land available along the river than the area for which water was available (RSA, 1963b:3).

Over the years, various attempts were made to build communal schemes. In 1918, the Upper Modder River Irrigation District was established to build a dam on the farm Waterval and then to use the water for the irrigation of about 24 000 morgen. Due to high costs the scheme was never built and in 1932 the Board was dissolved. In addition, in 1918, a petition was submitted for the establishment of the Mid-Modder River Irrigation District for constructing a weir on the Krugersdrif site. A large canal was to run from the weir to a proposed storage dam in the Kaalspruit. Yet the district was never established (RSA, 1963b:3).

In 1912, the Ritchie Irrigation District was established on the right bank of the lower Riet River. In 1963 it controlled over 68 irrigators with 113 scheduled morgen. This district is provided with water from the Riet River Government Waterworks (RSA, 1963b:3-4).

In 1939, the Scholtzburg River District was established for the control of the water in the weir that had been built there. In 1963, the Scholtzburg Irrigation Board was controlling 21 plots, which were scheduled for 560 morgen in all (RSA, 1963b:3-4).

As a temporary expedient to assist the irrigators of the lower Riet River, the Modder and Lower Riet River Irrigation District was established in 1961. The purpose of this exercise was to control the distribution of irrigation water, which was to be collected in three weirs. These weirs were still under construction by the DWA in 1963 (RSA, 1963b:4).

The Krugersdrif Dam was built to assist irrigators in the Riet and Modder Rivers, who were still pumping water from the river during the dry season for irrigation purposes. The dam's estimated cost in 1963 was R1.5 million, representing a capital expenditure of about R375 per morgen. It was envisaged that the dam would be completed in 1966, after parliamentary approval had been granted during 1963 and 1964 (RSA, 1963b:6).

In 1967, the DWA proposed that the dam be raised by 15 feet. The raising of the dam was to be brought about by installing sixteen 15-by-36-foot steel gates on the crest of the dam. This increased the estimated cost of the scheme by R2.5 million to R4 million. The date of completion was set for 1970 (RSA, 1967c:2, 3).

5.11.12. Raising of Koppies Dam

In 1963, the DWA proposed that the Koppies Dam, on the Renoster River, be raised. This dam is situated about 10 km east of the town of Koppies in the northern Free State. The DWA proposed to raise the dam by 12.5 feet to make more water available for irrigation on the Koppies and Roodepoort Irrigation Settlements. The DWA also noted, in 1963, that the dam, constructed in 1911, needed repair and reconstruction. The purpose of raising its wall was to offset siltation, which reduced much of its capacity (RSA, 1963c:3).

In 1969, the DWA requested approval from parliament for additional funds to do the work. Originally, the estimated cost for the raising of Koppies Dam was R1.5 million. Because of increased unit costs and a change of design, the cost increased to R2.1 million (RSA, 1969a:3).

5.11.13. The Mooi River Canals

The history of water resources development in the Mooi River basin is traced back to 1842. Furrows were already in place on some stretches of the riverbanks in that year. Yet the main development along the river took place after 1902. The government of the time granted certain irrigation concessions to private individuals, but these enterprises failed. The state took over the scheme and in this way the settlements of Vyfhoek and Mooibank originated. An agricultural research station was also established at that time on the town-lands of Potchefstroom and an irrigation canal was constructed (RSA, 1963d:4).

A storage dam, known as the Potchefstroom Dam, was constructed during 1908 to 1909. This was to assure a water supply for the irrigable lands downstream of Potchefstroom. Various legal proceedings were instituted from time to time regarding water allocations. This led to the passing of the Mooi River District Adjustment Act, No. 37 of 1954, the aim of which was to place irrigation in the Mooi River Irrigation District on a sound basis. This Act annulled orders made by the Water Court in 1915 and 1938 except in relation to private water, or water proclaimed to be private. It also empowered the Government to make provision for the allocation of water within the Mooi River District according to the schedule of rateable areas. The right to construct and alter works and to levy rates, as well as other incidental matters, was assigned to the government (RSA, 1963d:4-5).

In 1963, the DWA proposed betterments to the Mooi River Government Waterworks (canals). The scheme's origin can be traced back to 1955. During the parliamentary session of 1955 to 1956, a sum of R890 000 was voted for the construction of the Boskop Dam on the Mooi River. During 1961 and 1962, this sum was increased to R920 000 to provide for the cost of building a house for the water bailiff and of fencing the dam and for unforeseen servitude expenditure. During 1957 to 1958, it was decided that the canal system downstream of the dam would be improved by constructing new concrete-lined canals to place irrigation in the Mooi River District on a "sound footing". The sum of R1.5 million, which was voted for this purpose, was increased during 1960 and 1961 to R2.2 million to provide for the improvement of all canals along the Mooi River and the canal system on the Mooibank settlement (RSA, 1963d:3; RSA, 1966a:2).

When these canals were built, it was found that, to protect the Mooibank settlement, it would be essential to build a drainage canal past the settlement. This canal was capable of discharging 3 000 cusecs of stormwater and cost R300 000. Yet unforeseen stretches of pipeline had to be laid through the built-up area and to the airport. This involved another R150 000. In 1963, it was proposed in addition that the canals of the Upper Mooi River be rebuilt and lined with concrete, at an estimated cost of R600 000 (RSA, 1963d:3).

To stabilise the flow of the Mooi River was the original purpose of the scheme. This was to assure a greater and more assured water supply for existing (1963) development within the Mooi River Irrigation District. In the early 1960s, above Boskop Dam, the downstream riparian owners often experienced water shortages. This was due to poor canals, the slight fall of the river and high evaporation losses from the wetlands. Between the confluence of the Mooiriviersloop and Boskop Dam, adequate water supplies were available. These water supplies were due to strong springs at Turffontein and Gerhardminnebron. However, the canal was in a poor condition and caused water logging. In light of the unsatisfactory state and the resulting waste of water, it was intended that the canal system be improved and lined with concrete. The estimated cost of the betterments in 1963 was R600 000 (RSA, 1963d:3).

5.11.14. The Klipdrift Government Waterwork

In 1908, representations were made to the then Department of Irrigation for the construction of a storage dam on the Loopspruit, on the farm Klipdrift. The purpose of the project was to irrigate land on the farms Klipdrift, Nooitgedacht, and Teviotdale. The Loopspruit rises north of the town of Fochville. At the Klipdrift Dam, it meets with the Enselspruit and eventually joins the Mooi River, a tributary of the Vaal River, near Potchefstroom (RSA, 1964b:2).

After lengthy negotiations, the government bought the irrigable land below the dam in 1912, together with 68 morgen of Klipdrift, the latter to make provision for the storage of water in the Klipdrift Dam. After approval had been obtained from parliament, a contractor started with work early in 1913 on the 40-foot high earth wall. The dam, with a storage capacity of 4 370 morgen-feet, and earth canals on both banks of the Loopspruit, was completed in 1917 at a cost of just under R200 000 (RSA, 1964b:2).

The irrigable land below the dam was sub-divided by the Department of Lands into plots of 15 to 25 morgen. These plots were allotted to settlers subject to the terms and conditions

contained in Proclamation No. 388 of 1918. A number of ex-combatants from the First World War also settled there (RSA, 1964b:2).

In terms of the Klipdrift Settlement Act, No. 23 of 1947, the Klipdrift Settlement Board of Management was established. In terms of Section 4 of the Act, the control and maintenance of the irrigation works was vested in the Management Board. Due to excessive water losses in the earth canals the Management Board applied to the government in 1947 and again in 1954 to line the canals with concrete (RSA, 1964b:2).

In 1960, an amount of R200 000 was voted for the concrete lining of the canals of the Klipdrift Settlement. The work was undertaken as a government waterwork with control and administration vested in the Department of Water Affairs. Yet certain powers were delegated to the Klipdrift Settlement Board of Management for the general administration and maintenance of the work (RSA, 1964b:2, 4).

5.11.15. The Vaal-Gamagara Water Supply Scheme

In 1964, the DWA proposed to parliament to implement a scheme to pump water from the Vaal River near Delpoortshoop, and to distribute the water along the railway line to Postmasburg and further northwards to the Gamagara Valley. Here expanded development was taking place due to the development of mines (RSA, 1964c:2).

The first phase of the project involved the supply of water up to the new Finsch Diamond Mine. This mine required, in 1964, 6.75 million litres of water per day, for a working week of six days, to start diamond production. The South African Railways Administration also needed water, especially at Arriesfontein, where considerable shortages of water were experienced (RSA, 1964c:2).

The first phase consisted of a pumping station and purification plant at Delpoortshoop on the Vaal River, and a rising main consisting of about 100 km of steel pressure pipes, and three inter-stage booster pumps. The pipeline ends at a reservoir near Clifton. From here, the water is distributed to the mine by means of a gravity pipeline. In the second phase and subsequent phases, water was to be supplied from Clifton by gravity to more remote parts. The towns of Postmasburg and Olifantshoek were also to receive water from the scheme in later phases. The cost of the first phase was estimated at R2.8 million (RSA, 1964c:2, 4).

In 1966, parliament approved an additional amount of R1 550 000 to cover increased costs. The same happened in 1969, when parliament approved an additional amount of R900 000 to cover increased costs of the first phase of the project, as well as the second phase of the scheme, to increase the storage capacity of reservoirs (costing an estimated R260 000). Again, in 1972 parliament approved an additional amount of R1 750 000 to cover increase costs and also to raise the delivery capacity of both the purification works and the pump stations from 11 800 m³ per 20-hour pumping day to 30 300 m³ per 20-hour pumping day. In 1971, the third phase of the scheme was approved. A sum of R10 million was voted for the third phase to increase the combined delivery capacity of the rising mains between the Vaal River and Clifton to 60 000 m³ per 20-hour pumping day. Constructing a second rising main accomplished this. Work on the third phase started in 1974 and was completed by 1976. In 1974, the DWA requested approval by parliament for an additional amount of R3.5 million to

complete the second phase, and in 1976 another R8 million was sought to complete the scheme (RSA, 1974a:3-4; RSA, 1976a:2).

This first amount of R3.5 million was requested for the following reasons:

1. The design capacity of the gravitation pipelines had been increased. The resulting enlargement of pipe diameters brought about an increase in cost;
2. Since 1969, there had been two statutory increases in the price of steel. The cost of labour, building materials and fuel had also increased (RSA, 1974a:9).

Reasons for the additional R8 million were, *inter alia*, increases in the cost of labour, construction materials and fuel. In 1978, the DWA requested from parliament another R8.5 million. This increased the cost of the scheme to a total of R45 million by that year (RSA, 1976a:11; RSA, 1978a:3).

In the 1978 revised budget for the scheme R45 million was set aside. The total estimated cost for the scheme, at September 1980 prices, was put at R51.5 million (RSA, 1981a:3).

In 1981, the Department of Water Affairs, Forestry and Environmental Conservation (DWA FEC) proposed to increase the yield of the existing Vaal-Gamagara Government Regional Water Supply Scheme. The proposals comprised extensions to the abstraction works, purification works and high-pressure pumps at the Vaal River. Extensions were also proposed to the two intermediate pumping stations at Kneukel and Trewil. This was to increase their pumping capacity. The design capacity of the purification works was to be increased from 36 370 m³/d to 54 600 m³/d. This increase was sufficient to meet the demand until 1984 (RSA, 1981a:3).

The maximum carrying capacity of the pipeline between Roscoe and Sishen was to be increased from the existing 31 600 m³/d to 52 500 m³/d; sufficient until the year 2000. To provide enough storage for the increased capacity of the scheme, it was proposed that the storage capacity at Gloucester and Black Rock reservoirs be increased by 13 700 m³ and 2 500 m³ respectively (RSA, 1981a:3).

The reason for the extension of the scheme was decreases in the abstraction of groundwater resources at Olifantshoek and Black Rock. It was estimated that these yields would start to decrease from the second half of 1981. Regarding these decreases, DWA FEC stated that: "In this report it is assumed that the Vaal River will start to augment the water supply to the northern section of the scheme from 1983 and that all water except for the safe yield of the underground sources, which is taken as 5 [million cubic metres] per year, will from 1984 be supplied out of the Vaal River. It is thus planned to start the works in 1982-'83 and to complete them in 1984-'85. The additional storage at Black Rock, however, is required to operate the scheme efficiently and the works on the additional storage will have to be started in 1981-'82. Calculated on this basis, the cost of water from the scheme is estimated at 55,06 cents per m³" (RSA, 1981a:3-4).

Regarding the impact on the environment, DWA FEC stated that: "The proposed works are extensions of existing works and will be carried out on the sites of existing works. There will therefore be no additional detrimental effects on the environment. (RSA, 1981a:17).

5.11.16. The Kakamas Government Waterwork

In 1965, the DWA proposed that the existing canal system of the Kakamas Government Waterwork be improved. The history of the Kakamas Government Waterwork, after 1908, will be summarised briefly. In 1908, after the Dutch Reformed Church had obtained certain farms on the north bank of the Orange River, a start was made with the construction of the North Furrow. Two tunnels, 300 and 600 feet long, were constructed as well as two syphons 21 and 27 inches in diameter, to supply Drift Island and Paarden Island with water (RSA, 1965b:2).

Subsequent to the establishment of the Union of South Africa in 1910, state financial aid, in the form of loans, was granted to the settlement for the construction of canals and betterment works and a total amount of R95 250 was made available. At the end of 1914, some 340 settlers had already been placed on the Kakamas settlement. Thereafter the canal to Renosterkop Island was constructed and, by 1930, the number of plots had increased to 600 (RSA, 1965b:2).

The proposal to improve the works came after the government took over the scheme from the Dutch Reformed Church. However, these improved works were never implemented, due to a lack of government funds. Uncertainty about the degree to which the existing waterworks would be affected by the supply of water for irrigation expansion at a level above the existing development was a second reason. A construction organisation was only established in Kakamas in 1984 (RSA, 1988:3-4).

This was after the proposed improvements had been investigated in 1975. At that time, the estimated cost of the improvements was put at R9 million. In 1985, the costs increased to R36 million (RSA, 1988:3, 4).

Investigations into the feasibility of additional irrigation expansion revealed that about 5 800 ha of land could be developed. The water supply was to be augmented by enlarging portions of the three existing feeder canals at higher levels. The three feeder canals were therefore to be rebuilt. These betterments were to improve the water supply and drainage of the scheme (RSA, 1988:4).

Environmental impacts were to be "slight". "The addition of a larger weir at Neusberg can possibly aggravate the problems caused by excessive reed growth in the river and the River Gnat (*Simuliidae*), which breeds in fast flowing waters in this area. In order to contain the latter, provision will be made in the design to control the flow over the weir. The two existing tunnels in the North Furrow are of historical value because they were largely excavated by hand during the building of the scheme at the beginning of the century. According to proposals made in this report, the capacity of these tunnels should be increased. The intention is to limit alterations to the visible section of the tunnels to a minimum and to establish liaison with representatives of the local community in order to ensure that the proposed alterations are acceptable" (RSA, 1988:15-16).

In 1989, the DWA proposed that the Kakamas Government Water Scheme be extended. It was proposed that 5 600 ha of irrigable land adjacent to the existing scheme be developed in

phases over a period 1989 to 1997. This 5 600 ha was to be divided into 140 plots. On this land, the cultivation of sultanas was the primary objective (RSA, 1989a:3).

Other reasons for extension were also cited by the DWA:

- The further development of the scheme is attractive from an economic point of view.
- The South African Dried Fruit Board needed to produce more sultana raisins to supply overseas markets, and therefore largely stabilise existing trade.
- The proposed development also offered attractive advantages from a socio-economic viewpoint. Almost 600 temporary jobs during construction and 1 800 permanent jobs on completion of the project were to be made available.
- The settlement of a number of coloured farmers on a portion of the proposed development, whereby the foundation was to be laid for a prosperous coloured farming community, was also envisaged (RSA, 1989a:3).

Sultana raisin cultivation, like sugar-cane production in the Maputo River, was therefore the main driving force behind the proposed scheme. The largest part of the raisins marketed annually for both inland and export markets had already, by the late 1980s, being produced in the Lower Orange River Valley. The climatic condition for sultana production is a favouring factor, as well as the availability of irrigation potential. The area also had a well-established infrastructure and adequate water resources from the Orange River (RSA, 1989a:4).

The proposed works, according to the DWA, was to have a negligible impact on the environment. The reason for this was that the water was to be abstracted from existing canals and was to be utilised for development within a relatively limited area, which was not ecologically sensitive. The total cost of the works was estimated at R110 million at March 1989 prices and at R254 million should a cost escalation of 15% per year be calculated during the construction period. Construction started during 1989, but on a limited scale only. This was to allow for the phased introduction of the scheme and it was projected to be completed by 1997 (RSA, 1989a:19, 4).

5.11.17. The Oppermansdrift Dam

In 1965, the DWA proposed the construction of the Oppermansdrift Dam (now Bloemhof Dam) in the Vaal River, about two kilometres upstream from the town of Bloemhof. The purpose of the dam, as envisaged by the DWA, was to control the larger volume of the flow arising from the catchment area below Vaal Dam and to make it available for use to achieve increased utilisation of the waters of the Vaal River as a whole (RSA, 1965c:2).

The rationale behind the proposed construction of the dam was as follows:

1. It had become essential to augment the assured yield from the Vaal River within the next five years (1965 to 1970). The development of the source should be capable of delivering the required additional water on completion. In 1965, the DWA estimated that the present demand of water by all consumers (in morgen feet) was 458 000. For 1970 it was estimated to be 514 000 morgen feet, 1975, 568 000, and in 1985, 680 000;

2. After the completion of the Oppermansdrift Dam, it was envisaged that it should be capable of delivering sufficient additional water to allow adequate time for detailed planning and the construction of the subsequent units (dams, etc.) in later stages of the development of the water resources of the Vaal River; and
3. Any project now (1965) undertaken must fit in with the development pattern for the Vaal River as a whole and the storage dam must be sited in such a way that all consumers derived the maximum benefit from it. The cost of delivered water must also be as low as possible (RSA, 1965c:4, 5).

The dam was to be constructed at an estimated cost of R8.6 million. In 1967, the construction of the dam was approved by parliament as well as a sum of R10.5 million for its construction (RSA, 1965c:7; RSA, 1969b:3).

However, as regards the cost of construction, the DWA requested approval by parliament in 1969 for another R1.5 million. The reasons for this were as follows:

1. The actual contract price for the bridge and bridge approaches across the basin on the Bloemhof-Hoopstad road and the relevant consultant's fee amounted to R1.8 million as against the estimated figure of R1.5 million in 1965;
2. The original estimate for road, power line and telephone line deviations was increased by R685 000;
3. The estimated cost for the dam was increased by R473 000 due to the difficulties experienced with the excavation work for the earth embankment and apron;
4. The cost of additional concrete work, due to the excessive overbreaking of the tillite rock in the region where the apron was to be constructed, amounted to R600 000;
5. The actual total excavation for the earth embankment also exceeded the original estimate of 2 million cubic yards by 0.25 million yards. The revised estimate of extra cost of excavation and earth fill was R1.3 million (RSA, 1969b:3-4).

5.11.18. The Upington Island Scheme

The area affected by the Upington Island Scheme extends from 17 km east to 14 km west of Upington. The middle of the Orange River forms the boundary between the Divisional Council Districts of Gordonia in the north and Kenhardt in the south (RSA, 1966b:3).

Irrigation farming in this area started as early as 1883, when the Upington Canal was constructed. In due course, a large number of diversion weirs in the Orange River were constructed and canals were dug to irrigate the "fertile alluvial soils". As the number of irrigators increased, problems arose regarding the maintenance, water distribution from, extension and general administration of the canal systems and five irrigation boards and a settlement management board were established in the area (RSA, 1966b:2).

In 1966, the DWA proposed a project for the betterment and extension of a group of irrigation schemes in the area. This work comprised the replacement of various independent weirs and canal systems by a single weir and a concrete-lined canal, and integrated improved distribution canals and drainage systems (RSA, 1966b:2).

A number of irrigation districts and settlements were already in place by 1966, when the DWA proposed the works. These districts were either affected or unaffected by the proposed project. They were as follows:

1. The Upington Irrigation District;
2. The Straussburg Irrigation District established in 1925;
3. Olyvenhouts Drift, Swartkop Island, Kalksluit and Klippunt Settlements;
4. Louisevale Irrigation District, proclaimed in 1918;
5. Blaauwsekop Irrigation District, proclaimed in 1943;
6. Steynsvoor Irrigation District, proclaimed in 1939;
7. The Curries Camp and Geelkop Coloured Settlement; and
8. The Eksteenskuil Coloured Settlement (RSA, 1966b:2-6).

The advantages of the proposed works, as set out by the DWA, were as follows:

- Replacement of insufficient works: the flow in many of the canals varied and was often inadequate. This made the distribution of water unsatisfactory. Put more strongly, the canal intakes could not even function during the lesser floods in the Orange River. The canals were also constructed at an insufficient gradient, and had to be cleaned at great cost, which made the canal inoperable for a number of weeks. There was, in many cases, no provision made for stormwater drainage and during rains the canals had to be shut off to prevent them from eroding. Because of this, many of the fields were inundated with water during heavy rains.
- Expansion of existing development: The capacity of the canals was adequate for only 1 770 morgen. This was to be increased by the new works to 7 260 morgen.
- Improved efficiency of irrigation duty of canals: the irrigation duty of the planned canals was to be more efficient than the old ones.
- Reducing brackish conditions: the new concrete-lined canals would reduce the occurrence of brack.
- Modernising stormwater drainage: the proposed main drains would also form the key works to which modern stormwater drains can be connected. This would eliminate the flooding of cultivated land by rainwater.
- Improved control of the distribution of available water: because the water for all the settlements would be delivered from one diversion weir in the river and, as the water would flow in concrete-line canals, losses would be reduced and it would be possible to exercise better control over the abstraction and distribution of water from the river (RSA, 1966b:9).

The estimated cost of the project in 1965 was R9.2 million. The DWA stated, as was the case with expensive government irrigation works, that: "In accordance with the accepted policy of subsidising irrigation schemes which, as a result of increased production, benefit the country both directly and indirectly, it is not intended that the irrigators should repay the full cost of the scheme". However, and again in the case of this expensive irrigation projects, a R10 levy was to be paid per morgen per annum. This assured, in the case of the Upington Island Scheme, a capital amount return over 30 years of R1 116 370 (RSA, 1966b:10).

In the case of relatively inexpensive irrigation works undertaken by an irrigation board that administered and controlled a scheme, money had to be borrowed from government and loans repaid.

Once again, in 1974, the DWA reported to parliament that the cost of the scheme had increased substantially, "*as on all other schemes*" (the ORP included) (emphasis added). The DWA therefore sought approval for an increase of R1.3 million "in total expenditure to R10.5 million". This increase was to cover the costs of completing the major portions of the scheme. The increase in the cost was mainly due to an increase in construction costs (RSA, 1974b:3; RSA, 1974c:2).

Other reasons for this increase in cost were the following:

1. The original estimate was based on a construction period of about 5 years with an expenditure of about R900 000 per year. Owing to "financial stringencies", funds could not be provided at this rate. The DWA also had important construction programmes at Buchberg, Kakamas, and after January 1969 at Noord-Oranje. This meant that the detailed average expenditure had been about R630 000 over the seven years before 1974. The DWA said that the construction period of the scheme would be extended to about 10 years. As a consequence, administration and overhead expenses were higher for the unit of work completed;
2. While provision was made in the original estimates for the normal annual increases in wages, the actual increases both in wages and allowances during the construction period had been "very much higher than provided for";
3. There had also been large increases in the cost of materials, equipment, rail tariffs and transport costs (RSA, 1974b:10).

The government, in spite of the increase in costs to the irrigation schemes, did not withdraw from subsidising irrigation projects, because it still saw these schemes as benefiting "the country both directly and indirectly". The irrigators, therefore, were exempted from repaying the full cost of the scheme (RSA, 1974b:11).

In 1976, the DWA proposed that the scheme be expanded and that another R2.5 million be allocated to the estimated cost. This was to raise the estimated cost from R10.5 million to R13 million (RSA, 1976b:3).

Similarly, in 1979 the DWA proposed that certain betterments be added to the scheme, and that the group of irrigation schemes be consolidated, the purpose of which was to increase the water supply capacity. It was estimated that these betterments and consolidation was to increase the cost of the scheme from R13 million to R22.4 million (RSA, 1979a:3).

Apart from the increasing water supply capacity of the scheme the DWA also cited other benefits:

- Reduction of water losses in the canals and lower maintenance costs; a safer system in times of floods;
- Less water-logging and therefore greater productivity;
- Easy system to control and administer; and

- A system that will allow for greater sophistication in irrigation methods (RSA, 1979a:20).

5.11.19. The Vaal Dam Ancillary Pipeline

In 1966, the DWA proposed the laying of a pipeline from the existing outlets at the Vaal Dam (previously Vaalbank Dam), to convey water for use by the RWB. The pipeline was to form the link between the Vaal Dam outlets and the Rand Water Board's pipeline. This pipeline had been constructed for the following reasons:

1. By taking its supply of water at the boundary fence of the DWA's reserve at Vaal Dam, the RWB would save 105 feet of pumping head. Before the construction of the pipeline, the RWB abstracted its water from the Vaal River Barrage near Vereeniging and then pumped it to its Suikerbosch purification plant.
2. The water supply obtained would be of a better quality, because pollution by the Klip and Suikerboschrand Rivers, which affects the water quality in the Barrage negatively, would be eliminated (RSA, 1966c:3).

The length of the pipeline is 5 700 feet and the estimated cost in 1965 was R400 000. The DWA did not propose to levy an additional rate on water supplied to the RWB to cover the. Furthermore, the control and administration of the ancillary pipeline was to be vested in the DWA (RSA, 1966c:4).

5.11.20. The OFS. Goldfields Water Extension Scheme

In 1966, the DWA proposed the construction of pumping stations, pipelines and terminal reservoirs for supplying a number of Western Transvaal (now North West Province) towns with water. These towns were as follows: Leeudoringstad, Witpoort, Wolmaransstad, Makwassie and Ottosdal. Purified water was to be supplied to these towns from the purification plant of the OFS Goldfields Government Water Scheme (now Sedibeng Water), situated at Balkfontein near Bothaville in the OFS. The DWA furthermore proposed the construction of an ancillary pipeline to provide the town of Wesselsbron with supplementary water from the Department's ring main (RSA, 1966d:3).

The main purpose of the project was to alleviate the water shortages experienced in these towns. The boreholes and the reservoirs gave an insufficient amount of water, and could not be relied upon for further development. The extension plan was, according to the DWA, the best solution to the problem. These water shortages were caused by population growth within those towns (RSA, 1966d:5).

From the estimates of the DWA regarding the water requirements per person, the manifestation of South Africa's apartheid policy is clearly seen. In the White Paper of 1966, the following was said about water requirements: "In estimating future water requirements the increase in population has been taken into account as well as the fact that the unit consumption per person, which at present varies from 22½ gallons per day for a White person in the case of Makwassie to 57½ gallons a day for a White person in the case of Wolmaransstad and which overall comes to 2½ gallons a day for a non-White person, will also increase with the passage of time. For estimating purposes a unit consumption of 50

gallons a day for a White person in the case of the smaller communities and 60 gallons a day for a White person in the case of Wolmaransstad and Wesselsbron has been adopted. A unit consumption of 20 gallons a day per non-White person is used for planning purposes" (RSA, 1966d:5-6). Thus, even where water was concerned, as with jobs, other scarce material, and non-material resources, the white sector of South African society received the lion's share of water.

Even so, the plan was to extend the O.F.S. Goldfields Government Water Scheme. This scheme came into being in consequence of the development of the gold mines in the Orange Free State during the 1940s. In February 1950, the first supply of purified water from the Vaal River was delivered. The rate of delivery at that time was 2.2 million litres per day. The works were enlarged in stages and by 1958 the supply potential would have reached 72 million litres per day. Uranium production, however, caused an increased demand for water and after the Gold Producers Committee had submitted a revised estimate of water requirements it was decided to expand the scheme to its supply capacity of 216 million litres in 1966 (RSA, 1966d:6).

However, the average daily consumption of water never reached the figure expected by the committee. The reasons for this were as follows:

1. The uranium industry was a new undertaking for which no reliable figures for water consumption were available.
2. Initially it was thought that the underground water pumped by the mines from their pumping shafts would not be suitable for the processes involved in treating the ore owing to chemical impurities. Yet in 1966, the mines were making use of this water.

Thus, the daily demand for purified water to the goldfields in 1966 was 112.5 million litres per day. This left a reserve supply capacity of 103.5 million litres per day. The DWA stated in its White Paper tabled before parliament that: "It is therefore possible to utilise this reserve for the expansions proposed . . ." (RSA, 1966d:6).

The extension project had to deliver water for the expected needs for a period of 20 years after completion. It was estimated to cost in the region of R1 385 000 (RSA, 1966d:6, 8).

5.11.21. Extension of Buchuberg-Karos Scheme

The Buchuberg-Karos Government Water Scheme consists of the Buchuberg Dam across the Orange River, and the 171 km-long main canal on the south bank of the river, to the farm Karos. Part of the scheme is a branch canal and siphon, which conveys water across the river to the Gariep settlement on the north bank. At the extreme end of the canal, there is another siphon which supplies water to the Rouxville West Irrigation District situated on islands in the river (RSA, 1967b:2).

In 1967, the DWA was extending the main canal to a capacity of 345 cusecs (from 315) by raising the sides of the concrete lining to increase the supply of water to Gariep to 48 cusecs. This was also done to ensure a duty of one cusec per 22.5 morgen for irrigated land throughout the scheme so that irrigators could draw their full requirements during daylight hours. The DWA requested funds of R200 000 from parliament for the continuation of the

work, as well as for the concrete lining of the first 10 km of the main canal, which was never lined between 1953 and 1961. In its proposal the DWA also called for the construction of a siphon to the north bank below Buchuberg Dam as originally planned in 1934. The siphon was to supply water to the Noord-Oranje Estate and the farm Rooisand with water from the Buchuberg main canal (RSA, 1967b:2, 4).

5.11.22. Heilbron's Water Supply

During the 1968 session of parliament, the DWA submitted a report (number W.P. HH-'68) in which the department proposed to implement a water supply scheme to supply Heilbron (a town in the northern Free State) with water. It was proposed that a pipeline be laid from a point below the wall of the Vaal Dam to Heilbron. The report also mentioned that a purification plant should be constructed some time in the future. This plant was to be situated on a site at the intake works (RSA, 1972a:2).

In 1972, the DWA asked for parliamentary approval for the construction of the purification plant. The expected cost was in the region of R550 000. Approval was also sought for an additional amount of R250 000 "over and above the amount of R600 000 already approved for the construction of the pipeline to Heilbron". The total estimated cost of the pipeline therefore increased to R850 000. This was mainly due to the sharp rise in construction costs (RSA, 1972a:2).

Before 1972, the town got its water supply from the municipal Unieffes Dam, constructed in the Elandspruit, a tributary of the Renoster River. A spring below the dam and about 25 boreholes provided additional water to the town. The assured supply of water from Heilbron's source was 730 m³ per day. The pipeline was to give a more assured supply of water to the town. This supply was necessary because of the increase in water use by the town's population. What is also of interest is that the pipeline was also to supply water to the town of Deneyville, situated near the Vaal Dam's wall (RSA, 1972a:3).

5.11.23. Water Supplied to Mafeking

In 1968, the DWA proposed the Government Water Scheme for Mafeking. This scheme was to supply water to Mafeking and the adjoining black township with water from dolomitic sources located to the east of the town. The rationale behind the scheme was that Mafeking was becoming increasingly important for the following reasons:

1. It was an important administrative and railway centre on the main line from the Cape to Botswana and Rhodesia (now Zimbabwe), situated only 25 km from Ramathlabama on the Botswana border;
2. It was the railway junction where the Johannesburg-Mafeking line connected with the Cape-Rhodesia line; and
3. It was the administrative centre for the Tswana homelands (RSA, 1968b:3).

Water to Mafeking was originally supplied from a borehole and from the Malelane Springs to the north of the town. These supplies were, however, inadequate and unreliable. The only other nearby reliable source of water was the Grootfontein, a strong dolomitic "eye" or spring.

situated on the boundary between the farms Grootfontein and Valleifontein, in the Marico district (RSA, 1968b:3). Investigations showed that it was technically and economically feasible to supply Mafeking with water from the Grootfontein, but that Mafeking had no legal right to the water (RSA, 1968b:3).

Water from the Grootfontein Spring has been used for irrigation from the end of the nineteenth century. Increasing demands on the flow of the eye led in due course to an application to the Water Court for an apportionment of the flow. In a water order of 3 August 1915, the flow of the spring was apportioned as follows:

1. One half share to the farm Valleifontein;
2. One quarter share to the farm Grootfontein; and
3. One-quarter share to the "dispute furrow" (RSA, 1968b:3).

In order to obtain water from the Grootfontein spring the municipality of Mafeking sought legal authority to that end. The necessary powers were approved by parliament through Private Act No. 13 of 1932. The intention of this Act was "to provide for a supply of water from the Grootfontein Eye for the Municipality of Mafeking and to confer power upon the said Municipality in relation thereto" (RSA, 1968b:3).

The Act empowered the Municipality to purchase and expropriate land entitled to water from the Grootfontein Spring and to convey the appropriate share of water so acquired to Mafeking for sale and distribution. The farm Valleifontein over the years became extensively subdivided. By 1968, the Municipality had succeeded in buying out all but six of the subdivisions. It therefore required rights to 65.5% of the total flow of the spring. The remaining rights were held by landowners on Valleifontein (9.5%) and landowners on Grootfontein (25%) (RSA, 1968b:4).

Section 3 (b) of Act No. 13 of 1932 provides for the following: "the Municipality shall not be entitled to use any artificial or other means whereby the natural flow of the Grootfontein Eye may be increased nor to sink any borehole on any portion of the said farms Grootfontein and Valleifontein" (RSA, 1968b:4).

Before 1968, certain owners have drilled boreholes within the dolomitic compartment of the Grootfontein Eye and have pumped out large quantities of water for irrigation. This large-scale abstraction reduced the flow from the spring and depleted the supply to Mafeking. During the long drought of the mid-1960s, which resulted in reduced flows from the Grootfontein Eye at the end of 1966, it became necessary to authorise the Municipality to draw on the underground storage to supplement its share of the flow from the spring during periods of shortage (RSA, 1968b:4).

To legalise such a practise in the future and to provide for other conditions and changes that had arisen since Act No. 13 of 1932 was promulgated, amendments to the latter Act were approved by parliament and embodied in Act No. 73 of 1967. Section 3 (b) of Act No. 13 of 1932 then read as follows: "The Municipality shall not be entitled to use any artificial or other means whereby the natural flow of the Grootfontein may be increased but shall, subject to the provisions of the agreement concluded between the Municipality and the Roux family on the 10th May, 1967, be entitled to sink and utilize any borehole on any portion of the said farms

Grootfontein and Valleifontein presently owned or hereafter acquired by the Municipality" (RSA, 1968b:4).

To prevent the exhaustion of the groundwater supply and the drying up of the dolomitic springs and boreholes dependent on the Grootfontein dolomitic compartment, the DWA, in terms of Sections 28 and 30 of the Water Act, Act No. 54 of 1956, found it necessary to apply regulations controlling the drilling of boreholes and the abstraction of underground water (RSA, 1968b:4).

The Grootfontein Spring has been gauged intermittently from 1897 to 1958. Owing to the increased abstraction from the dolomitic compartment for irrigation and other usage, before 1968, the flow of the spring has decreased progressively. In January 1967, the minimum flow of the Grootfontein Eye was 2.25 cusecs or 5.49 million litres per day. The quantity of water available to Mafeking was 1.47 cusecs or 3.6 million litres per day. This was insufficient to meet the needs of Mafeking and of the Department of Bantu Administration and Development in the immediate vicinity of the town. The DWA argued in 1968 that: "... if all rights to the flow of the Grootfontein could be acquired for town use and no water was used for irrigation, the total minimum flow of the Grootfontein Eye, namely 1.22 million gallons [5.49 million litres] per day, would be available to Mafeking. By occasionally pumping from the underground storage to a slight extent, during dry years, and without causing a significant drop in the water table, this supply could probably be increased to 2 million gallons [9 million litres] per day . . . It would, of course, be necessary to ensure simultaneously that other abstractions in the Grootfontein dolomitic compartment are kept within bounds" (RSA, 1968b:4-5).

The DWA calculated the water requirements of the Municipality of Mafeking and the Department of Bantu Administration and Development as follows:

The present (1968) population of Mafeking:

Whites.....	5 000
Coloureds.....	1 300
Indians.....	200
Total.....	6 500

The immediate water requirements were estimated as follows:

Whites, 5 000 at 270 litres per day per capita.....	1.35 million litres per day
Coloureds and Indians, 1 500 at 112.5 litres per day per capita.....	168,759 litres per day
S.A. Railways.....	900 000 litres per day
Departmental and other users.....	101,250 litres per day
Total.....	2 520 000 litres per day

In 1968, the water requirements for the Department of Bantu Administration and Development were estimated as follows:

Black township	675 000 litres per day
Department of Bantu Administration.....	225 000 litres per day
Black hospital, with 1 800 beds.....	1 125 000 litres per day
Total.....	2 025 000 litres per day

Thus, the total water requirements of the Municipality of Mafeking, and the Department of Bantu Administration and Development for black requirements amounted to 4 545 000 litres per day, with an estimated peak requirement of 6 750 000 litres per day in 1968 (RSA, 1968b:5-6).

Future estimates were also made in 1968. The DWA estimated that the water requirements by 1975 of the Municipality and of the Department of Bantu Administration and Development would be 7 542 000 litres per day. The establishment of a territorial headquarters for the Tswana ethnical group would depend on adequate water supplies, according to the DWA in 1968. In that year it was estimated that Mafeking and its environs would require a peak demand of 18 million litres per day by 1980 and 22.5 million litres per day by 1990 (RSA, 1968b:6).

Additional water was therefore sought elsewhere. The DWA proposed that a further 9 million litres per day be abstracted from the Molopo Eye. In 1968 the DWA also stated that: "Water ultimately required beyond the capacity of these two sources will have to be brought on from an external source" (RSA, 1968b:6).

The Molopo Eye is a dolomitic spring at the source of the Molopo River, a tributary of the Orange River. Around 1905 the owner of the land on which the eye is situated constructed an earthen dam across the river below the eye to create a large pool and a holiday resort was developed there. Two furrows were excavated from either end of the dam of irrigating land on both banks of the river. However, the furrows leaked and a small area of land was irrigated. The area was so small that it was of insignificant economic value. Furthermore, water rarely flows down the Molopo River. Before 1968, there was some flow during the period 1955 to 1957 and again following heavy rains early in 1967 (RSA, 1968b:7).

The DWA, to augment the water supply of Mafeking and environs, proposed that to develop the local water resources the following steps should be taken:

1. Acquire the water rights of remaining owners at Grootfontein, which would then provide for a total assured supply of 9 million litres per day from that source;
2. Acquire the water rights to the Molopo Eye, make the necessary land purchases and convey water to Grootfontein, and then to Mafeking. This would provide another 9 million litres per day (RSA, 1968b:7).

It was proposed that, in order to do this, a pumping unit and pump-house situated at the Molopo eye be constructed. From there, the water would be pumped to a 22.5 million litre capacity reservoir. Water would then be gravitated from the reservoir to the Grootfontein eye. The gravitation main would be connected to the existing pipelines leading from the Grootfontein eye to Mafeking. The estimated cost of the scheme was R1.5 million and was to be completed in 1970 (RSA, 1968b:7-8).

In 1977, it was envisaged that the growth rate of the urban water requirements of the Mafikeng area would increase. This was due to Bophuthatswana's independence in 1977 and the development of the homeland's capital (Mmabatho) to the north of Mafikeng. In this regard, the Department of Environment Affairs (DEA) states in its 1984 report that: "This increase in water demand would have placed a great financial burden on Mafikeng and since the water would be supplied to another state as well, it was deemed desirable that the water supply scheme should become a Government Water Scheme so that negotiations on the matter of water supply could be conducted at an international level and between equal parties". It was therefore proposed in 1977 that the water supply scheme be enlarged by the take-over of the Town Council's existing works and of the extensions under construction. The works were taken over and the scheme became known as the Upper Molopo Government Regional Water Supply Scheme (RSA, 1984a:4).

In 1984, the DEA proposed that the scheme be built. This was after the water supply to Mafikeng/Mmabatho in Bophuthatswana from the Grootfontein eye became inadequate. The total costs of the scheme at March 1983 prices were estimated at R7.57 million. South Africa was to be responsible for financing only such portions of the scheme within its territory. The implementation of the scheme was an outstanding obligation of South Africa to Bophuthatswana. The Republic was therefore responsible for the costs as far as the border. No serious impacts on the environment were foreseen by the DEA. This was mainly due to the laying of the pipeline underground (RSA, 1984a:3, 4, 11).

When Mafikeng was incorporated into Bophuthatswana, all the works falling within Bophuthatswana were assigned to the Bophuthatswana Government. "By agreement between the two countries the scheme is operated mainly by South Africa. The costs related to this are being redeemed out of the revenue from the water sales to Bophuthatswana" (RSA, 1984a:4).

5.11.24. The Spitskop Dam

In 1968, the DWA proposed the construction of the Spitskop Dam on the Hartz River, in the district of Barkly West, in the Cape Province (now Northern Cape Province). The dam site is located at the lower end of the Vaal-Hartz Government Irrigation Scheme (the largest irrigation scheme in South Africa). Because of the inundation of properties, negotiations had to be entered into between the DWA and the Department of Bantu Administration and Development, regarding the affected land in the Mammutla and Mayeng Reserves (RSA, 1968c:3; RSA, 1976c:3).

The proposed dam would impact on the natural flow of the Hartz River and on the seepage water reaching the river from the Vaal-Hartz Scheme. It was also intended to stabilise the water supply to irrigators along the Hartz River below the farm Spitskop and as far down as Delpportshoop. From the dam, water was also to be supplied to the small local mines in the vicinity, when borehole supplies failed, and to the Department of Bantu Administration and Development (RSA, 1968c:3).

Surplus water from the scheme not required for the above-mentioned purposes was to be used to augment the supplies to the Vaal-Gamagara Government Regional Water Supply Scheme. The design of the Spitskop also allowed for flood absorption and control. This was to

decrease the possibility of devastating floods on the Hartz River, like those experienced in 1919, 1947 and 1967 (RSA, 1968c:3).

The possibility of building a dam on the site (proposed in 1967), located 32 km downstream of Espachsdraai, was first investigated in 1947. The basin was then surveyed and trial pits were excavated to test the foundations. The estimated cost of constructing the dam, including the cost of the re-location of roads and bridges, amounted to R1.5 million. This was equivalent to R65 per morgen-foot of storage capacity created. It was envisaged that the dam was to be completed in 1972 (RSA, 1968c:3, 6).

However, in 1973 the DWA asked for approval by parliament for an additional R600 000 for the completion of the dam. This brought the total approved amount for the completion of the dam and related works to R2.1 million. In 1976, an additional amount of R700 000 was required, over and above the amount approved in 1973. The expected completion cost of the dam then amounted to R2.8 million. One of the reasons for the increase in cost was that the allowance for inflation made in 1973 was inadequate. Other reasons cited were increases in construction costs due to poor foundation conditions, the construction of roads and telephone lines and the purchase of servitude rights (RSA, 1976d:3, 5).

5.11.25. The Tugela-Vaal River Scheme

In 1969, the DWA proposed the construction of the Tugela-Vaal Government Waterwork. In its White Paper laid before parliament, the DWA stated that: "This report proposed the construction of an intake at Spioenkop Dam on the Tugela River (now Thukela River), pumping stations, and a pipeline with a mean capacity of 60 million gallons [270 million litres] a day to the basin of a proposed dam in the Wilge River at Bloemhoek or some other suitable site, with a storage capacity of 270 000 morgen-feet, which forms an integral part of the project and for which financial provision would be requested next year [1970] as a second stage of development" (RSA, 1969c:4).

The purpose of the proposed dam was to increase the net assured yield from the Vaal River system by 810 million litres of water per day to 4.7 billion litres per day. This was after it became evident that the system of dams in the Vaal River was not capable of meeting the demands of water. This demand was to reach 1 600 million m³ per year by 1976 (RSA, 1969c:4; Van Robbroeck, 1979:31).

In this regard the DWA stated that: "In order to abstract the maximum quantity of water from the present development of the Vaal River, the storage dams on it would be operated as a unified system and not treated as individual storage units, each serving its own area. On the basis it would be possible to increase, the assured yield from the Vaal River to 883 million gallons [3.9 billion litres] per day as soon as the Vaal Dam-Oppermansdraai Dam-Vaal-Harts weir system has stabilized. It is expected that this increased yield would be sufficient to meet the requirements of all consumers between Vaal Dam and the confluence of the Vaal and Orange Rivers until 1973 if the demand increases according to the expected rate. ... In order to provide an adequate margin of safety, it is proposed to have the next stage of development in operation during 1973" (emphasis added) (RSA, 1969c:4).

This "next stage of development" was the Tugela-Vaal project. Midgley (1978:233) states that: "Even after all foreseeable demands in the Tugela basin have been catered for, there will still be substantial quantities of water available from this river system to aid less fortunate areas". Thus, the consumers in the Vaal River system were thrown a lifeline with the implementation of the Tugela-Vaal Project.

The consumers mentioned above were the Rand Water Board, the Vaal-Hartz irrigation area (at that time the largest consumers of water from the Vaal Dam), the OFS goldfields, the Western Transvaal towns of Wolmaransstad, Leeudoringstad, Makwassie, and Witpoort, the Vaal-Gamagara undertaking, SASOL and the Vanderbijlpark industrial complexes, ESCOM's power stations, and the municipalities of Vereeniging, Parys, Klerksdorp, Bloemhof, Warrenton, Kimberley, Barkly West and Douglas. The demand for water to these consumers increased substantially before 1969, especially regarding the expansion of mining and industrial activities in the Witwatersrand and adjacent areas. Because of these increases in demand, the Vaal Dam was raised in 1957. The Orange River Project was also underway, which assured a supply of water to the lower Orange River region and some towns in the Orange Free State, like Bloemfontein (RSA, 1969c:4).

The proposed Tugela-Vaal project, as envisaged by the DWA in 1969, was described as follows: "The construction of the Spioenkop Dam on the Tugela River was approved during the 1967 session of Parliament subsequent to the tabling of White Paper X-'67. The construction of this dam is under way and progressing well. After completion, the Spioenkop Dam will have a net assured yield of 249 million gallons [1.1 billion litres] per day, of which 150 million gallons [675 million litres] per day could be made available for use in the Vaal River catchment. It is proposed to utilize 60 million gallons [270 million litres] per day of this amount now [1969], and the balance at a later stage in the development of the Tugela-Vaal Project" (RSA, 1969c:8).

Thus, the main purpose of the Tugela-Vaal Project was to augment the supply of water to the Vaal River basin. However, the Tugela River basin on the eastern side of the Drakensberg Mountains in KwaZulu-Natal is situated lower than the Vaal River basin. The water had to be pumped over the escarpment.

To do this the DWA proposed the construction of a main pumping station immediately downstream of the Spioenkop Dam and either one or two booster pumps along the route of the 168 000 foot pipeline. The pipeline would discharge the water directly into the proposed dam at Bloemhoek or at another suitable site on the Upper Wilge River north of Van Reenen on the Drakensberg Mountain. It was envisaged that the proposed dam would have a capacity of about 320 000 morgen-feet (RSA, 1969c:8).

It was also proposed that this stage of the project be integrated with future development of the Tugela River and with the possible construction of the Lesotho Highlands Water Project (then referred to as the Oxbow scheme) in Lesotho. The DWA, in 1969, impressed on the decision-makers that: "In order to safeguard water supplies to the Vaal River basin ... it will be necessary to commence the following stage of development immediately on completion of the Tugela-Vaal Scheme ... so that it will be able to deliver water no later than 1977". The estimated cost of the project was R20 million for the pipeline and pumps and R12 million for the proposed dam and was expected to be completed by 1973 (RSA, 1969c:9, 10, RSA, 1970b:3).

In 1970, the DWA amended its previous proposal. It stated that: "In order to augment the stabilised supply of the Vaal River system by 818 280 m³ (180 million gallons) daily, which will satisfy the demand up to approximately 1983/4, an average of 272 760 m³ (60 million gallons) will have to be pumped daily out of the Upper Tugela basin and across the watershed into the Upper Vaal basin and stored so as to be available as a supplementary source during periods of shortage. Pumping costs will be very high and as much water as possible should, therefore, be obtained from the highest possible level in the Tugela basin in order to pump against a minimum height. It is proposed, therefore, to build a diversion weir near Rammelkop on the farm Wan Hoop, Bergville District" (RSA, 1970b:7).

Water from the weir, with a storage capacity of 1.42 million m³, would deliver 0.23 million-m³ daily into a canal with a capacity of 11 cumec (389 cusecs). The canal would convey water northwards for a distance of 15.6 km to a small balancing weir on the farm Kilburn, in the district of Bergville at the foot of the Drakensberg escarpment. At the weir, a pump station would be erected, with three multi-stage pumping units, with a capacity to pump 100 000 m³ of water per day. These pumps would raise the water through high-pressure steel piping, 5 100 m long, at the inlet of a tunnel through the top of the mountain. The tunnel, in turn, would deliver the water further into the basin of the proposed Sterkfontein Dam in the Nuwejaarspruit, situated in the Harrismith District. This dam would be the main storage unit of the system (RSA, 1970b:7).

The estimated cost of the new proposed project in 1970 was R28 million. This was a saving of R4 million from the previous project in 1969 (RSA, 1970b:3, 11).

In 1970, the DWA proposed the construction of the Elands River Government Waterwork. The work consisted of a storage dam at the Java site on the Elands River near Harrismith. The dam was to receive water from the Spioenkop Dam on the Tugela River, with the purpose of storing water to meet shortages in the supply from the existing dams on the Vaal River. These shortages, it was envisaged, would arise during times of severe drought. The construction of the dam constituted the second phase of the Tugela-Vaal Project. The two phases together were to increase the net assured yield to the Vaal River system from 40.2 million cubic metres (mcm) per day to 48.4 mcm per day. The estimated cost of the Java Dam was R12 million (RSA, 1970c:3, 5).

Because the Tugela-Vaal is an inter-basin transfer scheme, the DWA in 1974 decided to fence off the Sterkfontein Dam. This was due to the high risk that bilharzia infection would be transferred from the Tugela to the Vaal River basin. The fencing of the entire perimeter of the dam was to deny people access to the dam. A programme of observation in collaboration with the Department of Health was also started (RSA, 1974c:7).

In 1974, the DWA tabled a report before parliament stating that there was an increase in the cost of the Tugela-Vaal Project from R28 million to R34 million. This increase in cost was mainly due to the increase in cost of labour and materials (RSA, 1974d:2).

In addition, in 1974, the DWA proposed extending the Tugela-Vaal Scheme, which was virtually completed. This proposed extension included additional pumping capacity at Driel and Jagersrust and the construction of a dam on the Tugela River on the farm Woodstock (known as the Woodstock Dam). This extension was to further increase the water available to

the users of the Vaal River. This phase of the project was jointly implemented by the DWA and ESCOM, and the estimated cost was R53.4 million. Another purpose of this phase was for ESCOM to supply peak electric power. The Commission has shown an interest in developing a 1 000 Mw pumped storage scheme. This was to be done by using part of the Sterkfontein reservoir as an upper reservoir and a dam on the Mnjaneni River on the farm Kilburn as the lower reservoir. Water is pumped during off-peak periods and released back during peak hours to generate electricity. This phase became known as the Pumped-Storage Scheme (RSA, 1974e:3, 8, 12).

In 1975, the DWA reported that the Tugela-Vaal Project was nearing completion, at least the first phase. It stated in its report that the estimated total cost of the project (phase one) "will increase from R34 million to R38 million with R15 million being the cost of the Sterkfontein Dam and the cost of the Driel Barrage, pump stations, weirs and aqueducts amounting to R23 million" (RSA, 1975a:3).

This increase represented an increase of more than 10% in just one year, and an increase of R10 million from 1970 to 1975. Moreover, in 1977 the DWA asked parliament for approval for an additional R2 million, which increased the cost of the scheme to R40 million (RSA, 1977a:3).

What is also interesting to note is that the DWA stated that: "In the long run Sterkfontein Dam will be full for about one year in four during which time power costs to pump water for making up evaporation loss will be only R295 000 per annum". The Department also proposed that the rate on certain consumers of water from the Vaal River be maintained at 0.8 cents per cubic metre, as suggested in 1974. The DWA, considering the increased cost, suggested that the cost of delivering water into Sterkfontein Dam be increased from 2.8 cents per cubic metre to 3 cents, and the cost of water released from it raised from 4.6 cents per cubic metre to 5.1 cents (RSA, 1975a:6).

In 1980, the DWA reported that the cost for the second phase of the project had increased from R53.4 million to R75 million. In 1982, this amount had increased by R5.5 to R80.5 million. The report also proposed that the Sterkfontein Dam be raised. This was to enlarge the storage capacity of the dam from 1 203 million m³ to 2 656 million m³. By doing this the exploitable yield of the Vaal River System, including the re-use of water that flows back to the system, would be increased by 301 million m³ per year. The total estimated cost of the proposed raising of the dam was R50 million. However, the DWA considered inflation and stated, "...the actual amount will be nearer R64 million". In 1984, the estimated cost of the second phase had increased to R110.8 million (RSA, 1980a:3; RSA, 1982a:4; RSA, 1984b:3).

The latter increase of the estimated cost was due to the raising of the pumping capacity to fill the Sterkfontein Dam more quickly. Before this proposal to increase the pumping capacity, the DEA stated that: "The Sterkfontein Dam serves as reserve storage for the Vaal River System and is chiefly dependent on water pumped from the Tugela River. This means that should the Sterkfontein Dam be drained during a critical drought, it would take approximately seven years before it could be pumped to its full capacity. With the increased pumping capacity of 20 m³/s [from 11 m³/s] the Sterkfontein Dam could be pumped to its full capacity within four years, if there is water available in the Tugela River, thereby lessening the risks attached to a drought that might succeed the present one, with inadequate reserve storage"

(RSA, 1984b:3). Thus, drought was the main reason for the adaptive behaviour of the engineers to increase the pumping capacity.

Nevertheless, the proposed Lesotho Highlands Water Project (LHWP), or at least its implementation and completion, played a role. In this regard, the DEA stated that: "The feasibility study for the Lesotho Highlands Project is at present under way. Because of the comprehensive nature of the project the time required for starting may be so prolonged that the completion date could be postponed owing to unforeseen circumstances . . . If there is a hitch in the completion of the Lesotho Highlands Project, the delivery of 215 million m³ per annum as a result of the increase in the pumping capacity at the present lower supply assurance may well be used to ensure that an additional three years can be gained in which to complete the Lesotho Highlands Project. The risk of water restrictions will, however, increase once again during those three years" (RSA, 1984b:3).

With the extension of Phase II of the Tugela-Vaal project, the DEA envisaged that the Woodstock Dam would be emptied about every two years (computer simulations were used to indicate this). In this regard, the DEA stated that: "The recurring drawing down to low level will have a negative influence on fish and other aquatic life. It will render the dam less suitable for recreational purposes, and the development of recreational resorts should be carefully considered" (RSA, 1984b:9, 10).

In 1996, the *Vaal Augmentation Planning Study* (VAPS) report was published. This was after DWAF initiated VAPS to provide a comprehensive and sound basis for decision-making by the government regarding the best means of managing and providing water supplies to the Vaal River System. In this report, a pre-feasibility study was done regarding the further augmentation of the Vaal River's water resources from the Tugela-Vaal Project (DWAF, 1996b:31; Internet: DWAF, 2003).

5.11.25.1 VAPS, ORRS, and Further Developments of the Tugela-Vaal Project

The Vaal River currently supplies water to users in six provinces, including Gauteng, North West, Free State, Mpumalanga, Northern Cape and the Limpopo Province. Users of the Vaal River System represent a major portion of the population of South Africa and produce more than 50% of the country's GDP. These users include the following:

- Domestic, industrial, commercial, mining and irrigation users in Gauteng,
- Goldfields of the North West Province and northern Free State,
- Coalfields of the Free State and Mpumalanga,
- Petrochemical industries (SASOL),
- Iron and manganese mines of the Northern Cape (Sishen, *etc.*),
- Kimberley,
- Smaller towns along the Vaal River (Parys, Christiana, Klerksdorp, *etc.*),
- Riparian irrigation (Douglas),
- Vaal-Hartz irrigation (DWAF, 1996b:1).

Projections of water requirements made in 1994 showed that the Vaal River System would need additional water supplies by 2006. These projections were based on the expected growth

in the population and economic activity in the entire Vaal River supply area. Another factor that contributed to this growth in water demand is the growth in *per capita* demand as the living standards of the underprivileged part of the population were improved (DWAF, 1996b:2-4).

Augmentation of the Vaal River System's water resources therefore becomes crucial. However, DWAF believes that the need for augmentation can be delayed by the implementation of water demand management (WDM) and water conservation measures to check the excess use of water in the Vaal River System (Internet: DWAF, 2003).

As part of ongoing water resource development and management at the national level, the Vaal Augmentation Planning Study (VAPS) considered such aspects as non-augmentation, demand management, desalinisation of seawater, the importation of water resources from outside the Republic's borders, and inter-basin transfers within South Africa (Internet: DWAF, 2003).

Regarding water demand management the VAPS concluded that: "Whatever the outcome of demand management initiatives the indications are that, save for very dramatic influences of HIV/AIDS not yet taken into account, a strategy of non-augmentation would have to be followed or augmentation schemes would have to be implemented at some time in the foreseeable future" (DWAF, 1996b:5).

The non-augmentation option involved the relocation of industries to areas where water was in abundance and that populations would follow, changing the ESCOM power stations wet-cooling systems to dry-cooling ones, and reducing irrigation from the Vaal River System. A workshop held in 1995, attended by economists, found that: "... the South African economy would function much more efficiently with water being transferred to the major industrial growth centres, rather than to attempt to subsidize the relocation of industry". If irrigation was to decrease, it would lead to high salinisation of the Vaal River's water resources (DWAF, 1999:5).

Desalinisation of seawater was found to be uneconomical and international basin transfers, from the Zambezi for example, offered too many political obstacles, especially regarding the negotiations between the eight riparian countries sharing the basin, as well as extensive investigations and planning studies. Inter-basin transfer schemes, from the Orange (through further phases of the LHWP, the Eastern Free State Canal Scheme, and a reverse cascade of dams up the Caledon River), Tugela and Mzimvubu Rivers, were therefore the last option. As regards the Orange River, DWAF initiated the Orange River Replanning Study (ORRS), to see if there is enough water in that system for augmenting the Vaal River. The Mzimvubu option was found to be too expensive due to the remoteness of the river from the Vaal River system. The Tugela Transfer option was therefore the most likely candidate, because it is an attractive alternative to augment the Vaal River's water resources following Phase 1B of the LHWP (DWAF, 1999:5-6; Internet: DWAF, 2003).

The Thukela Water Project (TWP) was therefore investigated at reconnaissance and pre-feasibility levels to inform decision-making at national level. At pre-feasibility level of study, the TWP showed sufficient merit for DWAF to commission a comprehensive feasibility study in 1996. The primary aim of the TWP feasibility study was to investigate all factors that might affect the viability of the proposal. To this end, the study was designed to provide

DWAF with information and data necessary to compare further phases of the LHWP with the TWP as possible options to augment the water resources of the Vaal River System. This study took three years to complete (1996-1999). In the report, a number of innovative aspects came to the fore, unlike the planning of projects in the past. These aspects are as follows:

- The principle of integrated environmental management; and
- Public involvement of all affected and interested parties (Internet: DWAF, 2003).

"The principle of integrated environmental management (IEM) is a philosophy which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process in order to achieve a balance between conservation and development. DWAF has adhered to the basic principles of IEM which include:

- Informed decision-making.
- The adoption of a holistic understanding of the term environment that includes physical, biological, social, economic, cultural, historical and political components.
- Thorough consideration of alternatives.
- Democratic regard for individual rights and obligations.
- Opportunity for public and specialist input into the decision making process" (Internet: DWAF, 2003).

"The principles for public participation recommended by the Department of Environmental Affairs and Tourism were adopted for the purposes of the TWP Feasibility Study.

These are:

- The meaningful and timeous participation of Interested & Affected Parties.
- A focus on important (key) issues.
- The consideration of alternatives.
- Accountability for information used for decision-making.
- Inclusivity.
- Encouragement of co-regulation, shared responsibility and a sense of ownership.
- Dispute resolution" (Internet: DWAF, 2003).

Regarding public involvement, DWAF furthermore states that:

"Within the above principles, public involvement included a number of activities. Apart from introductions to stakeholders and assistance to study team members during fieldwork, Interested & Affected Parties were identified and their involvement in the Feasibility Study was facilitated. To facilitate participation, information was disseminated to stakeholders by a number of methods, including pamphlets, newsletters and an Internet Web Site. Where there were capacity constraints to involvement, training needs were identified and training was provided."

The programme of public involvement comprised meetings, services, products and general liaison activities. It is widely acknowledged that the public involvement programme for the TWP Feasibility Study has achieved its aims and objectives, and, importantly, has

successfully applied the recommended principles of public participation. Key aspects such as these exemplify this:

- A continuation of public involvement from the Reconnaissance and Pre-feasibility Studies, to the Feasibility Study, with an ever-increasing number of stakeholders participating as development proposals were formulated and elucidated. A database of over 1 000 people and organisations has been maintained during the course of the study.
- The provision of sufficient project information in an easily understandable manner to enable the participation of stakeholders in the formulation of project alternatives.
- A clear and unambiguous focus on matters that were important at any time during the study, for example, the pipeline versus canal aqueduct alignments and regional development.
- The allocation and utilisation of significant resources to consider alternatives, particularly aqueduct types and alignments.
- Particular attention to detailed information used in decision making by the production of Technical Bulletins.
- Technical and other assistance was given to stakeholders in the preparation of statements on their perspectives, for example, a perspective paper on the concept of a Thukela River Park.
- As and when disputes and conflicts arose, these were dealt with as part of the public involvement programme.

"After a lengthy and inclusive public involvement programme, the DWAF believes that stakeholders in the Thukela River Catchment have been afforded the opportunity to participate meaningfully during the TWP Feasibility Study. In addition, stakeholders from further afield have also participated, but to a lesser degree. Stakeholders have raised various positive and negative issues and recommendations. These are not statements of fact but, rather, opinions and perspectives. Importantly, they have been accommodated within the Feasibility Study where applicable, appropriate and possible."

"Importantly, the Public Involvement Programme has continued beyond the end of the Feasibility Study, albeit at a lower lever of intensity. Nevertheless, a seamless interface has been achieved between the Feasibility Study and the Decision Support Phase" (Internet: DWAF, 2003).

Integrated environmental management and public involvement was, after the end of apartheid, an important aspect in the planning, implementation and management of future water resource development projects. This was because of the low level (or complete absence of) public involvement in the planning and the implementation of water resources development projects in the past. Integrated environmental management was a break from the past, and in line with current global thinking regarding the planning, implementation, and management of water resource development projects. Thus, the TWP is setting the standard for the future planning, implementation and management of water resource development projects in South Africa, if not the Southern African region and the world.

What is the nature of the TWP and its benefits? The TWP is a major five billion rand (1998 prices) water resource development project that will be situated in KwaZulu-Natal. By implementing the project, the water resources of the Vaal River System will be augmented. It

has the potential to stimulate local and regional economic growth and can contribute significantly to the South African government's policy objectives, viz.: security of water supply to the Vaal River System, economic empowerment of previously disenfranchised people, poverty alleviation and job creation (Internet: DWAF, 2003).

Two attractive schemes, within the TWP, were identified in the 1999 feasibility study, which could have been developed either separately, or in combination. The first is the Southern Tributaries (Tugela) Transfer Scheme. This scheme is capable of delivering up to 15 m³/s of water *via* the Drakensberg scheme. This scheme was identified in the VAPS report as the most economical and could be implemented in a relatively short time. The second scheme, the Northern Tributaries Transfer Scheme, could deliver 22 m³/s *via* a transfer pumping station at Chatsworth in KwaZulu-Natal (DWAF, 1996b:31; Internet: DWAF, 2003).

The second scheme was deemed less economical than the first. The reason for this was that if "Mount Pleasant is converted into a multi-purpose unit to also supply water then the southern scheme will deliver about 1.9 m³/s more but the capacity of the northern scheme will decrease by about 1.6 m³/s" (DWAF, 1996b:31).

It was therefore recommended that a feasibility study of the Southern Tributaries Transfer Scheme commence immediately in 1996 to deliver additional water supplies to the Vaal River system by 2006. This was so that construction and commissioning was to be scheduled to meet the target dates for delivering water into the Vaal River. This was also so that further phases of investigation and implementation of the Northern Transfer Scheme should follow thereafter (DWAF, 1996b:31).

The extension of the Tugela-Vaal Project will increase the transfer of water from the Tugela to the Vaal River catchment by up to 450 m³/yr. During investigations carried out at reconnaissance and pre-feasibility levels, a large number of dam sites on the Tugela River and its southern and northern tributaries were looked at. The principal agent for the proposed implementation of the extension project is the Department of Water Affairs and Forestry (DWAF). The final feasibility study was to focus on the following major elements of infrastructure:

- A major dam (Mielietuin) in the Bushmans River;
- A major dam (Jana) in the Tugela River
- Major aqueducts consisting of pipes, canals and combinations of these two, from the dams to the Kilburn Dam in the existing Drakensberg Pump Storage Scheme (DWAF, 1999:17).

5.11.26. Water Supplied to Springbok

In 1970, the DWA proposed a pumping scheme as a government waterwork to supply the town of Springbok, the Okiep Copper Mine and the mining towns of Okiep, Nababeep, and Carolusberg, and the coloured towns of Steinkopf and Concordia with water from the Orange River (RSA, 1970d:2).

The towns to be supplied with water from the 1970 proposed scheme are situated in northern Namaqualand in the Northern Cape Province, south of the Orange River. From 1962 to 1969,

there was a sharp increase in water consumption in the Springbok area. The town had a population of 4 550 people. The demand for water doubled over the eight-year period. For instance, in 1962, water consumption was 153 000 litres per day, and in 1969 it was 342 000 litres per day or 346 m³. The mines and coloured townships were also using more water (RSA, 1970d:3).

Before the proposed scheme to supply water to the town and environs, it was dependent on boreholes for its water supply. In 1970, the municipality made use of three of its own boreholes and three private ones, as well as a mineshaft, to draw underground water. The average cost of the water from the private boreholes and mineshaft was 15 cents per cubic metre. The boreholes and mineshaft were able to deliver 705 m³ per day. However, by 1970 the safe yield of the supply was already exceeded because the groundwater became so weak in dry years. The municipality subsequently resorted to entering into an agreement with the Okiep Copper Co. Ltd, whereby a certain amount of their water from the sand-bed of the Buffalo River was used in times of drought. The municipality paid 22 cents per cubic metre for water from the copper mine (RSA, 1970d:2).

Consequently, the copper mine also experienced water shortages during droughts. Due to the low rainfall, the Buffalo River has not flowed since 1962. Because of the acute lack of water resources the Springbok municipality explored the possibilities of large storage dams in several rivers near Springbok. Because of the low rainfall and protracted droughts, there were no rivers that flowed for any length of time and the plans were abandoned. The municipality then resorted to drilling more boreholes (eight altogether) in a water-bearing quartzite reef. Six of these supplied water but they were not constant, especially during droughts (RSA, 1970d:2).

The two coloured townships of Steinkopf and Concordia were also without reliable water resources in their immediate vicinity. The Department of Coloured Affairs made representations to the DWA for the supply of water to the coloured towns, because water was essential to their development (RSA, 1970d:2-3).

The only reliable supply of water for the vicinity is the Orange River at Henkriesmond about eight kilometres downstream from Goodhouse. The proposed scheme envisaged pumping water from the Orange through a pipeline with a capacity of 13 600 m³ per day. The proposed scheme was to be implemented at an estimated cost of R6 million and was expected to be completed by 1974 (RSA, 1970d:6, 7, 8).

In 1973 and 1976, the DWA sought approval for another R5 million and R8 million respectively, to complete the scheme and install ancillary radio communication and telemetric equipment for the efficient operation of the enlarged scheme (RSA, 1976e:2).

Other reasons for the increase in costs were also cited by the DWA:

1. Tenders received for the construction of the pipelines from Okiep to Springbok and Concordia, and for the construction of reservoirs, were higher than originally estimated. The isolation of the works has had the impact that the unit prices quoted for labour and materials are generally much higher than in the case of tenders for works elsewhere in the country;

2. Very little of the construction material needed for the civil construction of purification works, permanent pump stations and housing was available locally and this had to be imported from elsewhere. The high transport costs involved, along with the higher cost of labour, materials and *fuel*, have had the effect that construction costs had to be estimated much higher;
3. Because of a lack of natural gravel near Henkries and Henkriesmond, where access roads were required, suitable material for road-building has had to be imported over long distances than originally estimated. In addition, lime and cement stabilisation of backfillings had to be used;
4. Because of the water shortage that had been existed at Okiep since 1973, the construction of pipelines, and the construction of temporary pump stations, sedimentation dams and a power station, had to be carried out in a very short period. Apart from the construction of pipelines, all the other temporary works were constructed with Department labour. The extent and cost of these temporary works are higher than was originally estimated.
5. As a result of an increase in the cost of civil construction works and the cost of electrical lay-out and mechanical and electrical equipment, the planning and design of which was entrusted to consulting engineers, the fees payable for these services were correspondingly higher than estimated;
6. Because of the rapid speed at which the pipeline between Henkriesmond and Okiep had to be constructed, a large number of inspectors from outside organisations had to be employed to maintain quality control. This contributed to an increase in the engineer's fee;
7. Construction costs have increased by between 15 and 20 per cent per year over the past few years before 1976. In this regard the DWA stated that: "As the building of outstanding works will extend over a comparatively long period and it is difficult at this stage to determine future cost rises accurately, an additional amount of R1 007 000 is being provided for indeterminable [sic] cost rises" (RSA, 1976c:8).

The DWA expressed the hope that, subject to parliamentary approval, purified water was would be delivered by 1980. Nevertheless, in 1980, the DWA reported and asked for additional funds to the amount of R1.4 million for the completion of the scheme. It also proposed that the scheme would also supply water to the De Beers Consolidated Mines Limited at Kleinsee and to the mining township there, to other smaller mines in the area, and to Port Nolloth. The plan was to construct a pipeline from the existing scheme at Nababeep to Kleinsee. This pipeline was to be financed and built by the De Beers Company. The pipeline was to be designed in such a way that it was able to supply water to Port Nolloth by means of a branch pipeline. The incremental cost of the bigger pipeline that De Beers was to lay was to be borne by the state. The cost of enlarging the Kleinsee pipeline and the branch pipeline to Port Nolloth was estimated at R2.6 million. This brought the revised estimated construction costs of the scheme to R23 million (RSA, 1980b:3).

5.11.27. The Douglas Weir

In 1970, the DWA proposed that the crest of the last weir in the Vaal River, situated eight kilometres above the town of Douglas, be raised by 1.22 m. This was to improve control over the water in the lower Vaal River and thereby decrease water losses. In this way, more water was to be made available to the Vaal River below the Vaal Dam. Thus, it was the intention to create additional storage in the Vaal River for better control over the run-off "which will come after completion of the proposed Spitskop Dam in the Harts River . . . mainly out of the

Riet River run-off area, below the Kalkfontein and the newly completed Krugersdrift Dam". Furthermore, more effective control over the discharge of water from the Vaalharts weir for the irrigation of 6 110 ha served by the weir was to be obtained (RSA, 1970e:3).

By increasing the useful storage capacity of the Douglas weir from 1.87 million m³ to 10.2 million m³, releases from the Vaalharts weir for irrigation can be made less frequently and in greater quantities. This will decrease the water losses by about 20%. Regarding economics, the DWA indicated that: "If the river losses are decreased by about 17 per cent this by itself will justify the scheme economically" (RSA, 1970e:3).

The intention was to raise the weir by means of 1.22 m steel sluice, of the drop type. A new concrete wall just downstream of the weir was to be built up to the crest level of the weir. The steel sluices were to be erected on this new wall. The estimated cost of the work was R1.5 million and the completion date was to be in 1972. As was the case with the implementation of the Bloemhof Dam, it was envisaged that the raising of the Douglas weir would result in more water being made available in the Upper Vaal River for industrial and domestic purposes because river losses in the Lower Vaal River will decrease. Less water will therefore be required for the Lower Vaal River from dams in the Upper Vaal (RSA, 1970e:5).

In 1974, the DWA altered its plans regarding the raising of the Douglas Weir. It envisaged constructing a new weir immediately downstream of the existing wall. This latter weir was then to be demolished on completion of the new one. It also proposed to build a saw-tooth type weir with two steel gates on the right flank. This weir was more suitable (no reasons were given as to why this was the case). The cost of implementing the new weir also increased from R1.5 million to R2.1 million. This was due to the new design and an increase in construction costs (RSA, 1970e:5; RSA, 1974f:2, 3).

In 1977, the DWA requested that parliament approve a further amount of R700 000 for the completion of the Douglas Weir. Reasons for this were as follows:

1. Protracted rains and high flow in the Vaal River impeded excavation work during the past two years before 1977. This resulted in a considerable increase in cost;
2. Concrete placing started in 1974. Continuous rains and high flows in the river also delayed this. At one stage, there was a delay of nine months. The cost of concrete materials like stone and sand also rose by 35%;
3. Normal increases in construction costs resulted in an increase in the cost of the earth embankment;
4. The final purchase cost of the mechanical equipment, including the two steel gates, was considerably higher than originally estimated (RSA, 1977b:3.5).

5.11.28. The Noord-Oranje Irrigation Board

In 1970, the DWA proposed the construction of an irrigation project for the Noord-Oranje Irrigation Board. The Board's history can be traced back to about 1910. Around this time, a certain Mr Newbury built a diversion weir in the Orange River opposite the farm that was known as Winstead. From the weir, he led the water to a turbine that pumped water for irrigation of land on Winstead and Tsebe. In the flood of 1925, the turbine was damaged and

covered with silt and sand, and the main pipeline to the canal was washed away (RSA, 1970f:3).

In 1952, a company purchased these lands, divided the property into plots, sold and transferred a number of these to different owners. The company repaired the old Newbury Estate's turbine, cleaned the earth furrow and undertook to supply irrigation water to the owners of the plots. A second, and smaller, turbine was added at around 1957 (RSA, 1970f:3).

Due to a lack of control over the turbine and the irrigation works and because spares for old turbines were unobtainable, the irrigators found it difficult to make a living. On the advice of the Department of Water Affairs, they petitioned, by Notice 703 in the *Government Gazette* 156 dated 21 October 1966, for the establishment of an irrigation district. Notice 108 in the *Government Gazette* proclaimed the Noord-Oranje Irrigation District 1733 dated on 12 May 1967. The Board consisted of six members (RSA, 1970f:3, 4).

In December 1967, there were 23 voters with a combined scheduled area of 1001.7 ha. Provision for the construction of a siphon across the Orange River to the north bank was made in White Paper W.P. Y-67, which was approved by parliament. The construction of the siphon and the raising of the Buchberg Canal were undertaken by the DWA in 1970 (RSA, 1970f:4).

The Noord-Oranje Irrigation Board raised a provisional loan of R59 000 in 1968. In May 1969, the Construction Division of the Department of Water Affairs engaged in the construction of the first portion of the Board's canal (RSA, 1970f:4).

The proposed irrigation work, in 1970, was to be implemented by means of a 1 373 millimetre (mm) diameter siphon. With this, the DWA intended to take irrigation water across the river from the enlarged Buchberg Canal on the southern bank of the river and deliver it into the Board's proposed canal on the northern bank. The full length of the canal would be 30 km from the outlet of the siphon. The first 610 m were to be lined with concrete to keep drift sand out of the canal. The estimated cost of the scheme was R975 000 of which R325 000 was subsidised. Thus, the Board had to repay a loan of R650 000, at 7.25% interest over 30 years. The gross expenditure of levy amounted to R61.70 per hectare per annum. It was intended that the project would be completed by the end of 1972 (RSA, 1970f:5, 6).

5.11.29. Betterments to the OFS. Goldfields Government Water Scheme

In 1973, the DWA proposed certain betterments to the Free State Goldfields Government Water Scheme, and requested funds for this purpose. In 1973, the scheme, from its intake works at Balkfontein on the Vaal River just below the confluence with Vals River, supplied water to a number of users. These were as follows: nine towns, 13 gold mines, 38 farmers and seven other smaller consumers. All of these were situated within the vicinity of the Free State Goldfields, of which the town of Welkom is roughly the centre (RSA, 1973a:2).

The most important additions proposed by the DWA involved the increasing of the water supply to Bothaville. It also involved the construction of sludge dams at Balkfontein, the

acquisition of servitudes for the completed Klipplaatdrift Weir, the building of further houses for supervisory staff and betterments to stormwater and sewerage (RSA, 1973a:2).

The history of the water scheme is intimately connected with the development of the gold-mining industry in the Free State. Shortly before the outbreak of the First World War, economically exploitable gold was discovered in the Odendaalsrus area. Yet the war put a halt on the development of the newly discovered goldfields. By 1945, extensive drilling investigations had proved the existence of a basalt reef at an economical depth (RSA, 1973a:3).

At that time, however, the area was a very thinly populated farming area, with Odendaalsrus and Virginia as its only towns. The nearest railway station was Henneman, 32 km away. Electric power was unknown, roads few and in poor condition, while boreholes formed the only source of domestic water. The decision to proceed with the exploitation of the gold meant that various services had to be provided. Amongst these services, a reliable water supply scheme was naturally one of the most important (RSA, 1973a:3).

With this in view, the various mining interests approached the Department of Irrigation during 1945. As a result of the meeting between the Chamber of Mines and the then Minister of Irrigation in May 1945, a committee consisting of officers of the Department of Irrigation and Mines started an intensive investigation into three possible water sources:

1. Boreholes;
2. Sand-Vet River canal scheme; and
3. Vaal River (RSA, 1973a:3).

A report, completed in December 1945, recommended the Vaal River. The required quantity of water could be drawn from the only constant and reliable source. At that time the water quantity was estimated at 38 640 m³ per day with a possible increase to 77 300 m³ per day (RSA, 1973a:3).

In the absence of a water board for the area and with the objective of supporting the new mining development on behalf of the government, the Department of Irrigation assumed responsibility for the supply of water. During May 1946 it was decided to construct the intake works, purification works and pump station on the southern bank of the Vaal River on the farm Balkfontein, about 13 km west of Bothaville. The planning of the scheme started in earnest in July 1946 and during July 1947 a start was made on the preparation of the final design plans (RSA, 1973a:3).

The initial planning provided for the supply of 4 546 m³ per day by the end of 1949, 6 820 m³ per day during 1950, 9 090 m³ per day during 1951, and 18 180 m³ per day during 1952 (RSA, 1973a:3).

A start was made on the sinking of the first mineshaft (St. Helena Mine), during December 1946. The actual construction of the water supply scheme started during August 1947, and during February 1950 the first partly purified water was supplied to the mines at a rate of 2 270 m³ per day while the supply of fully purified water started in April 1951 (RSA, 1973a:3).

In 1973, the DWA reported that the total quantity of water that had already been allocated to the Goldfields and neighbouring towns amounted to about 238 000 m³ per day. The continually increasing demand for water from the Vaal River meant that it had to be supplemented from elsewhere. This had in fact been envisaged for the near future in the form of the Tugela-Vaal River Scheme, which was being constructed in 1973 (RSA, 1973a:9).

The supplementation of water from another source was due to population growth of the Goldfields and neighbouring towns. For instance, in 1921 the total population of the area was 2 714; in 1970 it stood at 232 966 people. The estimated cost of the additions and betterments to the existing scheme was R18.4 million (RSA, 1973a:10, 15).

In 1978, the DWA proposed enlarging the capacity of the OFS Goldfields Government Water Distribution Scheme. This enlargement was to entail two lengths of pipeline totalling 14 km to increase the capacity of the most critical sections of the Virginia pipeline. This pipeline is one of the two major reticulation mains of the scheme. The estimated cost of construction was put at R3.4 million. It was also planned to construct an additional 300 mm diameter supply main from the scheme's purification plant at Balkfontein to the town of Bothaville. This was to secure the future water supply to the town. The estimated cost of construction was in the order of R600 000 (RSA, 1978b:3).

The reason for the enlargement of the scheme was that the demand for water by both the towns and mines was estimated to increase substantially. For instance, the water consumption of all the consumers of water from the scheme was 150 230 m³ per day (m³/d) in 1976. It was estimated that in 1991 the total consumption by all consumers would be 218 053 m³/d (RSA, 1978b:7).

With respect to the cost of the enlargement of the capacity, the DWA stated it would cost an estimated R3.3 million. However, the Department did not calculate the rise in inflation into the cost factor. The reason for this, according to the DWA, was that "this factor is difficult to predict so far into the future". The "future" was the increase in water consumption of the consumers up to 1991 and beyond. In this regard the DWA added that: "If annual costs rise above those estimated, the unit cost figure will be recalculated in the light thereof and the tariffs charged for water will be adjusted accordingly. The estimated cost given here must be regarded as provisional and will be revised on completion of the works when the actual capital expenditure and interest rate are known" (RSA, 1978b:13).

5.11.30. The Modder River Weirs

In 1973, the DWA proposed to parliament the construction of the Eureka and Roodekop weirs for the newly established Roodeheuwel Irrigation Board. The area to be served by the proposed weirs is situated in the Brandfort and Bloemfontein districts on the right and left banks of the Modder River. The proposed weirs were to be constructed for irrigation purposes (RSA, 1973b:2).

Before 1973, many dams and weirs had been constructed or raised in the upper Modder River catchment area. This resulted in an ever-decreasing flow of water into the natural pools in the river below Glen. Because of the resultant water shortages, a petition for the establishment of

an irrigation district was submitted by riparian owners for the purpose of the construction of two storage weirs to provide for a more assured supply of water (RSA, 1973b:3).

In 1973, four possible sites were investigated and the weirs proposed were found to be technically and economically the best. The weirs were required to irrigate 347 ha of scheduled land. After allowance for probable evaporation and distribution losses, sufficient water was available for 300 mm irrigation during the first few summer months. The DWA stated in this regard that: "During a normal year rain can be expected to replenish the supply in the weirs from December onwards, which will make further irrigation possible" (RSA, 1973b:3).

In order for the DWA to construct the weirs, the Roodeheuwel Irrigation Board applied for a loan of R175 000 with a subsidy of 33.3%. The loan was to be redeemed within 30 years. In case the subsidy was granted, the Board had to repay R116 667. The repayment of the loan, at 8% interest, amounted to R10 733. The estimated completion date of the scheme was during the 1973/74 financial year (RSA, 1973b:4).

5.11.31. The Usutu-Vaal River Government Water Scheme

In 1976, the DWA proposed the construction of the first phase of the Usutu-Vaal River Government Water Scheme. This scheme consisted of the Grootdraai Dam on the Vaal River upstream of Standerton; pump stations and the necessary pipelines to deliver water to SASOL II and into the balancing reservoir and Trichardtsfontein Dam on the watershed between the Olifants and Vaal Rivers, east of the town Trichardt. It was estimated in 1976 that the first phase of the proposed scheme would be able to deliver 112.7 million m³ per annum into Trichardtsfontein Dam, from where it would be distributed to consumers. These consumers were at first only the ESCOM power stations. In all, 109.9 million m³ per year, or 301 100 m³ per day, would be available in the Trichardtspruit after taking into account 2.5% river losses. The proposed capacity of this balancing dam on the Trichardtspruit is 15 million m³. It was estimated in 1976 that this volume of water was sufficient to meet the needs of SASOL II and ESCOM until 1994 for 10 days, without replenishment of the balancing reservoir (RSA, 1976b:8).

It was also envisaged that further future phases of the proposed Usutu-Vaal Government Water Scheme may consist of the transfer of water from the Hlelo, Assegaai and Ngwempisi Rivers. These rivers are all tributaries of the Usutu River. Water may be transferred from these rivers to the Grootdraai Dam. It would also be possible to transfer the waters of these rivers into the Trichardtsfontein balancing reservoir. The intention was to complete work on this scheme in time for water to be supplied to SASOL II by October 1979 and other consumers during 1980 (RSA, 1976f:8).

The estimated cost of the project, at 1976 unit prices, was R31 million. The DWA reported that: "On the basis of the delivery of water to SASOL II by October 1979 and the final completion of the scheme by 1980-81, and taking into account cost escalation due to the present inflationary tendency, the completion cost of the proposed works will amount to R42 million" (RSA, 1976f:15).

In 1980, ESCOM stated that it had decided to proceed with the building of the Tutuka Power Station. This power station has a total capacity to generate 3 600 MW of electricity. In 1981, DWAFEC proposed a water supply scheme for the new power station. The cost of the scheme was an estimated R13.5 million at 1980 unit costs. An amount of R30 million was provided for the scheme in the budget. Provision was also made for the cost of an additional gravitation pipeline of 46 km, and rising costs due to inflation. The gravitation pipeline was to deliver water of better quality from the Usutu Government Water Scheme to the new power station. This was to supply water for boiler use. However, further investigations revealed that the pipeline would not be economical (RSA, 1981b:3).

After investigations, it was revealed that the Grootdraai Dam in the Vaal River would be the appropriate initial source of water to Tutuka. It was therefore proposed by the Department of Water Affairs, Forestry and Environmental Conservation (DWAFEC) to pump water from an extension of the existing Grootdraai Pumping Station. A new rising main, 20 km long, to ESCOM's proposed raw water reservoirs, was also proposed. The proposed extensions to the existing Grootdraai Pumping Station were to entail the extension of the existing building and installation of four high-pressure pumps. These pumps were needed because the average consumption and ultimate peak demand of Tutuka were estimated at 155 000 m³/d and 200 000 m³/d respectively. DWAFEC intended to complete the scheme by the end of 1983 to supply water to ESCOM early in 1984 (RSA, 1981b:3-4).

Interestingly enough, and regarding the impact on the environment of the scheme, DWAFEC stated that: "The proposed pumping stations entails only the extension of the existing Grootdraai Pumping Station and will have no additional detrimental influence on the environment. The first section of the proposed rising main will be situated within the site of existing works while the rest will follow existing road routes over almost its whole length. The whole rising main will be laid underground and the area will be restored so that it will have no detrimental effect on the environment" (RSA, 1981b:10).

In addition, in 1981, DWAFEC proposed the construction of a storage dam (the Heyshope Dam) in the Assegaa River (a tributary of the Usutu River) 27 km west of Piet Retief. Two pumping stations, about 9 km of rising main and 38 km of canal were also to be constructed. The purpose of this dam was to deliver water into the upper reaches of the Little Vaal River and thereby to augment the yield of the Grootdraai Dam. The provisional estimated cost of the proposed scheme was R95 million after allowing for inflation at 15% per year (RSA, 1981c:3, 9).

Although the Vaal River's water resources had already been committed to the use of downstream users, DWAFEC stated that: "... the above [scheme] is possible since the flow will be supplemented lower down by the second phase of the Tugela-Vaal-scheme, the Drakensberg Project, when it is commissioned later this year [1981]". The Tugela-Vaal scheme was able to meet the demands of the users lower down the Vaal River until 1992. However, this demand was to be met by water which was being temporarily abstracted from the Vaal River at Grootdraai Dam. The water resources therefore had to be replenished from another source to supply ESCOM and the SASOL installations. The proposed Heyshope Dam, pumping stations and aqueducts were to supply this demand (RSA, 1981c:3).

Regarding the environmental impacts of the scheme DWAFEC stated that: "The Heyshope Dam, as well as the pipelines and canals are to be constructed in an area where agricultural

activities, particularly forestry predominate and the area is thus not viewed as an ecologically sensitive one. The impact of the proposed scheme on the environment is therefore not serious. The magnitude of the costs involved to restore the landscape is estimated to be somewhat lower than the average on other schemes, where these costs have been proved statistically to amount to 1.5 per cent of the total capital cost. Here an amount of about 1.0 per cent of the total capital cost of the scheme is considered realistic on condition that the borrow areas are situated within the proposed dam basin" (RSA, 1981c:13).

In 1983, the DWA proposed an emergency scheme to supply water from the Vaal Dam to the Eastern Transvaal Highveld. This was to ensure the continued operation of the ESCOM power stations and the SASOL I and II installations. This emergency plan was necessary to assure a water supply in the event of the normal water resources of the area becoming exhausted as a result of the prevailing drought. The drought, described as the worst on record, would have resulted in the power stations running out of water by September 1983 unless it rained (RSA, 1983a:3; RSA, 1983b:3). Unfortunately, it did not rain, and the drought prevailed until 1985.

The proposed scheme comprised seven earth embankments in the Vaal River between the Vaal and Grootdraai Dams with a pumping installation at each of the weirs and at the Grootdraai Dam. By means of the pumps, the water was to be pumped back from the Vaal Dam in stages. This was to be done at a net rate of 8.6 m³/s in the opposite direction to the normal flow of the Vaal River, to the Grootdraai Dam. The capacity of the aqueduct between the Grootdraai Dam and Trichardtsfontein balancing dam was to be enlarged from its 5.7 m³/s to 8.6 m³/s. This was to supply SASOL II and III, other smaller consumers and all the ESCOM power stations, except Camden (RSA, 1983a:3).

This emergency scheme was to be implemented at a total cost of R16.7 million, which was to be borne by ESCOM and SASOL. The effect on the environment, according to the DEA, was to be minimal. This was because of the nature of the scheme – it was only to be temporary. The DEA, stated in this regard, that: "Clearing up will be carried out to repair any damage to return the site to as near as possible its original state once the scheme has served its purpose" (RSA, 1983a:3, 9). This was to be the first phase of the emergency scheme.

The second phase comprised the doubling of the pipelines between the Grootdraai Dam and Vlakfontein, Grootfontein and Knoppiesfontein and Knoppiesfontein and the Trichardtsfontein balancing dam. It also involved the doubling of the pumping stations at the Grootdraai Dam and Grootfontein. Provision was also made for the doubling of the Grootdraai Dam and Grootfontein pumping stations that was to become necessary during 1987. This was to supply the Usutu-Vaal River Government Water Scheme with water under peak consumption conditions. Regarding the environmental impacts of the second phase of the emergency scheme, the DEA states that: "The proposed doubling of the pipelines will be underground within existing servitudes and will have no additional detrimental effect on the environment" (RSA, 1983b:3, 12).

The level of the Vaal Dam was very low at that stage, with water from the Sterkfontein Dam being used to augment the Vaal Dam. This augmentation, and the pumping of the Vaal Dam's water to the Grootdraai Dam, meant that the Tugela's water resources were utilised in the Eastern Transvaal. This achievement by the DWA, which was the first of its kind in the world, enjoyed international attention (DWA, 1988:3).

5.11.32. Drainage Works for the Vaal-Hartz Scheme

In 1976, the DWA proposed that additional drainage works be constructed on the Vaal-Hartz Government Water Scheme at an estimated cost of R8 million. The irrigation scheme was, in 1976, the largest of its type in South Africa, with 37 192 ha of land scheduled for irrigation. Although most of the area irrigated on the scheme lies in the Hartz River Valley, the scheme derives its water from a weir on the Vaal River just upstream from Warrenton. This weir has a height of 11 m and is 750 m long. It was designed to accommodate a flow of 10 000 cusecs, with water four metres deep flowing over the crest (SESA, 1975:110; RSA, 1976c:3).

Even so, natural drainage is poor due to flat surface gradients and typical soil profiles in the area. Irrigation over the years has brought about an undesirable rise in the level of the groundwater table (RSA, 1976c:3).

It was for this reason that the DWA proposed that additions to the existing drainage works at the scheme be urgently implemented. This was to prevent the groundwater table from rising, and rendering extensive areas of the scheme unfit for agricultural use. The DWA impressed on parliament that: "Authority is sought for the expenditure of R8 000 000 on portions of the drainage system considered to be of the highest priority at this juncture" (RSA, 1976c:3).

The reason for the urgency for the drainage works, according to the DWA, was that the Vaal-Hartz Scheme was an important component of the production of agricultural commodities and had a major role in maintaining a sound infrastructure in the area where it is located. The crops that were produced in 1975 were as follows: cotton, ground-nuts, maize, lucerne, vineyard, tobacco, tomatoes, asparagus, green beans, cucumbers, strawberries, peas, onions, dried peas, wheat oats, and barley (RSA, 1976c:9).

Regarding its production capacity the DWA stated in its report that: "Although it is always very difficult to determine the turn-over of a scheme such as this an estimate of the current gross farming income of the scheme as a whole was made with the assistance of the Department of Agricultural Technical Services. Using average production rates per unit area and current market prices, the gross income for the scheme as a whole is estimated to be about R20 million per year. A comparable figure of R11 million per year is quoted in the Report of the Commission of Enquiry into Water Matters as being applicable in 1966" (RSA, 1976c:9).

From this the DWA concluded that: "It is clear that this irrigation scheme makes a very important contribution to the agricultural production in the Republic and it is in the *national interest* that the production potential of this highly capitalised ground be safeguarded. A factor posing a serious threat to sustained high levels of productivity on the scheme is the rising level of the groundwater table". The intention of the drainage works on the scheme was therefore to keep the groundwater table below 1.5 m of the surface (emphasis added) (RSA, 1976c:9).

In 1976, the estimated cost of the drainage works was put at R8 million. In 1981, DWAFEC stated that the estimated capital cost of the scheme, at March 1980 prices, was R13 million. This was due to various reasons, including: the large area covered by the works that forced DWAFEC to acquire a radio communication system at R40 000; R30 000 was to be spent on

the relocation of roads and power-lines; clearing up of the construction site afterwards, *etc.* (RSA, 1981d:3).

In 1984, the DEA published its second supplementary report on the drainage works. This report states that the cost of completion with an inflation rate of 15% is estimated at R25 million. The main reason for the increased costs was that construction activities had to be curtailed due to a decrease in government expenditure. This resulted in an increase in costs such as overheads and unit costs and a further increase when inflation set in (RSA, 1984c:3).

In 1989, the DWA proposed that the main canal of the scheme be enlarged and that betterment works be implemented to improve it. The work was required so that both a larger quota and a higher peak supply rate could be supplied to the farmers. The canal system was already 50 years old in 1989 and was therefore in need of upgrading (RSA, 1989b:3).

The total cost of the work was estimated at R67.5 million at March 1989 prices and at R99.8 million if a cost escalation of 15% per year during the construction period was assumed. It was anticipated that the construction was to be completed in the 1993/94 financial year. It was also envisaged that the secondary and tertiary canal systems were to be gradually enlarged and upgraded. However, the cost for this was too high (R115 million) and provision was not made for this in 1989. The work was also proposed to enable delivery of an equitable allocation to the Taung irrigation area in the Republic of Bophuthatswana. (RSA, 1989b:3).

The supply of water to Taung dates back to 1952. Government Notice 2651 of 21 November 1952 stipulated that the rightful irrigation allocation from the Vaal River for land on the Taung Irrigation Scheme was equal to 7 700 m³/ha/year plus 10% distribution losses on an area of 6 424 ha. This was equivalent to 54.4 mcm/yr. Yet in 1989, only 37.7 mcm/yr could be supplied by the canal system. This was only sufficient for the irrigation of 4 447.2 ha at a quota of 7 700 m³/ha/year plus 10% distribution losses. The enlargement of the canal system therefore offered Bophuthatswana the opportunity of utilising fully the rightful allocation. The capacity of the canal was therefore upgraded from 28 m³/s to 48 m³/s. Moreover, further water requirements at Taung were to be satisfied by the construction of a dam near Taung on the Hartz River. Bophuthatswana was already engaged in 1989 in investigations and negotiations with South Africa regarding this dam (RSA, 1989b:5; DWA, 1990:87).

The betterments and enlargement of the main canal were not only to supply more water for irrigation purposes. Households and industries were also to be supplied with water in both Bophuthatswana and South Africa. Regarding the environmental effects of the proposed project, the DWA states in its report that: "An environmental impact study will be carried out to investigate all possible effects on the environment and to prescribe the necessary precautions to be taken to limit these effects" (RSA, 1989b:6, 11).

5.11.33. The Koppies Canals

In 1976, the DWA proposed certain betterments to the canal system serving the Koppies and Roodepoort Irrigation Settlements, situated along the Renoster River south of the town of Koppies in the Free State. The Department also made proposals for the better utilisation of the water supplies available in the Koppies Dam. This dam was raised in 1971 for making available a more assured supply of water. From 1968, the state assumed responsibility for the

operation and maintenance of the distribution works, and the proposed betterments, according to the Department, "are essential for putting efficient water distribution into effect". It was estimated that these betterments would cost R1.75 million, and would consist of the reconstruction and concrete lining of canals, construction of control and gauging structures and distribution furrows, the provision of sluices and meters, *etc.* (RSA, 1976g:2, 8).

The canals that were in use, before 1976, were constructed in 1911. In 1976 the DWA stated that: "The problems at present experienced are principally the high maintenance cost, control problems due to the flat nature of the irrigation land, inadequate carrying capacity for extensive scheduling and inefficient distribution of water owing to the lack of necessary facilities" (RSA, 1976g:2).

The DWA also stated that not all these problems could be eliminated by the betterments. The reason for this was that the shortcomings were tackled on a selective basis, which took into account the quality of the irrigation land and the possibilities of expansion (RSA, 1976g:2).

It was expected that after the implementation of the betterments the scheduled land under canal command was to be increased by 366 ha from 1 522 ha to 1 888 ha. It was also the intention to schedule another 545 ha of riparian land, by pumping water from the river. This was to increase the total scheduling area to 2 433 ha (RSA, 1976g:2).

A further rationale behind the betterments was to "improve the viability of a long-established farming community. The socio-economic condition of the scheme is at present [1976] such that without the prospect of a sustained water supply and the expansion of scheduling, some members of the community will probably have to settle elsewhere, and this would leave already available facilities of the infrastructure in disuse". The area, at that time, made a large contribution to the fresh milk produced for the Witwatersrand. Irrigation water was therefore mainly used for fodder production for dairy farmers. The DWA stated in the report that: "For these reasons justification can be found for the proposals" (RSA, 1976g:2).

5.11.34. Betterment Works for the Hoeko Irrigation Board

In 1977, the DWA submitted a report to parliament in which the Department proposed that additional drainage works at the existing Riet River Government Water Scheme be implemented. The total estimated cost of these works was in the region of R2 million (RSA, 1977c:2).

The reason for the additional drainage was that at certain parts of the irrigation settlement drainage was poor. This was a result of many years of intensive irrigation and the high rainfall that occurred from 1973 to 1977 caused the groundwater table to rise considerably (the same as had happened at the Vaal-Hartz irrigation scheme). The drainage works were therefore needed to prevent large portions of the irrigated land becoming unfit for agricultural purposes (RSA, 1977c:2).

The average total cultivated area was 2 100 ha in summer and 3 200 ha in winter. As was the case with the Vaal-Hartz irrigation scheme, the DWA stressed in its report the importance of the Riet River irrigation scheme in terms of the gross annual return of the scheme (R2.5 million in 1977), and the important role it played in maintaining a sound infrastructure in the

area where it is situated. The DWA said that: "It is therefore evident that this scheme makes an important contribution to the agricultural production of the Republic and it is important that the production potential of these highly-capitalised lands be safeguarded. A factor that contains a serious threat to the maintenance of high production on the settlement is the rising of the ground-water level" (RSA, 1977c:6). The same argument was used for the additional drainage works for the Vaal-Hartz irrigation scheme. However, the importance of the Vaal-Hartz irrigation scheme was greater than the Riet River scheme. It was stated by the government that the Vaal-Hartz scheme was an important asset to the national interest of the Republic of South Africa.

5.11.35. Betterments to the Kalkfontein Dam

Coinciding with the betterments to the drainage of the Hoeko Irrigation Board, the DWA in 1977 proposed betterments to the Kalkfontein Dam. These works were to be implemented for the safeguarding of the dam, which is the storage unit for the Riet River Government Water Scheme. The dam supplied water mainly for irrigation along both banks of the Riet River downstream of the dam and to the irrigation settlement near Jacobsdal. The Kalkfontein Dam was constructed in 1935 for irrigation purposes and partly also to create employment for hundreds of white labourers, who had no other means to sustain themselves after the severe drought and depression of the early 1930s. Despite labour shortages and the big floods of November 1936 by the end of 1938, the dam was completed. Interestingly enough, the dam was one of the earliest projects of the Department of Irrigation where a steam shovel was used for excavation (RSA, 1977c:6; RSA, 1977d:3).

The possibility of developing an irrigation scheme alongside the Riet River and its tributaries was realised as long ago as the beginning of the twentieth century. The then Department of Irrigation started with field and soil surveys in 1911 to determine the viability of such a scheme. Reconnaissance work was initially concentrated on the Kaffer River (now the Tierpoort River), a tributary of the Riet River. The outbreak of the First World War put a stop to the fieldwork. After the war, the scheme did not receive a lot of attention. It was only in 1926 that further work was done on the surveys, although the Tierpoort Dam for the Kaffer River (now Tierpoort River) Irrigation Board Scheme had already been completed in 1923 (RSA, 1977d:3).

After 1926, the investigation work was discontinued until the final Riet River survey was started at the beginning of 1935. Three dam sites in the Fauresmith-Koffiefontein area were surveyed in detail and a number of test boreholes were sunk to determine foundation conditions and the availability of construction material. The soil survey near Jacobsdal was also completed in 1935. The favourable results of the surveys led to the decision to proceed with an irrigation scheme along the Riet River (RSA, 1977d:3-4).

Due to labour shortages and floods, the dam was only completed in 1938. Significant construction work on the dam was resumed in 1960. A pan situated adjacent to the dam basin, called Holpan, was then connected to the dam basin by means of a canal. The pan had an effective storage capacity of 610 000 m³ and served 24 plots. By conveying surplus water into this dam a considerable quantity of water, which formerly went to waste, was saved, according to the DWA in 1977 (RSA, 1977d:4; RSA, 1977c:3).

In September 1936, a start was made on the construction of the canal system to serve the irrigated area. During the first four years after 1936 comparatively little construction work was carried out on this canal scheme. The work consisted mainly of excavations and the partial concrete lining of distribution furrows. Initially manual labour was used exclusively, but later excavation machinery was also used. With the outbreak of the Second World War, a large number of employees went on military service, with consequent labour problems on the scheme. The building of the internment camps at Koffiefontein and Jagersfontein was also undertaken by the Riet River construction organisation and this further contributed to the decrease in the rate of canal construction (RSA, 1977c:3). Interestingly, the former Prime Minister, John Vorster, and Brig. Van den Bergh were interned in these camps during the Second World War, because of right-wing sympathies towards Nazi Germany.

In spite of the many delays and the shortage of steel and cement, construction of the original basic canal system was completed by the end of April 1942. By that time, water had been provided for irrigation on riparian farms. From July 1942, no further work was done on the scheme until excavations and betterments were proceeded with during 1945. In the same year, the first batch of 30 settlers was placed on the settlement portion of the scheme, between Jacobsdal and Modder River Station. They were all ex-soldiers (RSA, 1977c:3).

Construction of the scheme still continued and consisted mainly of extensions and repairs to canals, canal lining and the construction of numerous outlets, distribution works, super-passages and culverts. Over the years, a number of balancing dams were built to increase the distribution efficiency (RSA, 1977c:3).

While the scheme was in an early stage of development and the irrigation area small, an unlimited quantity of water was supplied to the irrigators. This resulted in the poor natural drainage the DWA proposed to rectify in 1977 (RSA, 1977c:3).

In the same year, the DWA proposed to raise the dam wall of the Kalkfontein Dam by about 2.2 m. This was proposed because the DWA was concerned about the safety of the original structure. The Department stated that: "If an extremely heavy flood should occur, the possibility exists that the present structure may overflow, resulting in heavy damage. In the case of a flood with a recurrence interval of more than 500 years, a large-scale dam break can be expected. The cost involved in such damage would be many times greater than the expenditure involved in the proposed raising. Apart from the cost of repairing damage to the dam structure, cognisance must be taken of the cost of inundation of lands, repairs to washaways, damage to canals, loss of stored water, loss of production, loss of animals and possible loss of human lives. The cost involved in the proposed safeguarding of the dam is therefore well justified" (RSA, 1977d:9).

5.11.36. Vaal Dam Betterments

In 1978, the DWA reported on the betterments to the Vaal Dam. These betterments were required to increase the stability of the dam to meet "present-day criteria", to safeguard it during extreme floods, and to improve its flood "attenuation capabilities". The Department requested an estimated sum of R8 million for the betterments (RSA, 1978c:3).

The Vaal Dam was completed in 1938 at a total cost of R3.3 million. The Rand Water Board made a total contribution of R2.3 million towards the total cost of the dam, in exchange for the right to abstract free of charge a quantity of 977 400 m³ per day (RSA, 1978c:4).

The dam consisted of a mass gravity concrete structure 518.6 m long, with a height of 41.14 m above the mean river bed level and an earth embankment on the Transvaal (now Gauteng) side or right bank of the river, 1 890 m long. It had a storage capacity of 1 076 mcm, and a net dependable yield of 770.2 mcm per year (RSA, 1978c:4).

After the Second World War, because of the rapid expansion in industrial activity and development of the Free State Goldfields, it was decided that the Vaal Dam be raised by 6.1 m to make additional supplies of water available. This consisted of raising the concrete overspill crest by 3.05 m and installing 60 crest gates 3.05 m high on top of the concrete. The earth embankment was also raised. The work started in 1952 and was finished in 1956. The raising increased the storage capacity to 2 330.16 mcm, which increased the net dependable yield to 1 029.3 mcm per year. The cost of raising the dam was R2.9 million (RSA, 1978c:4).

In 1978, the DWA elaborated on the reasons for raising the dam. These reasons were as follows:

1. The dam as originally designed was considered safe according to standards generally accepted at the time. However, by 1978, design standards had become more stringent, and it was necessary to strengthen the dam. This was the main purpose of the proposed work. It was also intended to safeguard the dam against extreme floods in accordance with the standards necessary to improve control during floods. The DWA said in its 1978 report that: "No failure of the main concrete wall and earth embankment can be tolerated, because of the large urban population downstream of the dam. Any interruption of water supplies to the area served by the Vaal Dam would be a major economic disaster to the country"¹³. It was for this reason that the stability of the dam was necessary (RSA, 1978c:5-6).
2. The dam, originally constructed as a water conservation work and in spite of a very small excess flood absorption capacity has been operated successfully in an attempt to reduce flood peaks. With the dam's design in 1978, only relatively small floods could be adequately controlled. The maximum that could have been discharged from the dam, before the betterment works, was 2 000 m³/s. Serious flooding of houses in the Vereeniging area commenced at 3 000 m³/s. There had been, before 1978, six floods exceeding this value. Two of these floods occurred after the raising of the Vaal Dam, in 1957 and 1975. The possibility of flood damage could not be eliminated but an increase in the storage capacity to improve the control of floods of moderate return interval could be advantageous, the DWA stated in this regard (RSA, 1978c:6).

In order to demonstrate the ingenuity of the engineer in the raising of the Vaal Dam, which had to comply with stringent dam safety standards, it is necessary to give a brief description of how the dam was made safer.

¹³ In fact, in 2002 a group of right-wing extremists planned to destroy the dam and the Grootdraai Dam by blowing them up. The intention of this act was to start a racial civil war in South Africa, by crippling the Gauteng industrial heartland. Fortunately, these extremists were caught before their plan came to fruition.

To better control floods, the gate height was increased by 1.82 m. This was done by adding a 1.82 m bottom extension to the existing gates. This resulted in a saving as compared with the installation of new gates. Furthermore, it was proposed that a pilot channel be provided through the saddle dam embankment. This saddle dam is situated on the Gauteng side of the Vaal River. If this pilot channel were not installed a flood could breach the saddle dam and cause extensive damage to the undeveloped valley below the dam. Provision was also made for foundation drainage to reduce uplift to the dam wall itself. This was to improve the stability of the concrete wall, and was done by providing foundation drainage through a drainage tunnel in the foundations below the concrete wall. This tunnel is 600 m long and a vertical curtain of drainage holes was drilled between the tunnel and the foundation line. The stability of the concrete wall was also improved and to decrease tensile stresses on the upstream face. This was done by installing a set of pre-stressed cables near the upstream face. A total of 320 cables along the crest, 2.8 m from the upstream face, were installed. Each cable reaches from the crest to a maximum of 25 m below foundation level. New hoisting structures and hoisting gear capable of raising the gates completely clear of the bridge deck were installed (RSA, 1978c:10-11).

In 1979, the DWA proposed to raise the Vaal Dam wall to 3.05, instead of the 1.65 m planned in 1978. This was to increase the capacity of the Vaal Dam reservoir by 1 033.5 million cubic metres to 3 363.7 million cubic metres. It was proposed that 1.1 m of this raising be used for supply storage and the rest, 1.95 m, for flood storage. In this way, it was possible to store for consumption an additional 342 mcm of water. The new estimated cost of this was R24 million as against the estimate of R8 million envisaged in 1978. In 1982, the DEA asked approval for an additional R21.4 million from parliament (RSA, 1979b:6, 9; RSA, 1982b:3).

In the 1982 report of the DEA, a number of environmental impacts were listed. These were as follows:

1. Impact on recreation was expected because of the fluctuation of the water level of the dam as more water was to be delivered from it.
2. Certain recreational and other facilities that had been illegally constructed within the servitude area were to be removed to higher ground by the owners.
3. Several thousand eucalyptus trees on about 200 ha of land within the servitude area had to be removed at considerable expense.
4. Disturbance to the environment at the construction site of the dam wall was to be minimal. DEA said that: "Care will be taken to restore the landscape to such an extent that the negative impact of the disturbance will be largely eliminated" (RSA, 1982b:9).

5.11.37. Douglas Irrigation Scheme Betterments

The DWA also proposed, in 1978, certain betterments to the main and distribution canals which serve the Douglas irrigation area. The estimated cost of the proposed works was R1.35 million (RSA, 1978d:3).

The main purpose of the proposed betterments was to reduce, to a minimum, the severe canal leakages which occurred in the sections of the main canal. The water resources of the Vaal River catchment were by 1978 already fully exploited and water from the Tugela River was

being used to supplement these resources at great cost. The DWA said that: "Seen in this context, unnecessary losses cannot be tolerated" (RSA, 1978d:3).

In addition, the carrying capacity of the canal system was at that time inadequate to cope with the peak demand. The proposed betterments were intended to solve this problem as well. Vineyards and vegetables are particularly sensitive to the correct amount of water being applied at the correct time and an inadequate supply during the maximum demand months can cause a significant reduction in yields, the DWA argued (RSA, 1978d:3).

The estimated cost of the betterments was R1.2 million. However, the DWA also stated that the proposed works would require two and a half to three years to complete. For this reason the escalation of the cost would have to be taken into account. This the DWA did, and it assumed that the increase in cost was to be 10% per year. It envisaged that the cost in 1980/81 would therefore be R1.3 million (RSA, 1978d:8-9).

5.11.38. The Lesaka Government Water Scheme

In 1979, the Department of Plural Relations and Development (previously the Department of Bantu Administration and Development) was busy with the development of an area to the west of Thaba Ncu. The purpose of the development was the settlement of South Sothos. A new town, Lesaka, was planned about 8 km west of Thaba Ncu and had to be supplied with water (RSA, 1979c:3).

The residents of the planned town were to be moved from Seloshesha, a black township in Bophuthatswana, near Thaba Ncu, "as well as people squatting on the smallholdings around Bloemfontein". For the supply of water to the planned town, the DWA proposed a scheme for the supply of water to Lesaka out of the Rustfontein Dam. This dam is situated in the Modder River about 12.5 km west south west of the planned town. The total estimated capital cost of the proposed scheme amounted to R6 million (RSA, 1979c:3).

The proposed scheme involved the pumping of raw water from the dam's outlets over a distance of about 3 km, through a 600 mm diameter asbestos-cement pipeline, to purification works. The water was to gravitate through all the purification processes. It was then pumped against a head of about 48.5 m through a pipeline with a length of about 9.4 km to a tank on the farm Enkelboom. From there, it was to be pumped against a further head of 128 m over a distance of 3.2 km into a terminal reservoir on one of the hills near Lesaka (RSA, 1979c:3).

The average capacity of the scheme was in the region of 9.4 mcm/yr. The scheme was designed with a peak capacity of 39 000 m³/d. The scheme had to be implemented at a very fast pace. To do this the pump stations were designed for only 15 000 m³/d in 1979. This was also to save costs (RSA, 1979c:3).

The DWA also said, in its report tabled before parliament, that "The works described in this report had to be planned in a hurry owing to the urgency of water supply, and in the final design there may have to be deviations from the descriptions of the pump stations, pipelines and reservoirs in order to adapt to the actual requirements, but there will be no deviation from the principles on which the scheme is based" (RSA, 1979c:3).

The control and administration of the scheme were set out as follows: "Initially control over and administration of the scheme will be undertaken by the Department of Water Affairs, but it is expected that later this will be shared with the Black authorities in terms of an agreement to be negotiated" (RSA, 1979c:11).

Of interest was the way the cost of water was to be distributed between Bloemfontein and Lesaka. Bloemfontein was to receive water, until 1986, from the Rustfontein Dam. This was stipulated in an agreement in 1951 between the Bloemfontein City Council and the Department of Irrigation. The agreement was operative until 1986. According to the agreement, Bloemfontein was entitled to abstract a maximum quantity of 18.25 million m³ per year from the Maselspoort Weir (water was released from the Rustfontein Dam into the Maselspoort Weir). Of this abstraction, the first 9.96 million m³ per year was free. The rest was to be charged at 0.275 cents per cubic metres. Because of the proposed new scheme, the total quantity of 18.25 million m³ per year, which the Department undertook to make available to Bloemfontein at Maselspoort with the aid of releases from the Rustfontein Dam, would not always be available. Any shortages in this quantity, which Bloemfontein required, were to be supplied from the Caledon-Bloemfontein pipeline (Welbedacht Dam) (RSA, 1979c:7).

This water was much more expensive than the water from Maselspoort, and Lesaka was therefore to be responsible for the increased cost of the replacement water from the Caledon-Bloemfontein pipeline. Thus, Lesaka was to pay for the difference (RSA, 1979c:7-8).

In 1980, the DWA reported that it needed a further R4.5 million for the implementation of the Lesaka Water Distribution Scheme. This was because the tender prices exceeded the 1979 estimates. In addition, of importance was that further investigations showed that it would be much more cost-effective if water were to be delivered from the Caledon-Bloemfontein pipeline. The scheme was therefore amended. This implied a total cost saving of R1.4 million (RSA, 1980c:3, 8).

5.11.39. The Total Water Strategy for the Vaal Triangle

In 1980, L.H. James (Chief Engineer of the Rand Water Board) argued for a total water strategy for the Vaal Triangle. His argument for this strategy was based on the increased consumption of potable water requirements of the RWB. According to James (1980:103) usage of water from the Board was expected to double every 12 years.

The RWB required 38% of the total water available from the Vaal Dam in 1975. James (1980:103) noted that: "This figure will increase to 50 per cent in 1990, 60 per cent in 2000 and 80 percent in 2020". Against the backdrop of the increases in water requirements from RWB, James (1980:103) asked "... what plans are being considered to meet the requirements of the Board and other users of water from the Vaal River?"

He gave examples of a number of "water importation schemes that have been considered by various authorities to supplement the supply of the Vaal River". He also stated that this "... list is not exhaustive but is sufficient to indicate that in the medium term satisfactory solutions to the problem are available" (James, 1980:103).

These plans are as follows:

1. The Lesotho Highlands Water Project (LHWP);
2. Additional Development of the Tugela-Vaal link;
3. Linking the Orange and the Vaal Rivers;
4. Sub-division of the Vaal Dam;
5. Water from the Okavango Delta (James, 1980:103, 107).

Regarding the LHWP, James said that there is an increasing possibility that this scheme could become a reality if the formation of the Constellation of Southern African States (COSAS), "which is being mooted these days, took place and Lesotho was a member of such a constellation". The quantity of water available from the project could be in the order of 3 billion litres per day. This was enough to satisfy the needs of those dependent on the Vaal River until about 2010. Added advantages of the project were that it could generate hydroelectricity for Lesotho and thereby make a major contribution to its economic development (James, 1980:103).

With respect to the additional development of the Tugela-Vaal Project, the Spioenkop could supply additional water of 1.2 billion litres per day to the Vaal River system. This dam, part of the Tugela-Vaal Scheme, played no direct role in the transfer project in 1980. The dam's purpose was only to ensure a minimum downstream flow during the winter months when the full flow of the upper Tugela was taken up by the pumping of water under Stages I and II. The drawback of this proposal was that the incorporation of the Spioenkop Dam in the transfer of water to the Vaal River would be an expensive, energy-consuming scheme. The advantage was that the storage had already been constructed by 1980 (James, 1980:103).

The link between the Orange and Vaal Rivers would entail the connection of the outlets of P.K. le Roux Dam (now Vanderkloof Dam), on the Orange with the Vaal-Hartz Weir on the Vaal River. This could be done via a 200 km system of canals and pipelines. This was to supply more water that was not delivered by the Bloemhof Dam in 1980. The rationale behind this was that it would relieve the Vaal Dam of the requirements to meet the load. Unfortunately, the quantity of water transferred would not be large – about 400 million litres per day. James (1980:107) said that: "The scheme is, however, worthy of consideration because it could form part of an overall plan to optimise the use of all local resources of water". Another possibility was to pump water from the outlets of the H.F. Verwoerd (now Gariep Dam) to Vereeniging. The drawback to this was distance (about 500 km), and the capital and operating costs would be high. However, it would have made an additional 500 million to a billion litres of water per day available, thereby releasing the load on the Vaal River (James, 1980:107).

The DWA considered the sub-division of the Vaal Dam into compartments. "The water would be transferred by pumps from the shallow to the deep compartments and so evaporation losses could be reduced. Details of this scheme have not been released but it seems to have merit and will no doubt still be pursued", according to James (1980:107). The energy for the pumping of the water could be obtained from generation at the outlets of the dam. The capital cost of the scheme is high. The evaporation losses from the dam, when full, are 900 million litres per day and 500 million litres per day when half full (James, 1980:107).

The plan regarding the Okavango Delta was more of a long-term possibility. This was to obtain water from the Delta in Botswana, as has been proposed by Prof. Midgeley in the past. This proposal would also become a reality, just like the LHWP, if the initiative of COSAS materialised. The reason for this, James (1980:107) asserts, is that: "... the scheme could have economic benefits for both countries". Regarding the environmental aspects, James (1980:107) is of the opinion that: "The environmental aspects would, of course, have to receive very careful consideration, but the quantity of water available is said to be substantial and provided the amount taken is not a large portion of the total available, a scheme could be evolved that should not affect the ecology. The scheme needs to be the subject of a feasibility study, however, before its viability could be confirmed and estimates of the available quantities determined".

James (1980:107-111) also writes about the water quality of the Vaal River as part of the total water strategy. Salinity of the water of the Vaal River is of particular concern. To improve the quality of water in the Vaal River system a number of other plans were proposed by James, and tested by the Water Research Commission (WRC) at the time:

- a) The construction of small dams in the streams and rivers leading into the Vaal River Barrage to impound saline floodwater. The impounded water would be released under control conditions to minimise high salinities in the Barrage;
- b) The construction of a dam below the Barrage to store saline floodwater. The impounded water would be released in a controlled manner to minimise the occurrence of high salinities in the lower reaches of the Vaal River. Normal river flows would have to be canalised to bypass the proposed dam;
- c) The dam proposed in (b) above could be used to store non-saline floodwater – that is, after the first flush has occurred. The impounded water could be released in a controlled manner to minimise the occurrence of high salinity water in the lower reaches of the Vaal River;
- d) The creation of saline lakes in the catchment area into which high salinity waters are pumped. The water would eventually evaporate but could be used for boating, *etc.*;
- e) An extension of option (d). The water is desalinated and returned for industrial and urban use;
- f) Desalination of effluents from waste-water treatment works;
- g) All water to be used in the Pretoria-Witwatersrand-Vereeniging (PWV) (now Gauteng) area to be drawn from the Vaal Dam.
- h) The control and improvement of non-point pollution sources such as mine-dumps, streets, air pollution, *etc.*

These were all engineering solutions to increase the quantity and quality of the Vaal Rivers water resources. Political circumstances, and especially those that had an impact on the regional political situation in Southern Africa, also played a role in James's (1980) arguments. The "mooted" Constellation of Southern African States, under the P.W. Botha administration is of special importance here. What is of more significance is that James (1980) spoke of a "total water strategy". It is no irony that he used this concept. It was perfectly in line with the "total national strategy", with which South Africa warded off the "total onslaught" from its perceived enemies in the 1980s (see the chapter on historical events for an outline of the strategy). The PWV area was very important in this regard, for it produced more than 50% of South Africa's economic output. With water playing such an important role to sustain the

industrial capacity of the area, a total water strategy was therefore needed to safeguard its water supplies against pollution and to increase its quantity.

The water quality in the Vaal River is of great importance, especially given that the river contains and supports South Africa's economic heartland. The Vaal River Catchment produces only eight per cent of the MAR of the country, but has the highest concentration of urban, industrial, mining and power generation development in the Republic. Seen against this backdrop the Vaal River can justifiably be called Africa's hardest-working river and the main artery of the South African economic heartland (Vaal River Catchment Association, 1981; DWA, 1985; Raubenheimer *et al.*, 1985; Braun & Rogers, 1987:1).

Furthermore, from the mid-1970s, the Vaal River became more integrated with other South African river catchments. Water was first imported from the Tugela River basin in 1974. Later the Vaal River catchment was linked to the Inkomati and Usutu Rivers to meet the needs of the industries growing around the coalfields of the Upper Vaal and Olifants catchments. Thus, the centres of high water consumption in South Africa are situated in areas where water resources are sparse; this is especially the case with those areas in the Gauteng region. However, with growing demand and increasing river regulation, the proportion of polluted return flows to natural run-off in the Vaal River increased. This led to a steady decline in the quality of the water supplied to the PWV area (Van Robbroeck, 1979:29; Braun & Rogers, 1987:1). Therefore, James (1980) was correct in his assessment that water quality should also be included under strategic concerns regarding South Africa's most important surface water resource.

5.11.40. Water Supply for the Lethabo Power Station

In 1981, ESCOM planned the construction of the Lethabo Power Station. This power station was to have an initial capacity of 3 600 MW. Yet in 1981 contracts were limited to 1 800 MW. This power station was built in the area between the Vaal Dam, Sasolburg, and Vereeniging (RSA, 1981e:3).

ESCOM planned the Lethabo Power Station because of the economic growth in the Republic. For this reason, ESCOM had to continuously expand the national power grid. ESCOM's forecasts of the power consumption growth rate had risen from 6.03% per year in 1979 to as much as 7.25% per year by March 1980 (RSA, 1981e:4).

Like all of ESCOM's thermal power stations, Lethabo also needed water. A water supply at a peak rate of 0.4 m³/s was required by the end of 1984 or even as early as June 1984. This peak rate was to be increased to 2.3 m³/s. This was due to the progressive commissioning of individual generator sets. It was expected that the last (sixth) generator set would be commissioned by July 1988 (RSA, 1981e:3).

The proposed water distribution scheme for the power station was therefore planned with a peak capacity of 2.3 m³/s. The mean full supply of 54.75 mcm/yr was expected to be used by 1990. The estimated capital expenditure of the scheme was R4.6 million at September 1980 prices (RSA, 1981e:3).

Regarding costs, DWAFEC stated in its report that: "Because the final location of the power station was not known at the time of budgeting, R15 000 000 was budgeted on the basis of direct supply from the Vaal Dam itself. The final location of the power station has made it possible to save about R10 332 000 on the cost of canals and pipelines. The unit cost of the water at September 1980 prices is calculated to be *1.62 cents per cubic metre*. The proposed tariff for water is *4.02 cents per cubic metre*, which includes the tariff for water from the Vaal Dam and the Water Research Fund levy" (RSA, 1981e:3).

In the early 1980s, there were two large water consumers in the distribution system of the proposed Lethabo Government Water Distribution Scheme. They were SASOL and ESCOM (RSA, 1981e:4).

ESCOM, at that time, used 27.4 mcm/yr (an average of 75 000 m³/d). This was abstracted for the Vaal, Taaibos, and Highveld Power Stations combined. Each of these stations was supplied with water by its own pumping station and pipeline from the Vaal River. During 1979 SASOL's average daily consumption of water was about 100 000 m³. Of this, 7 000 m³ of water per day was supplied through a steel pipeline about 5 km long. A further 45 000 m³ of water per day on average was pumped to SASOL from the Barrage through a pipeline about 10 km long. The remaining 48 000 m³ of water per day on average was pumped from the Highveld Power Station. This was done through a pipeline 25 km long (RSA, 1981e:4).

In 1981, SASOL planned to replace the last-mentioned quantities of water from the Vaal River with about 50 000 m³ of water per day, on average, from the new RWB's right bank canal. This canal was to convey water from the Vaal Dam to the Board's purification works at Zuikerbosch. Yet the water would still be pumped to SASOL by the Highveld Pumping Station (RSA, 1981e:4).

The proposed works were to include a weir (three to four metres high), to prevent mineralised water from the Suikerbosrant and Klip Rivers heading up past the uptake point of the existing pumping stations. A pumping station was also to be constructed, together with a rising main and a terminal reservoir, to convey water from the Vaal River to the proposed Lethabo Power Station (RSA, 1981e:7).

5.11.41. The Kalahari West Rural Water Supply Scheme

In 1985, the Kalahari West Water Board applied for a loan for the construction of a rural water supply scheme. The possibility of such a scheme for domestic and stock-watering purposes to the Kalahari had been mooted in 1948 by the Department of Irrigation (RSA, 1985a:3, 4).

Various other authorities also examined the possibilities of providing stock-water to the region. They were the Orange River Agricultural Union in 1957, the Pipeline Committee of the Orange River Agricultural Union since its establishment in 1961, the Cox Committee of 1962, and the Commission of Enquiry into Agriculture in 1967. They were all in favour of proposed schemes to provide water to the entire area. However, these schemes were not found to be economically viable (RSA, 1985a:3, 4).

After further petitions, the DWA investigated a scheme in 1975. This scheme aimed at providing water to a smaller area of 1.5 million ha. Yet this would have placed too heavy a financial burden on the properties concerned. Proposals like the desalination of groundwater, the more efficient use of water from "gatdamme", and the introduction of water from the Vaal-Gamagara Government Water Scheme were then considered (RSA, 1985a:4).

The Pipeline Committee had in mind a scheme similar to the one proposed in 1985. This scheme was investigated by consulting engineers during 1978. After the expected agricultural advantage was established by the Department of Agriculture, the Directorate of Water Affairs compiled another report in December 1980 on the possibilities of such a stock-watering scheme (RSA, 1985a:5).

The greatest problems were encountered in the western regions (the so-called Salt Block area). These areas were dependent on surface water resources in 1983. Due to the drought of the mid-1980s, a state of emergency had arisen in these parts. In January 1982, after representations had been made, the cabinet gave its consent for the construction of an emergency water supply scheme. Water was to be pumped from boreholes in the bed of the Kuruman River to reservoirs at strategic places in the area and transported from there by the farmers themselves to their farms. This scheme was to be subsidised by 66.6%. The Kalahari West Water Board was established to carry out the task (RSA, 1985a:3, 5).

The Board proposed certain amendments to the emergency scheme. It also asked for approval for the construction of a secondary supply system to the boundary of every farm with a 33.3% subsidy on these costs. The scheme supplied water to 74 farms with a total combined surface area of 648 000 ha and was undertaken in collaboration with the Upington Municipality. The Municipality was to draw water from the rising main for the Van Rooysvlei mine, and the Hondejag industrial area. The role of the Municipality was to contribute towards the cost of the scheme, supply purified water to the Board and maintain and operate the scheme as far as the main reservoir at Spitskop (RSA, 1985a:3).

The water was to be drawn from the municipal reservoir and pumped over a distance of 20 km to the main reservoir on the watershed at Spitskop. The maximum carrying capacity of this portion of the scheme was to be 4 400 m³/d. The municipality was entitled to draw a maximum of 2 400 m³/d from the rising main. From the Spitskop reservoir the water was to gravitate to the Board's supply area. From there, and with the aid of two booster-pumping stations, a pipe network of about 400 km and 13 reservoirs, the water was to be distributed to the farms in the area (RSA, 1985a:3).

The cost of the project was estimated at R13.4 million, according to the tenders. A basic levy of R1.74 per hectare per year was proposed to cover redemption of capital costs and the Board's other fixed obligations. Construction of the scheme started in January 1984 and it was expected to be completed by July 1985. Regarding the influence on the environment, the DWA states in its 1985 report that: "A large part of the pipeline is being placed next to existing road routes. All pipelines are to be laid underground and the terrain restored. With the water supply systems already installed on the farms in the area, the scheme will have no adverse effects on the environment" (RSA, 1985a:3-4, 12).

5.11.42. The Lesotho Highlands Water Project¹⁴

The LHWP is an international inter-basin transfer scheme (IIBTS) that was jointly implemented by Lesotho and South Africa. The purpose of the project is to divert water from the headwaters of the Orange/Senqu River in the Lesotho Highlands to the area of the Vaal River catchment (Meissner, 1998:48) where South Africa's economic heartland, Gauteng, is situated. The joint venture consists of several major and minor dams, a series of water-transfer tunnels dug through the Maluti Mountains, and various associated infrastructures, including hydroelectric generators and pumping stations. More than 90% of the construction work is located in Lesotho. If the project is brought to completion, nearly 50% of Lesotho's water will be diverted for use into the Vaal River basin in South Africa (Gleick, 1998:93).

Phase 1A of the project is designed to transfer 18 m³ of water per second to South Africa and generate 72 MW electricity for use in Lesotho. This phase consists of two dams, the Katse and Muela, the excavation of 82 km of subterranean water transfer tunnels, and the construction of an underground hydroelectric power station. Phase 1B consists of the construction of two dams, the Mohale and Matsoku, which are connected to the Katse reservoir. This phase, if implemented, should be completed by 2003 (Meissner, 1998:48). It should deliver 12 m³ of water per second (Gleick, 1998:95). A joint venture of this magnitude also needs institutional arrangements.

The project is managed by the Lesotho Highlands Development Authority (LHDA), a joint Lesotho-South Africa organisation. This establishment is responsible for construction, environmental protection, and all resettlement and compensation issues regarding the project in Lesotho. In South Africa, the project is overseen by the Department of Water Affairs and Forestry (DWAF) and the Trans-Caledon Tunnel Authority (TCTA). The Lesotho Highlands Water Commission (LHWC), formerly the Joint Permanent Technical Commission (JPTC), was established to represent both countries (Meissner, 2000c:26). The LHWC has monitoring and advisory powers over the administrative, technical, and financial activities of the project (Gleick, 1998:93).

5.11.42.1 The History of the LHWP

The LHWP, like all other massive water resources development schemes in South Africa, has an interesting history. It differs substantially from those of other massive water schemes implemented by South Africa, because it involves another state – Lesotho.

The LHWP originated from two main considerations: (1) the Vaal Dam would not be able to meet the growing needs of South Africa's most important industrial area indefinitely; and (2) the Lesotho Highlands are potentially a most rewarding and reliable source of water supply to the Vaal River basin and the industrial heartland of South Africa. In 1950 the High Commissioner to Lesotho (then known as Basutoland, a British Protectorate) Sir Evelyn Baring, requested a survey of the water potential of the territory. He realised that water was

¹⁴ Part of the history of the Lesotho Highlands Water Project was taken, verbatim, from R. Meissner's uncompleted D.Phil Thesis: *The Transnational Role and Involvement of Interest Groups in Water Politics: A Comparative Analysis of Selected Southern African Case Studies*, under the supervision of Prof. Anton du Plessis.

the only natural resource Lesotho had in abundance. Sir Peter Ballenden, Director of Public Works, chose the Cape Town-based engineer Ninham Shand to determine the viability of exporting Lesotho's water to areas in South Africa in need for augmented supply (Brooks, 1970:12; Van Robbroeck, 1986:1; LHDA & TCTA, 2001:1).

Ninham Shand consequently published a plan to harness the upper reaches of the Orange River in Lesotho and transport the water to the Orange Free State gold mines. At that time, the project was known as the Oxbow Scheme. This initial project involved the construction of a high-altitude dam, a hydroelectric power station, and a tunnel through the Maluti Mountains to transport the water to South Africa. The water would have been delivered to the Vaal Dam *via* the Elands River. In other words, the Oxbow was similar to the current LHWP, with the LHWP being of a much larger magnitude in terms of the number of phases and components to it. The plan was initially rejected, but in the mid-1960s, a drought caused renewed interest in the scheme (Eksteen, 1972:123; Van Robbroeck, 1986:1; LHDA & TCTA, 2001:1).

The reason for the selling of all electricity to South Africa was that at the time of the Oxbow Scheme Lesotho was still a very poor and underdeveloped protectorate of Britain, and could not use all the electricity. It could therefore be assumed that Lesotho and South Africa would both benefit from the scheme. South Africa would get water to sustain gold production and Lesotho much-needed development in the form of infrastructure.

From its inception it was realised that the Oxbow Scheme's success would entirely rest on South Africa's willingness to buy the water and electricity. Not only that, in 1956 Britain announced that South Africa's cooperation was necessary if the Oxbow was to be build. However, South Africa did not give this guarantee at the time because Lesotho was more underdeveloped than South Africa and it was impossible for the country to solely implement such a project, which would have had a cost of R24 million. It was therefore necessary for South Africa to become a partner in the venture (Eksteen, 1972:121) in order to supply the financial resources.

South Africa's unwillingness to become a partner in the Oxbow Scheme changed during the period 1966-67. In that year South Africa realised that the Vaal Dam would be insufficient in providing water for its economic heartland. The period 1966-67 was also a drought year. In 1966, the South African government set up a commission to look into the matter of alternative water resources and hydroelectricity from Lesotho. The commission found that it would be in South Africa's best interest to implement the project, but the country would not be dependent on water and electricity from Lesotho. The scheme would only serve as a supplementary source of water (Eksteen, 1972:122) to South Africa. A water scarcity therefore prompted the South African government to look for new sources of water. Yet South Africa was still not willing to go into a joint venture with Lesotho regarding the scheme. It seems that politics played a big role in this regard.

A few political issues were identified that could jeopardise the scheme:

- South Africa's insistence on the incorporation of Basutoland into the Republic. Jan Smuts, one of South Africa's former Prime Ministers, was urged in parliament in March 1945 to create a massive federal state. This state would have consisted of the territories of South Africa, Rhodesia (Zimbabwe), Kenya, Tanganyika (Tanzania), and the High Commission

Territories of Bechuanaland (Botswana), Basutoland and Swaziland (Barber & Barratt, 1990:19):

- South Africa's *apartheid* policy and the critique it attracted;
- The Basutoland Congress Party's (BCP) demand that territory lost in the Basotho Wars of the previous century be handed back to Lesotho (Young, 1961:227; Shand, 1956) and;
- South Africa's unwillingness to be dependent on a foreign state for its water resources (Eksteen, 1972:122).

In March 1967, a preliminary feasibility study was presented to the government of Lesotho. This study was conducted by Ninham Shand and Partners in association with Merz and McLellan. Discussions of the report's proposal with the South African authorities resulted in substantial changes. This resulted in the publication of a report to the Government of Lesotho entitled *The Oxbow Complex – Consolidated Proposals*. The scheme proposed in that report was to divert water from the Caledon and its tributaries, and from the Malibamatso towards the Klerkspruit, a tributary of the Vaal River. The intention was to construct this modified project in phases that would gradually supply more water to the Vaal River catchment. Furthermore, it was planned that the Pelaneng Dam would be used as a low evaporation reserve storage reservoir. This would have allowed the Vaal Dam to be overdrawn on its safe yield. In turn, this would have improved the yield of the combined resources (Van Robbroeck, 1986:1-2).

Also included in this "consolidated plan" was a hydroelectric power station at Lala. These proposals were subjected to a full feasibility study. This study was to be financed by the United Nations Development Programme Special Fund, acting through the World Bank. This resulted in a 1971 report entitled *Lesotho, Study on Water Resources Development, Feasibility Report*. In this report, a scheme was recommended. This scheme was to consist of a 94 metre-high dam at Pelaneng on the Malibamatso River, with a 60 km tunnel along a western route to the Elands River. It was envisaged that eight m³/s of water would be transferred through this tunnel by 1977. This became known as the Binnie proposal, after the Binnie and Partners who conducted the study (Van Robbroeck, 1986:2).

In the coming decades these issues, and particularly the question concerning *apartheid*, would have a significant influence on the interaction between Lesotho and South Africa concerning the LHWP. These issues also defined South Africa's security concerns regarding the project.

The question of South Africa's *apartheid* policy was, in the period before Lesotho's independence, already a thorn in that country's side. The then Minister of Economic Development, Molapo, stated that if South Africa should buy water and electricity from the Oxbow Scheme, it would change Lesotho's economy drastically. Nonetheless, he stated simultaneously that the citizens of Lesotho were afraid, that should South Africa get a hold on his country's economy, South Africa would impose its *apartheid* policy on Lesotho (Eksteen, 1972:122-123).

After Lesotho gained independence in October 1966, Premier Lebaau Jonathan said that the Oxbow scheme was high on his country's development list. In fact, Jonathan stated that if the scheme were implemented, Lesotho's budget would show a positive balance for the first time (Eksteen, 1972:123). Negotiations between Lesotho and South Africa took place, and on 23

February 1968, Jonathan announced that an agreement in principle was reached (Smit, 1967:298).

This step was hailed by South Africa and Lesotho as the beginning of a long-term positive relationship between the two countries (Eksteen, 1972:124). Construction of the scheme did not start immediately; firstly because South Africa was implementing the Tugela-Vaal water transfer project, that would provide sufficient water to the *Witwatersrand*, and secondly South Africa was not ready to be dependent on water and electricity from an "unreliable state" (Barber & Barratt, 1990:129). Already the hydraulic mission was hampered by the political circumstances rather than insufficient technical and human resources.

For instance, negotiations on the implementation of the Binnie proposals between Lesotho (assisted by the World Bank) and South Africa failed to produce an agreement and were terminated at the end of 1972. Van Robbroeck (1986:2) writes that: "The reason for this failure was the vastly different perceptions the two countries had on the Royalty to be paid for the water. The RSA originally (in 1968) offered a tantieme of 0.5c/m³, which was later raised to 1.25c/m³, over and above the full cost of water production. Lesotho on the other hand, as advised by the World Bank, wanted a return of 8% per annum on capital invested. The RSA argued that this was unreasonable, because Lesotho did not put up equity, but relied on loans, which were fully serviced by the RSA".

In addition, South Africa could increase the capacity of the Tugela-Vaal at a much lower capital cost. This was because of the provisions that were made for extensions in the first phase. In this regard Van Robbroeck (1986:3) states that: "Running costs would be substantially higher, but there was a limit to what the RSA could pay before the Tugela-Vaal second phase would become more attractive. After the deadlock, the Department of Water Affairs proceeded with the Drakensberg Project as an extension to the Tugela-Vaal Scheme, which together with the raising of Sterkfontein Dam was considered able to supply sufficient water to meet the demand of the Vaal consumers until 1992".

In the beginning of the 1970s, relations between South Africa and Lesotho started worsening. In fact, in 1975 the Vorster government classified Lesotho "an extremist state" (Barber & Barratt, 1990:130). Between 1976 and 1978, the project came to a halt because of the worsening political situation between the two neighbours. In 1978 the LHWP was again revived, but the two governments still disagreed on a few issues. The revival of the project came when the Planning Division of the DWA produced an internal report. The report recommended that the Upper Orange again be considered as a source of water for the Vaal River. A larger scale development project was now feasible. This was after consideration was given to the exponential nature of the demand growth for water and the time lapsed since the Malibamatso scheme was recommended. At this stage, analysts pointed at the economic interdependence between the countries, regarding the project (Wilsenach, 1982:104; Van Robbroeck, 1986:3).

Henry Olivier and Associates, consulting engineers, were appointed to carry out some desk studies. Discussions with Lesotho were re-opened. These negotiations were interrupted by the Soweto Riots of July 1976. However, after these unfortunate events it was agreed that a joint preliminary feasibility investigation be launched. Each country was to appoint its own consultants, under the direction of a Joint Technical Committee (JTC), which held its first meeting in 1978 (Van Robbroeck, 1986:3).

Henry Olivier and Associates and Binnie and Partners were instructed to collaborate in the production of a joint preliminary feasibility report. Lesotho insisted on two conditions:

1. All layouts considered were to include hydroelectric power development in Lesotho itself; and
2. No layouts were to involve storage capacities on the Caledon River.

These conditions had an important impact on the outcome of the study. In May 1979, the JTC produced a report on the strength of which it was decided to proceed with a final feasibility study. Each country was to contribute half the cost of the study. A single layout to be subjected to final feasibility had not been definitely identified (Van Robbroeck, 1986:3-4). Cooperation was unfortunately inhibited due to the low level of conflict between them.

(a) The Feasibility Study

According to Van Robbroeck (Date Unknown:4): "It took Lesotho a considerable time to mobilise funds for its share of the cost of the feasibility study. Although it had provisionally been agreed to establish a joint body to appoint joint consultants, conditions attached to the funding acquired [sic] by Lesotho from the European Development Fund prevented this, and a complicated arrangement had to be devised for coordinating and supervising the study".

Although this complicated arrangement was made, a satisfactory result was achieved. This bore testimony to the goodwill and negotiating skills on both sides (Lesotho and South Africa). It was never necessary to take disputes to higher levels. Meetings at these levels were only held at the particular stages when important policy decisions were required (Van Robbroeck, 1986:4).

The Olivier Shand Consortium was appointed by South Africa and the Lahmeyer MacDonald Consortium by Lesotho. The Lesotho Highlands Project Unit of the Ministry of Water, Energy, and Mining was assisted by Tippetts-Abbett-McCarthy-Stratton as study supervisors for Lesotho. This assistance was funded by the UNDP using the World Bank as agent. The DWA supervised the study for South Africa. Its share of the cost was paid for from the Department's budget. Mobilisation of the study teams started in August 1983. The study was conducted in two stages (Van Robbroeck, 1986:4).

Identification of the layout was to be studied in detail in Stage 2. The first stage was to confirm that there were no insurmountable socio-environmental or legal barriers. It was also to establish that the benefits would be sufficient for both countries to continue with the study. By the time the study was started, the DWA had already conducted studies of alternatives to the LHWP. These alternatives were to give an indication of the LHWP's economic advantages. A rough comparison with South Africa's best alternative, the Orange-Vaal Transfer Scheme, showed that there was an appreciable economic advantage to the LHWP (Van Robbroeck, 1986:5).

This scheme was capable of transferring up to 70 m³/s to the Vaal River. It was to consist of a dam on the Orange River near Aliwal North and a 500 km long aqueduct and pumping stations. "The RSA was not satisfied that the optimum layout had been identified in the Stage

I Report, and in addition, it was considered necessary to jointly determine and agree the magnitude of the benefit to be gained from the implementation of the LHWP. This was regarded as essential in view of the failure to agree on the size of the *tantieme* in the past. A joint study of the best alternative open to South Africa would prevent differences in perceptions arising again" (Van Robbroeck, 1986:5).

Accordingly, it was decided to divide Stage 2 of the study in two parts. Stage 2A was to determine the benefit by comparing the 70 m³/s optimum Orange-Vaal Transfer Scheme with an optimum combination LHWP-Orange-Vaal Transfer Scheme producing the same yield. The comparison was to be made between present values at an agreed discount rate of 6% per year. Benefits derived from this were to be shared more or less equally. The precise division was to be negotiated at the political level (Van Robbroeck, 1986:6).

The main conclusions of the Stage 2A report were as follows:

1. That the benefit at 1983 price levels, expressed as a present value in 1995, would be about R1.9 billion, which could be divided between the two countries;
2. That the maximum cost advantage is provided by the LHWP alone, rather than a combination with a follow-on Orange-Vaal Transfer Scheme;
3. That the lowest cost layout for an ultimate 70 m³/s would consist of four phases. Based on these results, both governments decided to proceed with Stage 2B of the study. This was concluded by December 1985 and the results were published in the final report in April 1986 (Van Robbroeck, 1986:6).

The report consists of 19 volumes of text and eight albums of drawings. These volumes and albums are altogether 62 centimetres (cm) thick and weigh 33 kg. The report consists of a Main Report and a number of Supporting Reports:

- A. Hydrology Studies
- B. Geotechnical and Construction Materials Studies
- C. Environmental and Social Impact in Lesotho
- D. Topographical Surveys and Mapping
- E. Management and Manpower Studies
- F. Legal Studies in Lesotho
- G. Infrastructure
- H. Design Studies
- I. Project Cost Studies
- J. Economic and Financial Appraisal (Van Robbroeck, 1986:7).

Three issues could not be resolved during the feasibility study:

1. Hydrology, due to problems regarding the scarcity of flow gaugings of sufficient length or record and with the accuracy of some of the gaugings. A mutually acceptable hydrology was needed for two reasons: (1) to produce a fully optimised scheme during the design stage; and (2) for calculating the correct Royalty, because the comparison between the Orange-Vaal Transfer Scheme and the LHWP was sensitive to the adopted hydrology.
2. The hydro-station layout, because the rate of return on the investment in the 110 MW Tlhaka power station was not sufficiently high to meet the normal World Bank criteria.

3. Cost allocation between the hydro and the water transfer function (Van Robbroeck, 1986:9-10).

Regarding socio-environmental impacts, the report concluded the following:

- The main impact would be the loss of some 4 000 ha of arable land and 18 700 ha of grazing.
- Some 1 365 people would have to be resettled.
- Extra employment, new and improved infrastructure, fisheries and tourism, and the distribution of the extra income from water sales in the Lesotho economy would more than offset the negative impact (Van Robbroeck, 1986:11).

On institutional arrangements, the report recommended that a parastatal authority be set up in each country, responsible for all the works within its own territory. This was because of the disproportionate size of the project to Lesotho's economy (most of the project would be located in Lesotho). It was therefore considered inappropriate for a bi-national agency to implement, maintain, and operate the project. The parastatal agency responsible for work in Lesotho was to be called the Lesotho Highlands Development Authority (LHDA), and the South African authority, the Trans Caledon Tunnel Authority (TCTA). Furthermore, and because the South African water user would pay most of the cost of the works, it was found necessary to establish a joint agency for monitoring and having certain powers of approval. (In 1988, the South African parliament accepted a report to levy a charge of two cents per cubic metre (2c/m³) regarding users of water from the section of the Vaal River from Grootdraai Dam to the Vaal Orange confluence. This levy was raised to 4c/m³ in October 1989 and thereafter it was raised on an annual basis according to a predetermined formula. In 1992, the price was to be 10c/m³ or 14c/m³ in future (from 1989) money values.) Each country was to have equal representation on this agency called the Joint Permanent Technical Commission (JPTC) (now the Lesotho Highlands Water Commission (LHWC)) (Van Robbroeck, 1986:11; RSA, 1989c:1, 3).

The consultants also prepared a draft treaty. This treaty contained the agreement reached at technical level. The treaty was extensively reviewed and revised by the legal staff of both Departments of Foreign Affairs, without changing any of the principles that were agreed. The treaty, *inter alia*, stipulates that the benefits of the project would be divided 56-44 in Lesotho's favour. This means that, expressed in 1986 values, at January 1995, using 1985 prices, Lesotho would receive an estimated R1.297 billion (Van Robbroeck, 1986:11).

(b) Continuing Conflict

The conflictual situation between the two countries reached an apex in December 1982, after South Africa launched an attack against African National Congress (ANC) targets in Lesotho (Sullivan, 1989:208). In 1983, Lesotho threatened South Africa that it would keep back the water from the scheme if South African military involvement continued and said it would suspend any form of cooperation on the project (*Die Vaderland*, 16 March, 1983:3). With the military intervention in mind, Lesotho demanded that a clause be written into the agreement on the LHWP, wherein Lesotho could shut off water in case of a political dispute with South Africa. Lesotho felt that because it would deliver the water it could also control the source.

Lesotho, to give South Africa some reassurance, said that it would inform South Africa before such a cut-off. South Africa was dissatisfied with this, and demanded an uninterrupted water flow. It also threatened Lesotho that, should it should break its promise (made in a future agreement on water transfers), this would constitute the right to a military invasion (*The Daily News*, 16 April 1983:7).

South Africa was unable to get such a guarantee and the negotiations over the water came to a halt (*The Star*, 12 August 1986:11). Both South Africa and Lesotho thus used the LHWP for political ends: Lesotho to get assurance that its territorial integrity and sovereignty would not be breached and South Africa to ensure that it would get an uninterrupted water supply. The fact that Lesotho controlled the source of the water gave Lesotho a certain amount of power to influence South Africa's behaviour.

Planning for the LHWP continued from August 1983 to August 1986. It was contained in a feasibility study carried out by the Lahmeyer MacDonald Consortium Study Consultants. The 24-volume final report included not only designs for dams, tunnels and pumping stations to reverse the flow of the Orange River through the Maluti Mountains and the construction of a small hydroelectric plant, but also an outline of the bureaucratic structures required to manage the scheme. The report also included draft legislation to create the Lesotho Highlands Development Authority (LHDA) to implement the project in Lesotho, and the draft of a Treaty between Lesotho and South Africa (Showers, 1996:12).

During 1984, the situation surrounding the LHWP was still tense. This was due to South Africa's unhappiness over ANC members residing in Lesotho, the presence of communist bloc embassies, Lesotho's critique of *apartheid*, and South Africa's assistance to the Lesotho National Liberation Army (NLNA). South Africa demanded that Lesotho enter into a Security Agreement with it, but Jonathan declined (Barber & Barratt, 1990:318). In response to this South Africa threatened to withdraw from the LHWP if the security situation did not improve (*The Star*, 19 May 1984:2). The viewpoint of Lesotho was that the LHWP had nothing to do with a security treaty (*Rand Daily Mail*, 19 August 1984:3). South Africa, on the other hand, said that sabotage of the project was a possibility (*The Cape Times*, 22 August 1984:2). The carrot of the LHWP became a very important diplomatic tool for South Africa to try to get concessions from Lesotho. South Africa thus used the LHWP as an attempt to better its external security position. This indicates that South Africa still did not want to place itself in a position whereby its economic heartland would be vulnerable to decisions made by one of its enemies (Leistner, 1984:113) and thereby also jeopardise its economic security. The LHWP was therefore during this time seen as both a source of socio-economic development and a security concern.

On 21 August 1984, negotiations between Lesotho and South Africa took place in Cape Town (*Die Burger*, 21 August 1984:5). After the meeting, the feasibility study for the LHWP was restarted following the pullout of South African engineers from the study earlier that year (*Sunday Express*, 7 October 1984:1). The security argument was still high on South Africa's agenda. South Africa, for example, still insisted that it would not sign the LHWP treaty without an integrated security arrangement and that Lesotho should get rid of "political problems" like the ANC (*Beeld*, 9 October 1984:14). South Africa still felt that it could not trust Lesotho regarding the physical security of the project (*Die Vaderland*, 11 October 1984:10). The reason for South Africa insisting on the guarantee of the physical security of the project could be a result of the bad experiences South Africa had with the Caluque

Scheme on the Kunene River in August 1975 as well as the Cahora Bassa Dam in Mozambique during the 1980s. At the Calueque Dam harassment of workers by the *União Nacional para a Independência Total de Angola* UNITA¹⁵ and Angolan government forces, after Angolan independence, led to a suspension of the project (Meissner, 2000a:111).

The security situation was in 1984 still the most important issue for South Africa (Coetzee, 1984:132) regarding the LHWP. At a National Party (NP) congress the then Prime Minister of South Africa, P.W. Botha, stated that for South Africa it was very difficult to start with the LHWP because of Lesotho's insensitivity towards South Africa's security needs (Leistner, 1984:113). The development of the LHWP was therefore dependent on the international relations between the two states and the improvement of the internal political climate within Lesotho (Coetzee, 1984:132). South Africa therefore coupled the LHWP with the issue of security throughout the 1980s. If Lesotho should sign a security treaty with South Africa, it would have had a positive impact on South Africa's regional security climate.

The "last straw" regarding South Africa's relations with Lesotho was the opening of the Cuban embassy in Maseru and continuous support of the ANC by the Jonathan government. This led to an economic blockade imposed on Lesotho by South Africa late in 1985 (Tsikoane, 1990:117). This economic barricade had an important, although negative, impact on Lesotho's internal political situation. Political events can have some influence on the hydraulic mission. These political occurrences can be from either inside or outside the state.

(c) *Coup d'état and the LHWP Treaty*

On 16 January 1986, a *coup d'état* took place in Lesotho, toppling the Jonathan government and ushering in the government of Gen. Maj. Lekhanya (*The Economist*, 25 January 1986:41). It is argued in some circles that South Africa was the main instigator of the *coup d'état*, especially after evidence that South African officials had met with Lekhanya on 17 January 1986 (Sullivan, 1989:209). In spite of the meeting, it could not be proved whether or not South Africa was directly involved in the *coup d'état* (Baynham & Mills, 1987:52). The *coup d'état* was a watershed in the relations between South Africa and Lesotho, not only over the broad spectrum of political issues, but also regarding the LHWP. The reason for this was that an unfriendly government was removed and replaced with a more compliant one. With the political "problem" out of the way, the hydraulic mission could be implemented.

After the *coup d'état* relations between the two governments started improving, especially on security and economic matters. Lesotho expatriated most of the ANC's members and broke off diplomatic ties with the communist countries. This improved environment culminated in the signing of the LHWP treaty on 24 October 1986 (*Beijing Review*, 10 February 1986:11). The treaty was very important for South Africa in that it helped South Africa break out of its isolation mould. It was the first treaty South Africa signed after the Nkomati Accord with Mozambique in 1984 (*The Star*, 31 October 1986:14). The treaty showed the rest of Southern Africa that to work with South Africa could have positive implications, according to the South African government. The signing of the treaty could be seen as a reward from South Africa to Lesotho for complying with South Africa's wishes regarding the ANC and

¹⁵ Former Angolan rebel movement and now a political party after the end of the civil war in Angola in 2002.

communist bloc embassies (Sullivan, 1989:209). The LHWP treaty was therefore a very good public relations exercise for South Africa in the mid-1980s.

From 1986 onwards relations kept on improving. After the collapse of the Soviet Union and the De Klerk speech of 2 February 1990, the whole region saw a reduction of hostilities, at least in some parts of the region. In 1992 South Africa and Lesotho exchanged diplomats, and in March 1993 the military government was replaced by a civilian one. After an election in the beginning of April 1993, Vincent Mokhele was sworn in as Prime Minister of the Mountain Kingdom. He immediately committed himself to good relations with South Africa and the development of Lesotho's economy. Within this framework of better relations and economic development, the LHWP would be of paramount importance, he said (*Beeld*, 31 March 1993:15).

During the period 1993 to 2001, the overall international relationship between South Africa and Lesotho was characterised by growing cooperation concerning the project. Collaboration regarding the LHWP was further strengthened by the ongoing political reform in South Africa and the election of the ANC in 1994. It is interesting to note that the ANC was, during South Africa's *apartheid* years, in principle against the LHWP, for political reasons, and in particular because the project was seen by the organisation as a tool of domination by South Africa in the Southern African political milieu. The LHWP was also used by South Africa as a bargaining chip against Lesotho's Jonathan government, to put pressure on Lesotho to get rid of the ANC and communist bloc embassies. This was understandably also unfavourably received by the ANC. After the elections in 1994, the ANC changed its stance regarding the project, and started to support it for the benefits it would bring to South Africa and Lesotho (Meissner, 1998).

(d) Operation Boleas

In 1998, South Africa, under the auspices of the Southern African Development Community (SADC), was involved in a military operation (Operation Boleas), together with Botswana to quell a rebellion in Lesotho. This rebellion was led by members of the Lesotho Defence Force. After the 1998 SADC involvement in Lesotho, speculation and even outright accusations were rife, to the effect that the incursion was for one reason and one reason only – water. Some organisations, especially interest groups campaigning against the project, raised their voices and branded the Lesotho Highlands Water Project (LHWP) the main reason for the SADC involvement. A closer look at the situation reveals that there is no connection between the military engagement in Lesotho and the LHWP (*The Economist*, 26 September 1998; *Saturday Star*, 7 November 1998:11).

States and international organisations become involved in the domestic politics of other states for various reasons. These reasons can range from humanitarian assistance to creating a public authority in an environment of chaos (Geldenhuys, 1998). International involvement in a country's affairs can also occur when a particular state requests such involvement, which makes it legal in some way. One can ask what the objective of the SADC intervention in Lesotho was. This question is central to the argument that South Africa did not become involved solely to defend a water source.

In South Africa's relationship with Lesotho it was not the first time that a link could be found between water and intervention. One will recall the 1986 *coup d'état* in Lesotho. After the *coup*, it was mooted that South Africa had deliberately installed a more friendly government to ensure an unhindered supply of fresh water to South Africa. The connection was reinforced when, nine months later, the LHWP agreement was signed.

Water played a secondary role in the *coup* of 1986. This is also true of the LHWP and the SADC military intervention in 1998. Water plays an important role in the relations between South Africa and Lesotho, but it was not the main reason for the intervention.

Boleas was launched at the written request of the elected government of Lesotho, which was being threatened by a military *coup d'état*; the rationale, therefore, was to prevent this from happening and to restore security within the Mountain Kingdom. The fact that fighting occurred at the Katse Dam has been said by some commentators to be evidence of a "water war". Turton (2003b:159) refutes this conclusion. This was because the fighting was not over the resource itself, but to assist a government threatened by its own security forces.

One thing is true, though, and that is the strategic importance of the LHWP. It is fortunately of not only strategic significance to South Africa, but also to Lesotho and the entire Southern African region. As Graeme Addison in a letter to the *Mail & Guardian* of 2-8 October 1998 said: "The attack was more than symbolic. Like the United States in Kuwait, we had a strategic interest in a precious natural commodity. The Lesotho Highlands Water Project and in particular Katse dam are the key to South African thinking (if you can call it that) about Lesotho". This importance became known during the involvement of the South African National Defence Force (SANDF) when it dispatched troops in and around the Katse dam to secure the facility. The military identified the Katse dam as an asset to be protected in case harm came to it. Here the idiom "better safe than sorry" was the main motive for this action, and not to grab the water supply. Addison has it wrong when he says that the LHWP and the Katse dam is the key to South African thinking about Lesotho. The LHWP indeed played a role in the South Africa-Lesotho association, but it has been a source of cooperation since 1986. Why should it suddenly become a source of alleged South African hegemonic imperialism?

Internally, Lesotho has had a very unstable political climate. The country has a history of political conflict, which has revolved mainly around resource distribution, political participation, and the legitimacy of the government. The split in the Basotho Congress Party (BCP) in 1997, leading to the establishment of the Lesotho Congress for Democracy (LCD), was the major cause of the 1998 conflict in Lesotho. This culminated in the opposition parties mounting a protest and destabilisation campaign. The Lesotho army was also a factor that led to the dispute. In the past, it had been an instrument of the BNP, as it is still to some extent, and has undermined democracy. These factors gave rise to Lesotho's unstable political nature. It is also in South Africa's best interest for stability and democracy in Lesotho to flourish, not only because of South Africa's partial dependency on Lesotho's water, but for the fact that instability and conflict could spill over into South Africa. In other words, the LHWP is not the only aspect in the Lesotho-South African relations. Migrant labour and cattle theft are also factors. South Africa is not solely dependent on Lesotho for water. South Africa may be the third driest country in the region, but water for South Africa can also be found within its borders and other countries, like Swaziland. One should keep in mind that it was an internal political dispute in Lesotho, which could have resulted in a *coup*

d'état and anarchy in general, that prompted the SADC involvement. Resource allocation between Lesotho and South Africa did not create the SADC reaction. It was an interceding variable but not the causal one, for water from the LHWP is important to South Africa.

Mike Muller, the Director-General of the Department of Water Affairs and Forestry (DWAF), is correct in his response to Addison's letter when he says that the LHWP brings benefits to both countries. In other words, a win-win situation prevails in the relationship between South Africa and Lesotho regarding the LHWP. While South Africa gets much-needed water from Lesotho, Lesotho is paid royalties for this resource and hydroelectricity is produced, which will be sufficient for Lesotho's total needs. If South Africa did intervene in Lesotho and used the fostering of democracy as an excuse, as the conspiracy theory goes, the water from Lesotho would have become too expensive for South Africa, not only in terms of human lives but also economically. Water is too precious a resource over which to go to war. The saying by Mark Twain that "whiskey is for drinking but water is for fighting over" does not hold true in this instance.

Therefore, geopolitics had a role to play in the SADC's involvement. The involvement of South Africa can be partly explained by Lesotho's geographic location. Lesotho is surrounded by a large neighbour that denies Lesotho the option of non-involvement in its internal affairs. This geographic location is more of an explanation for the engagement of the SADC forces than the water itself. To lend weight to this argument, the fighting that ensued after the SADC forces crossed the border into Lesotho was concentrated in and around Maseru. If South Africa intervened to secure or grab the LHWP, most of the action would have occurred near the project.

Furthermore, when one looks at South Africa's relations with its other neighbours and when the issue of shared water resources is discussed, one is struck by the high level of cooperation between the riparian countries. Collaboration is a continuing process in all of South Africa's international river basins, e.g. the cooperation between South Africa, Swaziland, and Mozambique concerning the waters of the Komati and Pongola Rivers. A spirit of cooperation can also be discerned between the countries sharing the Limpopo River. It is, however, in the Orange River basin that a high level of cooperation is most evident. The riparians are cooperating on a wide range of issues – from infrastructure projects to the sharing of information. The question of the water of the Orange River is of great importance not only to South Africa, but also to Lesotho and Namibia. These three riparians will find it in their worst interest not to cooperate when it comes to water.

During the SADC involvement in Lesotho the quelling of a *coup d'état* and the restoration of law and order superseded the issue of water. This is evident in the Lesotho government's request for the SADC to become involved in the crisis and to prevent a *coup* from taking place. That the DWAF was not involved in the intervention or that it did not request this action is more evidence that water was a secondary issue of the involvement. That it was a collective involvement on the part of an international regional organisation is evidence enough that the LHWP was not the main reason for the foreign engagement in Lesotho.

In addition, the water supply to South Africa is secured by an international treaty. It would be folly, and also technically impossible, for Lesotho to cut off the water in circumstances such as those in 1998. If Lesotho should cut the water supply it would not only limit its own supply of hydroelectricity, but it could also be seen in the eyes of the rest of the international

community as an unreliable partner. It would have been unnecessary for South Africa to intervene on behalf of the water supply, because of these guarantees.

The reason for the involvement of the SADC – and especially South African – was not purely for water, but to stabilise an unstable state that had fallen victim to its own politicians' selfish endeavours. In other words, the decision by SADC to become involved in Lesotho was to save a democratically elected government from being overthrown by means of a military *coup*. In essence, the involvement was for the purposes of altering the authority structures of Lesotho, to influence the balance of domestic forces and to neutralise the destabilising influence of the Lesotho army. Moreover, relations between South Africa and Lesotho regarding the LHWP were not soured by the incident. This is an indication that, although it might seem that countries are in conflict with each (which was not the case regarding the SADC military involvement in Lesotho), they can and will still cooperate regarding water resources of international importance.

(e) Interest Group Involvement

From the commencement of construction on the Katse Dam, as part of Phase I of the LHWP, a number of local and international interest groups lobbied both the governments and the LHDA and TCTA to implement alternatives to the LHWP. These interest groups hailed from a number of different backgrounds, from environmental groups to communal groups. The alternatives suggested by the interest groups were mainly in the form of water demand management in Gauteng (Meissner, 2000d:25).

As part of their strategy over the years, these interest groups also lobbied the World Bank (financing only 4% of the project), to look into the negative environmental impacts of the LHWP. Not only was the issue of environmental impacts articulated by the interest groups. They also articulated human rights issues. These issues ranged from fair compensation to the people who had to be relocated to labour relations. For instance, in September 1996 at Butha Buthe an episode of labour unrest gave rise to an incident ultimately causing the death of six people. The coalition of international and local interest groups called on the World Bank to use its good offices to press the Lesotho government and the LHDA to take proper measures regarding the incident. A team of World Bank officials visited Lesotho in October 1996 to find out for themselves what had happened at Butha Buthe. The coalition of interest groups had even asked for an international commission of inquiry to be launched, but the Lesotho government refused. The Lesotho government did, however, launch an internal inquiry into the matter, following pressure from the World Bank (Meissner, 2000d:26).

In May 1999, a Memorandum of Understanding was signed between the LHDA and interest groups in Lesotho. This memorandum, *inter alia*, addressed the responsibilities of the interest groups involved in the LHWP. The signing of the memorandum was a new development in the relationship between the LHDA and Lesotho-based interest groups. The relationship between the two groupings dates back to 1994. In that year, the LHDA initiated regular monthly meetings with the interest groups at which issues of concern were tabled and discussed, with ensuing action plans developed and implemented. This positive approach eventually led to the signing of the Memorandum of Understanding which was hailed by both the World Bank and the United Nations Development Programme (UNDP) as "unique" (Meissner, 2000d:26).

One of the most important sections of the MOU is the principle of cooperation. This principle, like any other principle in an agreement, has the task of guiding the parties' cooperative endeavours as set out in the framework agreement. The principle not only outlines the nature of the relationship between the LHDA and NGOs but also the way interest groups will go about in their dealings with affected communities. Section 6.1 and 6.2 are the principles outlining the nature of the relationship:

- 6.1 Lesotho Highlands Development Authority and the cluster of NGOs [interest groups] commit themselves to work in ways that ensure integrity, mutual respect, transparency, accountability, efficiency, full disclosure and access to information in their dealings with each other and affected communities.
- 6.2 The NGOs commit themselves to work in ways that ensure accountability to the affected communities, integrity, effectiveness and accountability in their implementation of specific programmes falling within the areas of cooperation identified in section 5.0 of this MOU. The NGOs working on LHWP programmes that are governed by this MOU shall be capacitated to perform the services and carry out their obligations with due diligence, efficiency and economy, in accordance with generally accepted techniques, practices, professionalism and shall observe sound management and technical practices (Memorandum of Understanding, 1999).

It seems as if momentum will not be lost after the signing of the MOU. In section 6.5 of the MOU, the parties are asked upon to develop a code of conduct to govern the cooperative relationship and which will apply to those activities carried out on behalf of the affected communities (Memorandum of Understanding, 1999:5). This practice between governments, project authorities and interest groups and interest groups may become the norm in future regarding large dam projects. The memorandum of understanding between the LHDA and the interest groups can become a blueprint for other large-scale water projects that have an impact on local communities in Southern Africa and other parts of the world. An impediment that may hamper such a development in future could be the desire of governments and project planners, desperate to implement water development projects, to exclude non-state actors in such endeavours (Meissner, 2000e) out of fear that these interest groups will be an obstacle in the path to development.

(f) Completion of the Mohale Dam

The Mohale Dam was completed in January 2003, which formed the end of construction of Phase 1B. It was already filling in January, to supply water to the Katse at a rate of 9 m³/s. Together with 18 m³/s from Katse and 2 m³/s from the Matsoku weir, the Vaal River will be supplied with water at a rate of 30 m³/s. The annual delivery of water from the LHWP to South Africa has also increased from 500 mem per to 600 (*Business Day*, 24 January 2003:3; *Die Volksblad*, 24 January 2003:3; P. Pyke, personal communication, 18 December 2003).

Construction on the Mohale Dam and the Mohale Transfer Tunnel to the Katse Dam started in 1998. For now, plans to construct further dams, tunnels, and weirs have been completed. This is because enough water is being delivered to South Africa. Willie Croucamp, Director of International Projects at DWAF, states that the water being delivered is sufficient for South Africa's water needs beyond 2020. Croucamp said that: "It is clear that there is no need for

further construction in the immediate future. The decision to implement further phases has been postponed". The project is now maintained by the LHDA and TCTO. The two authorities have also started with development projects, an offshoot from the project. The World Bank and other development institutions are seeing this as the main test for the project. What is going to happen now is development in Lesotho. From the royalties a number of projects will be started, including skills development, economic development, and the promotion of agriculture. Even so, later phases of the LHWP are still under consideration, but any decision to proceed, is likely to be somewhat later than originally envisaged due to lower water demands (*Business Day*, 24 January 2003:3; *Die Volksblad*, 24 January 2003:3; P. Pyke, personal communication, 18 December 2003).

5.11.43. The Zaaihoek Dam

In 1986, the DWA embarked on the implementation of the Zaaihoek Dam. This dam supplies water to ESCOM's Majuba Power Station and the Vaal River system. This project was formerly known as the Slang River Government Water Scheme. The Zaaihoek Dam, situated on the Slang River, a tributary of the Buffalo River in northern Natal, also delivers supplementary water to the towns of Volksrust and Newcastle. Thus, the Slang River Government Water Scheme is an inter-basin transfer scheme, transferring water from the Buffalo River to the Vaal River system (RSA, 1985b:3, 4; DWA, 1986:10).

The scheme consists of a dam in the Slang River on the farm Zaaihoek, in the District of Utrecht, Natal, as well as a pumping station and pipeline. The dam and pumping station are situated about 12 km southwest of the town of Wakkerstroom. Before the implementation of the Zaaihoek Dam, several alternative sources were studied and the Slang River Scheme was found to be the most economical (RSA, 1985b:3).

The capacity of the dam is 60 mcm with a dependable net yield of 27 mcm. This was, in 1986, adequate to supply in full the water requirements of ESCOM's proposed Majuba Power Station and the adjoining coalmine. This volume of water was also adequate as a source of supplementary water to Volksrust, Newcastle, and the towns of Madadeni, Osizweni, and Nqutu in KwaZulu. Water is also released from the dam to compensate downstream riparian rights (RSA, 1985b:3).

The dam can be raised to a maximum capacity of 163 mcm with a dependable yield of 60 mcm/yr. The total estimated expenditure of the scheme amounted to R45 million at April 1984 prices and R70 million if cost increases of 15% per year during the construction period were taken into account (RSA, 1985b:3).

A breakthrough in the field of dam-building technology was also achieved for the first time in the construction of the Zaaihoek Dam. This was the use of rollercrete (roller-compacted concrete). This method is both timesaving and economical (DWA, 1988:3).

5.11.44. The Caledon-Modder River Scheme

In 1987, the DWA proposed the Caledon-Modder River Government Water Scheme to supply additional water to the region served by the Caledon-Bloemfontein Regional Water Supply Scheme and the Lesaka Government Water Distribution Scheme. The region is situated in the upper Modder River catchment (RSA, 1987:3).

The Thaba Ncu area of Bophuthatswana was also to get water from this scheme. The DWA stated in its 1987 report that: "The way in which future increasing demands of the Thaba Ncu area will be supplied, will be negotiated by the governments of South Africa and Bophuthatswana" (RSA, 1987:3).

The rationale behind this scheme was the silting up of the Welbedacht Dam, which was completed in 1973. The rate of sedimentation was exceeding the original estimates by a considerable margin. This resulted in its reservoir capacity becoming inadequate for the water demand of the areas from the Caledon-Bloemfontein Scheme. Regular silt surveys showed that the original gross capacity of 114.9 mcm had been reduced to a net capacity of 51.6 mcm by October 1984 and to 39.6 mcm by April 1986. Sediment surveys after 1986 estimated a reduced capacity of 27 mcm in 1989 to 17 mcm in 1992. This loss of supply was to be augmented by the Caledon-Modder Scheme (RSA, 1987:3, 8).

Water was to be pumped from the Caledon River to the proposed Knellpoort Dam on the Rietspruit. This proposed dam was to be situated adjacent to the Welbedacht Dam basin. The dam was designed to have a gross capacity of 125.4 mcm. The Caledon River pumping station was to be situated below the full supply level of the Welbedacht Dam. As the eventual sediment level at this point was to be higher than the full supply level, the pumping station was to abstract water from the river channel in the sediment deposits (RSA, 1987:3, 15).

The proposed Knellpoort Dam was to serve two purposes. Firstly, water was to be released from there to augment the supply to the Welbedacht Dam to maintain the use of the full capacity of the Caledon-Bloemfontein Regional Water Supply Scheme. Secondly, water was also to be pumped across the watershed. This water, to augment the supply of the Rustfontein Dam was to be discharged into the Modder River (it is therefore an inter-basin transfer scheme). The proposed scheme was to cost an estimated R62.1 million at 1987 prices and was scheduled to supply water from 1989 onwards. This scheme was not part of the ORP (RSA, 1987:3, 4).

Regarding environmental impacts, the DWA indicated that: "There are no critical environmental aspects that can result in valid and reasonable objections being made to the development of the proposed schemes. During the construction and maintenance phases of the scheme due care will be taken of environmental problems that may arise. There are no exceptionally sensitive species of flora in the area of the proposed scheme that need to be singled out for conservation and the work of environmental rehabilitation will generally consist of revegetating disturbed and eroded areas with indigenous flora and of the preventing the intrusion of pioneer and Karoo species into these areas. The proposed scheme does not threaten any rare or endangered species of fauna" (RSA, 1987:22-23).

The DWA did investigate the preservation of some Bushman paintings and a fossil bed on the banks of the Rietspruit that were to be flooded by the proposed Knellpoort Dam. However,

the DWA concluded that: "The greatest negative environment [sic] impact will be on farming activities. A considerable area of grazing and a smaller area of cultivated and irrigated land will be taken out of production" (RSA, 1987:23).

Interestingly enough, on the technological front, the Knellpoort Dam was the first arch dam in the world where the rollercrete technique of construction was used (DWA, 1988:11).

5.11.45. The Kalahari East Rural Water Supply Scheme

In 1989, the DWA proposed the Kalahari East Rural Water Supply Scheme. The first phase of the scheme was to supply household and stock water to 256 farms in the central-eastern Kalahari region. Adequate reservoir capacities were also to be built into the scheme to expand future water supplies to agricultural areas. These areas are situated in the border region of South Africa with Botswana, the Mier settlement, and possibly the Kalahari Gemsbok National Park (RSA, 1989d:1).

Potable water was to be abstracted from a pipeline of the Vaal-Gamagara Government Water Supply Scheme at the Kathu pump station. This water was to be pumped against a head of 120 m to a reservoir on the farm Appelby. The water was then to gravitate across the entire region through a pipeline network of 1 095 km. Apart from the main reservoir, another four smaller reservoirs were needed (RSA, 1989d:1).

The system was to be built to supply a peak demand of 8 516 m³/d to supply future demands. Initially only 6 178 m³/d was to be supplied by the scheme. The estimated cost of the proposed scheme was, in 1989, R77.4 million. The cabinet had already approved a subsidy of 66.6% of the completion costs. The rest of the cost was to be carried by the Kalahari East Water Board. For this purpose, it was to apply for a loan of R32.7 million (RSA, 1989d:2).

In 1986, the farmers of the Kalahari East region had already petitioned the government for the construction of the scheme. Before the scheme, water was obtained from boreholes. These boreholes, however, delivered an erratic and unstable water supply and water had to be transported over long distances. The boreholes' water quantity and quality also deteriorated during the 1980s. The farmers were therefore facing an untenable situation. On 9 August 1988, the cabinet approved the petition of the farmers. The Kalahari East Water Board was established on 4 November 1988, for the supply of water to the region it served. On 19 April 1989, cabinet approved the proposed works (RSA, 1989d:12).

The objectives of the scheme were not justified from a pure economic perspective. However, it had other benefits:

- A lower mortality rate and a higher birth rate of sheep, and a higher meat quality meant an increase in meat prices for farmers;
- The farmers would have more time to apply better farming practices and scientific farming methods (this was to be derived from the fact that water was not to be transported by truck);
- It was not necessary for the Department of Agriculture and Water Supply to implement an extensive boring program, which was to save R5.5 million;

- Stabilisation of the economy of the region; and
- Strategic factors also played a role. By the late 1980s, many farmers had left their farms. The region, bordering Botswana, had therefore already a low population density (RSA, 1989d:12-13).

5.12. The World Commission on Dams' Hearings

5.12.1. The Gariep and Van der Kloof Dams

Regarding the Gariep and Van der Kloof Dams, a Mrs Mbalula from a community affected by the Gariep Dam stated that they were never consulted when the dam was planned. They were just told to move from the farm they were living on, as it was going to be inundated by the reservoir. They also had to sell their cattle or to leave some of them behind. The workers on the farms affected by the dams could not readily resettle in the towns, because they were forbidden to as a result of the pass laws. Some of the farm workers looked for an alternative place to stay and jobs for nearly ten years. What also became known was that the white farmers were consulted in good time when the dam was planned, but not the farm workers. There was no alternative accommodation for these workers, and they had to settle in another area or squat alongside roads. Yet some of the positive aspects of the dam on some of the communities were also highlighted by Mbalula. Communities who were not displaced receive water from the dam as well as electricity (Stott, Sack and Greeff, 2000).

5.12.2. The LHWP

Mr Didian Malisemelo Tau, from the Makotoko Village in the Lesotho Highlands, told of the people's experience regarding the implementation of the Mohale Dam. This dam is part of the LHWP. He described their way of life before the LHDA asked them, in 1995, to move off their land to make way for the Mohale Dam. The village community literally lived off the land. They had enough firewood for cooking and heating, enough clean water from springs and wells for drinking and cooking, enough pasture to raise livestock which was sold for an income, and homes. The village was therefore sustaining itself off the land and its economy was based on subsistence farming. Maize and vegetables were grown to satisfy their own needs and the surplus was sold (Stott, Sack and Greeff, 2000).

The LHDA told them to move "because they will build a dam there which will help the R.S.A. by water. The factories and industries of R.S.A need water to proceed with their work", according to Tau. The community did not want to move. According to Tau "L.H.D.A project promised to beautify our lives more than what we had. Promised to increase our buildings. They said we are few and they can help us but the people who need our water, are many and it is difficult for them to help them because they are many. If we move away there, and the project builds a dam there, that water can save many people's lives. We agreed to move away to save many people's lives with our water and we hoped that the project will be trusted to satisfy us with all that it promised to do for us because we save many people's lives". The community's motto was "few people agreed to move away from a place to save many people's lives" (Stott, Sack and Greeff, 2000).

According to Tau, the LHDA also promised them compensation for their lost maize gardens, kraals, fruit trees, forest, and wood trees. This compensation was to satisfy the needs of each individual who decided to move to a new place. The community signed the consent forms for the compensation and they were satisfied with the amount of compensation. The compensation for the maize and vegetable gardens was to be enough to supply in the needs of the community for fifty years. Larger houses would also be built for the families. They would have enough water, schools, clinics, and fodder for their livestock, and work on the project would be provided (Stott, Sack and Greeff, 2000).

The community promised to move to a new place in June 1998 (the middle of the winter). When they reached their new destination, they found that there was no water. Water was to be carried in wheelbarrows from the river, a long distance away from the village where they had settled. Houses were constructed, but the elders of the village complained that the buildings were not befitting their status in Sotho society. For instance, some people with equal status and rank got different-sized houses. Some had three-room houses, while others only had two-room houses. There were no stoves in the houses, as was promised by the LHDA. Fires could not be made inside the new houses, as they did in their traditional homes. The compensation for maize gardens was not as much as the villagers initially agreed it would be (Stott, Sack and Greeff, 2000).

According to Tau, a certain person by the name of Sefeane from the Mohale office changed the agreements for compensation they had signed in December 1997. He stated that: "Sir Sefeane says if somebody has garden more than 400 sqm [sic] [square metre], by 650.88 sqm, he compensate only 400 sqm and 250.88 sqm falls under the compensation of mealie [maize] field which is R4.66 per 100 sqm. He [Mr Sefeane] says 100 sqm for the garden, is R7 761.00 but this rate does not work to all square meters a person has. It works to other square meters and does not wok to other square meters. He [Mr Sefeane] said we should not sell our vegetables we should only eat them ant it is not their fault that we sold vegetables, they only compensate 400 sqm whether a person had a garden of 900.61 sqm" (Stott, Sack and Greeff, 2000). Thus, according to Tau, the compensation money to be paid out for gardens was decreased by more than 50%.

No compensation money, for ten years, was also paid out for their fruit trees, forest, and wood trees as agreed. The period for this type of compensation was changed to one year. The size of the kraals for their livestock was inadequate. They were promised sizeable kraals, this did not happen. They also received fruit trees and potatoes, but they had to pay for these. The compensation for their resettlement was paid according to the agreements signed, but the villagers were starting to become "thunder heads" which could "not be controlled" about other types of compensation (Stott, Sack and Greeff, 2000). This meant they were starting to become angry and showed resentment towards the LHDA and for the way in which the authority handled some types of compensation.

Tau asked that the LHDA fulfil its promises of compensation. He said that: "They must fulfil what is signed down and not to change what is signed down. We ask the project to make at least one tap inside our new village because a human being is a human being by water. We shall be very glad if the LHDA can work with us and fulfil what is said. Secondly, if it can build our buildings honestly and kindly. We shall be pleased if we can get our compensation. The soil is on [sic] everlasting property and it is for generations and generations. When we

don't get enough compensation for our soil e.g. mealie lands and gardens, it is the death of our children and the death of coming generation because they would have nothing to help them survive in their future" (Stott, Sack and Greeff, 2000). Thus, in his concluding remarks before the hearings, Tau stated that the type of compensation they received for their land was not sustainable.

Ana Moepe also gave evidence of the experience her village's people had to endure when the LHWP was constructed. Moepe is from the Matala Community. She told the same story as Tau did regarding their lives before and after the LHDA, but with a slight twist. Before the construction of the LHWP, the village grew an illegal cash crop that enabled them to sustain themselves. This crop was dagga (marijuana) (Stott, Sack and Greeff, 2000).

Before the construction of the LHWP (it is not certain which of the dams affected the community Anna is from), they were told that it would have a positive impact on their lives. They were promised medical services and full compensation for all assets that would be lost due to dam construction. Their properties that were affected were trees, houses, huge fields, gardens, pastures, medicinal plants (including the *dagga*¹⁶), and other natural resources (Stott, Sack and Greeff, 2000).

At the hearings Moepe said before the hearings that the only properties that had been compensated were houses, fields and some people had received their garden compensation while others have not. "The people are not satisfied with the compensation they are getting because it is below [less] what was initially promised . . . Compensation package is too small to sustain our lives. It comes when we are already in debt, not having money to buy paraffin and candles to light our houses" (Stott, Sack and Greeff, 2000).

Moepe also said that their lives were not what they used to be. They were also not accepted by the host community at Matala. "They have, on a number of times expelled us from using the community graveyard in this place. Sometimes we are forced to squeeze our dead in habitable places, which is not a good thing to do" (Stott, Sack and Greeff, 2000).

Moepe's community was also promised by the LHDA that they would have stoves in their homes and clean water. The resettled community did receive water but they have to pay for it. According to Moepe they do not have the money to pay for potable water, because they receive compensation money only once a year and this is then inadequate. She concluded by saying that their lives had not improved, for they did not receive the promised training in self-reliance projects (Stott, Sack and Greeff, 2000).

On the Katse Dam resettlements Benedict Leuta gave evidence of the impact his village, Ha Nkokana, experienced when the dam was built. He said that the Katse Dam "brought many changes to my village. It took fields, pastures, gardens, fruit trees, wood trees, and other things. Most people were compensated for these, but some were not" (Stott, Sack and Greeff, 2000).

Leuta had a garden where he grew potatoes, beans, and pumpkins. In 1988, a road was constructed over this garden. He was given no warning that this was to happen, and he received R100 in compensation for the garden. He complained and was promised more

¹⁶ Marijuana.

compensation. This did not happen. By 1999, his village was still struggling to get compensation for lost pastures. The LHDA had apparently told them they would not get compensation because the villagers did not indicate to the authority that they would use the money "in a good way" (Stott, Sack and Greeff, 2000).

He also said that the only good thing about the project were the roads that were constructed. Before there were any roads it took them two to three days to travel to the Lowlands; now the roads took them there in a matter of hours and literally to anywhere. Yet the roads also destroyed a lot of their property. For instance, the road culverts cause erosion in their fields and they covered some of the wells in the village. These wells were used for domestic, stock-watering, religious, and medicinal purposes. They did not receive any compensation for these wells. Instead, they had to pay the government to lay in new water supplies to the village (Stott, Sack and Greeff, 2000).

He also complained that they lost traditional medicinal plants, like poho-tsehla and koena, used to cure headaches and broken legs respectively. The Katse Dam covered most of the koena reserves and the only place where it was to be found afterwards was in the Matsoku River. They have no reeds to cover the roofs of their houses, and the fish had all but disappeared. No compensation was received for the loss of these natural resources (Stott, Sack and Greeff, 2000).

The Katse Dam's reservoir is also causing cold winds, which causes frost affecting their maize. Reservoir-induced seismic activities (earthquakes) also caused problems. In Mapeleng village, the earthquakes caused springs to dry up. Many people in and around the construction area were not hired as workers when the dam was constructed. Stock theft also increased after construction of the dam started. Leuta also said that the general health of the people deteriorated, with the increase of HIV/Aids infection. A clinic was built at Katse but it is too expensive for the villagers (Stott, Sack and Greeff, 2000).

He also remarked that: "I think South Africa gains more from this project than Lesotho does because we have not seen any of that money that they are paying Lesotho. If Lesotho is gaining, we should be seeing something that is paid for by this water. We haven't seen a single new clinic or irrigation project. No new government transport to show us that we have at least gained something".

5.13. Conclusion

This chapter has shown that the Orange River basin is the most developed of all rivers in South Africa. This is evident from the large number of dams, compared to South Africa's other international river basins, that have been constructed in the basin. The Orange River is, therefore, a closed river basin.

This closure started in the nineteenth century, with the closing of the frontier, and ended in 2003, with the completion of the Mohale Dam, part of the LHWP. However, interest from white settlers in the river basin started in 1777. This was when Robert Gordon named the river in honour of the Dutch royal house of Orange. The river was only utilised in the late 1890s when irrigation projects started to appear in the basin. This ushered in the era of the hydraulic mission in the Orange River system. During the twentieth and early twenty-first

centuries an increasing number of dams and irrigation works were constructed. These projects were mainly intended to supply more water to an ever-increasing population, growing towns, and more industrial complexes situated inside or outside the river basin.

The chapter has therefore documented the hydropolitical history of the Orange River basin in a coherent manner. It has also outlined the past experiences of water resources management in the basin. This is evident in the manner in which decision-makers of the Cape Colony grappled with the notion of irrigation works in the Colony before the closing of the frontier. They were at odds about whether to implement these schemes, and a long debate raged on the issue. It was after the first irrigation congress and the depression and drought of the 1930s that the implementation of water resources development works took off at an increasing rate. This culminated in the completion of Phase 1 (A and B) of the LHWP in 2003.

6. THE LIMPOPO RIVER BASIN

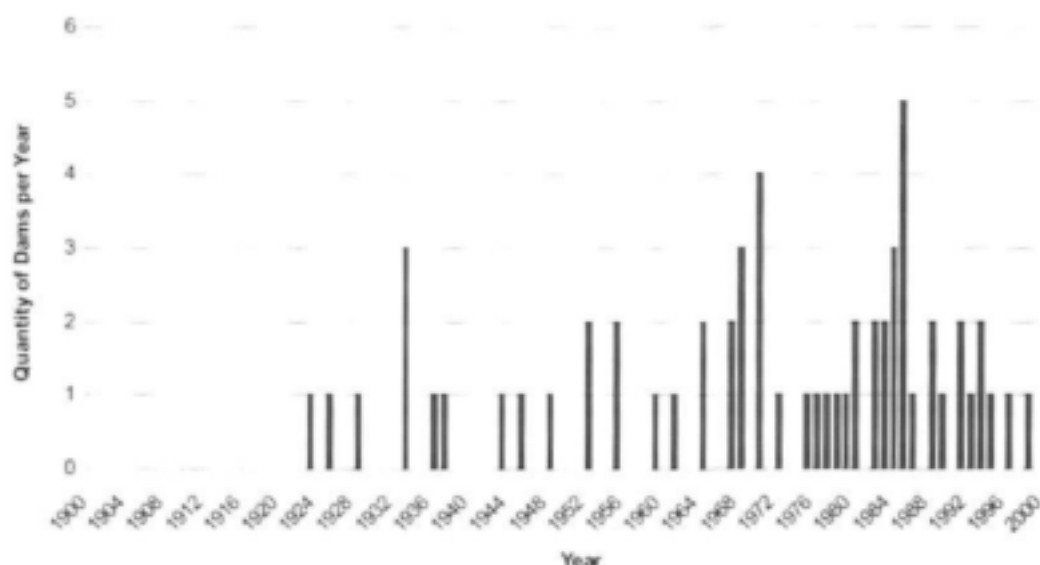
6.1. Introduction¹⁷

The Limpopo River Basin is highly developed: it contains more than 43 dams with a storage capacity in excess of 12 mcm each (three in Botswana, two in Mozambique, 26 in South Africa (see Figure 7) and 12 in Zimbabwe). No fewer than 13 of these dams have a storage capacity in excess of 100 mcm each (one in Botswana, one in Mozambique, seven in South Africa and three in Zimbabwe) (Heyns, 1995:7). The largest reservoir in the basin is behind the Loskop Dam, which has a storage capacity of 348 mcm. The North West Province, Mpumalanga and the energy generation for Gauteng are serviced from that source. The Limpopo River Basin is the second largest of all the "international river basins" in South Africa in terms of both surface area and MAR availability. The Limpopo is the recipient basin for four IBTs, is a donor basin for no IBTs and has two intra-basin transfers (Turton, 2003a).

This chapter will show the historical trajectory of the developments that made the Limpopo such an important source of water in South Africa. In the first part of the chapter a physical description of the river basin is presented. This is followed by a discussion of the early development of irrigation development in the river basin. Over the course of the twentieth century the Limpopo River was increasingly utilised for a number of reasons, ranging from urban developments to the discovery of minerals. The fourth section of the chapter will explore these developments in more detail. Lastly a conclusion is drawn.

¹⁷ Part of the introduction to this chapter was taken, *verbatim*, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

Figure 7
Number of Large Dams Built in the Limpopo River Basin between 1900 and 2002



6.2. Physical Description of the Limpopo River Basin¹⁸

There are no major dams on the main stem of the river, which is also the border between South Africa and Botswana, and between South Africa and Zimbabwe. The Limpopo has a total basin area of 183 000 km² with an MAR of 5 750 mcm. There are four riparian countries, with 20% of the basin area lying in Botswana (upstream riparian), 45% lying in South Africa, 15% in Zimbabwe and 20% in Mozambique (downstream riparian) (Mohamed, 2003:217; Turton, 2003).

Contribution to MAR by each "riparian state" is disputed, with between 66%-88% coming from South Africa, 3%-6% coming from Botswana, 7%-16% coming from Zimbabwe and 9%-12% coming from Mozambique, depending on whose data is being used. The water for Gaborone, the industrial hub of Botswana, was initially supplied from South Africa via the Molatedi Dam and associated pipeline, at a rate of 7.3 mcm per year, although the design parameters will allow for the delivery of 9 mcm per year (Conley, 1995:13; Savenije & van der Zaag, 1998:30; Mohamed, 2003:217; Turton, 2003).

A second source of supply has subsequently been developed via the North-South Carrier (NSC) and the Letsibogo Dam on the Moutloutse River, which is a tributary of the Limpopo. The NSC can be extended northwards to receive water from the Zambezi River Basin in future (Heyns, 2002:164), with technical investigations currently under way (Turton, 2003a).

¹⁸ Part of the physical description of the Limpopo River basin was taken, *verbatim*, from A.R. Turton's (2003) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

"Basin closure" is approaching (Conley, 1995:14; Conley, 1996b:35), with water use in the South African portion alone exceeding the yield potential by $800 \times 10^6 \text{ m}^3 \text{ yr}^{-1}$, which is made up by importing water from the Vaal River as potable water, with the return flow of treated effluent augmenting supply for downstream users. Heyns (1995:8) notes that South Africa already has the capacity to transfer 700 mcm per year from various "international river basins" into the Limpopo as needed, giving an indication of the response to, and magnitude of, "basin closure" (Turton, 2003a).

The trajectory of the development of the Limpopo River, from an "open" river system to one that has become "closed" will be outlined in the next section of the report. The Limpopo River, like the Orange, is a river with a long hydropolitical history, dating back to the settlement of humans in South Africa between three and one million years ago. It was only towards the end of the nineteenth century that the Limpopo River became relevant within the context of the South African political economy.

6.3. Early Developments in the Limpopo River Basin

One of the reasons for the slow development of irrigated agriculture in the Limpopo and other international rivers in the Transvaal, compared to the Orange River, in the nineteenth century was that the economy was based on hunting. From this an ivory trade developed. This was described by H.W. Struben, who arrived in the Soutpansberg district in 1857. He stated that: "Each hunter, according to his recognized value, was given a certain number of carriers to take his truck in, and ivory out, and the hunters got a percentage on the ivory delivered. Some of these men were good elephant shots and made lots of money" (Struben, 1920:86). With ivory hunting dominating the economy there were no incentives for the establishment of irrigated agriculture. Towards the end of the nineteenth and the beginning of the twentieth century, this changed, however.

Table 6.1 Rough Estimates of Irrigated Areas in the Limpopo River Basin in 1907 in the Transvaal Colony

Name of District and River Basin	Areas of Irrigation in Hectares from:				Total
	Fountains	Wells and Boreholes	Rivers and Streams	Small Reservoirs	
Marico (Limpopo)	2 079	180	1 814	250	4 323
Pretoria (Limpopo)	1 522	311	4 854	530	7 217
Rustenburg (Limpopo)	1 755	-	3 346	105	5 206
Waterberg (Limpopo)	650	44	1 278	127	2 099
Soutpansberg (Limpopo)	830	9	2 250	87	3 176
Grand Total					22 021

Source: Hurley (1909:92)

Irrigation in the Soutpansberg area got a boost after a railway was laid from there to the nearest markets (Hurley, 1909:98). What is also significant, regarding the size of irrigated areas in the Transvaal, is that Pretoria had the largest portion of irrigated land in the Transvaal Colony in 1907. It can be assumed that this was partly due to the irrigation works established at Hartebeespoort before the end of the nineteenth century.

Some of the reasons for the promotion of irrigation projects in the Transvaal Colony were put forward by Hurley at the First Irrigation Congress in 1909. He stated that the government would be wise to invest in irrigation projects for the following reasons:

- The government would get direct financial advantages from implementing such schemes because of the wealth-increasing effect on a certain sector of the population¹⁹, regarding the increase in rail freight and income tax;
- The population of "new" land and the "removal of excess peoples on farms and towns" (Hurley, 1909:99).

The construction of the Hartebeespoort Dam is an indication of the importance of irrigation development in the Transvaal province. The number of irrigation districts established by the end of March 1920 will also give an indication of the rate of irrigation development in the Limpopo River, ten years after the establishment of the Union of South Africa. This is summarised in the table below.

Table 6.2 Irrigation Districts Established by the End of March 1920.

Name and District	Source of Water	Cost of Works	Works Completed or Otherwise
Bon Accord, Pretoria	Apies River	£70 000	Prepared
Broederstroom, Pretoria	Fountain	-	Control of Irrigation works only
Piensaars River, Pretoria	Piensaars River	-	Investigated
Tsaneen, Pietersburg	Magoebas River	-	Under construction
Warmbad, Waterberg	Plat River	-	Control of existing works
Zandspruit, Pretoria	Zandspruit	£600	Completed

Source: Union of South Africa (1920:519).

Thus, by 1920 a total number of six irrigation districts had been established in the Limpopo River basin, with three irrigation projects completed and two under construction or being investigated. By 1930, the number of irrigation districts in the Limpopo River basin had increased from five to 15 (Union of South Africa, 1930a:361). This represents a 150% increase during the period 1920 to 1930.

By 1920, the number of major urban centres tapping water from the Limpopo River basin stood at one – Pretoria. This figure remained the same up to 1930 (Union of South Africa, 1920:520; 1930a:366).

6.4. Large Schemes, Small Schemes, the Raising of Dams and Betterments

During the twentieth century the Limpopo River was increasingly utilised for a number reasons. These range from urban developments to the discovery of minerals. This section of the chapter will explore these developments in more detail.

¹⁹ Hurley (1909:99) did not elaborate on which sector of society he was referring to.

6.4.1. The Olifants Nek Irrigation District

In 1921, the Olifants Nek Irrigation District was established by Proclamation 63. In 1928, it was proposed that a dam be constructed on the Hex River, at Olifants Poort, about 16 km south-east of Rustenburg. The land to be irrigated was to stretch from the dam to about 3 km from Rustenburg. The estimated cost, in 1928, of the proposed irrigation project was £120 000 (Union of South Africa, 1928a:15, 18). The Director of Irrigation reported in 1929 that £45 614 "was expended" and that the works neared completion. He also predicted that the project would be completed within the estimated budget, and that there might even be a considerable saving of money (Union of South Africa, 1930a:15).

6.4.2. The Zeerust Irrigation Board

In 1924, an Irrigation Board was established by interested parties in the district of Zeerust. In the same year a survey was carried out for the construction of a dam across the Groot Marico River for the conservation of water for irrigation purposes (Union of South Africa, 1928b:10).

6.4.3. The Middelburg Irrigation Board

In 1924, the Middelburg Irrigation Board was established. An application for an irrigation loan for £21 650 was received from government in 1927. The purpose of the loan was to construct a weir and canals for diverting water from the Olifants River (Union of South Africa, 1928b:11).

6.4.4. The Marico Bosveld Irrigation Works

In 1930, the Lands Department acquired land for the implementation of the Marico Bosveld Irrigation Works. The Irrigation Commission recommended that this scheme be constructed at a cost of £233 000. The purpose of the scheme, like the one at Buchberg, and numerous other schemes in the Orange River, was to supply work for the unemployed. This project was subsidised by government. This also meant that the Union government participated fully in the project (Union of South Africa, 1932a:19).

Construction of the project started in August 1930 "with white labour" as a means to relieve unemployment. The works comprised the construction of an earth dam and canals for distributing the stored water (Union of South Africa, 1932a:19). The dam was completed in 1933 and was filled in January 1934 (Union of South Africa, 1935a:24). In September 1934, the dam was completed and filled to capacity. The canal system was only completed in November 1934, due to delays in dividing the government land. At the end of November 1934, water was led through the canals for the wheat crop and a "good harvest was reaped" (Union of South Africa, 1936:37).

6.4.5. The Letaba North Irrigation Scheme

Irrigation development, before 1961, had been confined almost entirely to the activities of individuals. Irrigation was made possible by pumping water from the Groot Letaba River. The exceptions to the individual development of irrigation were as follows:

- i. Land scheduled under the Tzaneen Irrigation Board, established in 1918. This Board, however, drew its water, by canal, from the Debenegi River, a tributary of the Politsi, which in turn flows into the Groot Letaba River;
- ii. Land under irrigation in the Masalal Irrigation District, established in 1944. The canal for this district took its water directly from the Groot Letaba River on the left bank;
- iii. The Letaba Estates, owned by the African Irrigated Land Co., Ltd;
- iv. Land belonging to one or two lesser companies and served either by a diversion canal or by pumping plants; and
- v. The Pusela Irrigation District, which was established in 1929, had, by 1961, no communal irrigation works (RSA, 1961b:4).

Owners on the Groot Letaba River made representations to the Department of Irrigation in the mid-1950s for the construction of irrigation works on the Groot Letaba River. This was due to insufficient water in the river at times of low flow. Because of this, the irrigated lands could not be adequately served. The government, after full investigations, constructed the Ebenezer Dam immediately below the confluence of the Broederstroom and Helpmekaar Rivers. Construction of this earthfill dam started in 1955 and was completed in January 1960. Its main purpose was to augment the flow of the Groot Letaba River as the necessity arose (RSA, 1961b:4).

When the Water Act, No. 54 of 1956, came into force, it was decided to proclaim the valley a government water control area. It was also decided to apply Section 62 of the Water Act to ensure the total potentially irrigable area of the available water. After detailed investigations the total potentially irrigable area of the riparian farms was assessed at 37 000 morgen, while the total available water resources were sufficient for the irrigation of only 12 500 morgen. Of this total 6 500 morgen was to be irrigated from the Groot Letaba and 6 000 morgen from water stored in the Ebenezer Dam (RSA, 1961b:4).

On this basis permits for the abstraction and use of water from the Groot Letaba River and its tributaries were allocated to each separate registered property as existing at the date of proclamation of the Water Control Area – 7 December 1956 (RSA, 1961b:4).

It became immediately clear to all parties that, while one cusec of water per 40 morgen was adequate, an efficient distribution system was essential. This system was necessary to irrigate the maximum extent of land. With this in mind, the farmers of Fleurbaai to Janetsi came together and petitioned the government to form an irrigation district (RSA, 1961b:4-5).

Consequently, the Letaba North Canal Irrigation District was established by Proclamation No. 297 of 1960. Preliminary investigations were made into the construction of a system of canals to serve the farms from Fleurbaai to Janetsi. The scheme was to be financed by means of a government loan to the Board and a subsidy of 33.3% was granted to the Board. It was to cost an estimated R600 000. The loan was to amount to R400 000. The estimated time of completion was set for two and a half years (RSA, 1961b:5, 6).

In 1961, the DWA proposed a water scheme to supply water for irrigation purposes to the farms from Fleurbaai to Janetsi, in the district of Letaba, Transvaal. These farms are situated on the north bank of the Groot Letaba River (a tributary of the Olifants and Limpopo Rivers), east of the town of Tzaneen (RSA, 1961b:3).

The original loan for an amount of R600 000 was approved on 4 August 1961. Tenders were called for the construction of the work in June 1963, and contracts were signed on 29 August 1963, the total cost of which amounted to R606 171. Subsequent to the letting of these contracts, the Board decided to install integrating meters at all the outlets. This was so that each irrigator would be able to operate his own sluice gate without the intervention of a water bailiff. The cost of the meters was conservatively estimated at R23 829. This increased the cost of the works to R630 000. To this total was added items such as payments for servitudes and compensation, engineers' salaries, transport and secretarial fees. The total of these items was not to exceed R120 000. The final estimated cost of the work was therefore R750 000 (RSA, 1964d:3).

6.4.6. The N and N Irrigation Board Scheme

In 1961, the DWA proposed the construction of an irrigation scheme for the use of the N and N Irrigation Board Water Scheme. This proposed water scheme was to supply water for irrigation purposes to the farms from Mohlaba's Location to Nagude, District of Letaba in Transvaal. These farms are situated on the south bank of the Groot Letaba River, east of the Town of Tzaneen (RSA, 1961c:3). The N and N Irrigation Board had the same history as that of the Letaba North Canal Irrigation Board.

However, the N and N Irrigation Board was established by Proclamation No. 314 of 1960. The scheme that the Board petitioned the government for was too costly (at an estimated R600 000) – the same as the Letaba North Irrigation Board (RSA, 1961c:5, 6).

In 1966, the DWA proposed the expansion of the N and N Irrigation Board Water Scheme. This was to be done to increase the irrigation district to include the farms Mohlaba's Location and Berlyn. This was to increase the irrigable area to 1 656.7 morgen, of which 253.9 morgen was situated in Bantu Trust Territory under the control of the Department of Bantu Administration and Development. The head capacity of the canal was consequently increased from 40 cusecs to 56 cusecs. The estimated cost of the expansion of the scheme was put at R900 000 (RSA, 1966e:2, 3).

6.4.7. The Nwanedzi River Government Waterwork

In 1961, the DWA proposed the construction of two storage dams, one the Nwanedzi River and the other in its main tributary, the Luphephe River. Both dam sites were to be situated in Bantu Trust Area, 48 km to the south-east of the town of Messina in the Transvaal (RSA, 1961d:3).

The purpose of the works was to regulate the flow of the Nwanedzi and Luphephe Rivers (both tributaries of the Limpopo River). This was to provide an increased and assured water

supply for existing and additional irrigation development in the area of the Nwanedzi River Irrigation Board. Some minor developments under the control of the Department of Bantu Administration and Development were also to benefit from the project (RSA, 1961d:3).

In 1961, some 500 morgen of land had been developed under partial irrigation. It had been assessed that there was about 2 500 morgen of potentially irrigable soil. However, the quantity of the water resources in the valley was of such a nature that only a total of about 1 000 morgen was to be irrigated (RSA, 1961d:4).

The farms in the area were originally used for stock farming and hunting. There was, nonetheless, a need to improve the carrying capacity for stock. The Nzhelele irrigation scheme was also so successful that it was decided to go ahead with irrigation development in the valley. The Nzhelele irrigation scheme developed in the mid-1930s and the crops were mainly lucerne and pasture. With increasing irrigation development, by directly pumping water either from the river or diversion works, it was found that lower owners had no dependable water supply. For this reason the cultivation of permanent crops had to give way to cash crops, especially vegetables (RSA, 1961d:4).

In 1961, there was only minor development under citrus and sub-tropical fruits, but the yields were outstandingly high. It was also anticipated that, with adequate and more assured water supplies, increased development was to take place under these crops. However, the major crops were still lucerne and irrigated pasture for fodder purposes. Road communications to the valley were, in 1961, adequate, but the long distances to any major market were a drawback to the economical production of perishable crops (RSA, 1961d:4).

Over the years before 1961, increased development along the river led to inevitable water shortages. In normal times, the upper riparian owners had been able to divert reasonable quantities of water supplies. Yet the lower riparian owners had suffered repeated losses, due to the lack of water altogether, or to the "brak" quality of the available supply. This made the water unsuitable for irrigation. In dry years, the natural flow was inadequate even to meet the requirements for the upper owners (RSA, 1961d:4-5).

At around 1945, these conditions became extremely serious and resulted in a request by the owners concerned for an investigation into storage regulation possibilities. The investigations revealed a number of possible sites for dams. It was only in 1951 that the Department of Irrigation was able to carry out the necessary surveys of the sites and basins. Following a preliminary geological investigation in 1953, drilling was carried out in 1954-55 to test the foundation conditions of the dam sites. This was followed in 1956 by an extensive soil survey of the available land for irrigation, and also by tests of the quality and suitability of the river water (RSA, 1961d:5).

Of the four potential dam sites investigated, one site located some distance downstream of the confluence of the Nwanedzi and Luphephe Rivers was found to be too costly and less conveniently situated. This site could therefore be rejected. Two of the sites, one on each river, were located immediately upstream of the confluence. The third lay a short distance below. Detailed designs and cost estimates have shown that it would be more economical to construct two dams at the sites above the confluence, rather than a single structure downstream. In addition, the configuration near the two dam sites is such that their basins can conveniently be interconnected by excavating a channel through a low saddle on the divide.

Water can therefore be led from one basin to the other in the event of one of the rivers carrying an excess flow. This allowed for the full potentialities of the joint storage to be used. The two proposed dams were therefore to function as an integrated unit (RSA, 1961d:5).

These dams were to allow the full development under irrigation of 1 000 morgen. About 100 morgen of this area was to be required for development within the Bantu Trust Area and the remainder (900 morgen) was to be available for use of the 34 private riparian owners (RSA, 1961d:5).

The dams were designed so that they could be raised by 10 feet in future. This was to offset the siltation of the reservoirs, for the Nwanedzi River had a high silt load. The total estimated cost of the project was R560 000. The economic benefits of the project were more irrigation development by the riparian owners, and an increase in the stock-carrying capacity of the farms by at least 50%. It was also expected that the production of vegetables, citrus and sub-tropical fruit would increase. According to the DWA (RSA, 1961d:6): "A conservative estimate of the enhanced returns indicates that the average increase of the net income per owner will amount to about R900 per annum, or R30 per morgen, on stock-farming alone".

6.4.8. The Koster River Government Waterwork

It was proposed in 1961 by the DWA that a storage reservoir be constructed in the Koster River on the farm Waterval, in the district of Rustenburg, Transvaal. The site of the dam was to lie 33 km west of Rustenburg, south of the main road from Rustenburg to Zeerust (RSA, 1961e:3). The purpose of the dam was to regulate the flow of the Koster River and to provide increased and more assured water supplies for existing irrigation development (RSA, 1961e:3).

Irrigation had been practised along the Koster River for many years, before 1961. In 1916, a group of farmers appealed to the Water Court and obtained an apportionment of the normal flow of the river. Their action was impelled by periodic shortages of water. The apportionment was, however, difficult to apply, and did not prove to be a practical solution to the water problems of the area (RSA, 1961e:4).

During the period 1927 to 1935 interested parties along the river called on the government to investigate various storage propositions. Four schemes were investigated and rejected as uneconomical. Again, in 1936, after a severe drought, representations for the provision of storage dams were made. Because of the subsequent investigations the cabinet in 1937 agreed in principle to the construction of storage dams on the Koster River or its tributaries. Various sites were considered, but these proved either technically unsuitable or uneconomical (RSA, 1961e:4).

The dam site that was recommended in 1961 by the DWA was first inspected in 1958 and again in 1959. The rationale behind the storage dam was the huge volumes of water needed for tobacco and citrus production. The dam was to store 2 100 morgen-feet of water, or 80% of the estimated MAR of the river. The DWA states in its report that: "Increasing the storage beyond this point will be costly and will not provide commensurate advantages. The 2 100 morgen-feet of stored water will give an assured supply of 900 morgen-feet of water during

drought years, which will ensure full production for 60% of the present developed area during such dry periods". The estimated cost of the scheme was put at R400 000 (RSA, 1961e:4).

6.4.9. The Bon Accord Irrigation Board Canal Improvements

In 1961, the DWA proposed the concrete lining of various distribution canals under control of the Bon Accord Irrigation Board. This irrigation scheme is situated on the Apies River, about 14 km north of Pretoria (RSA, 1961f:3).

Irrigation along the Apies River was carried out without the aid of storage works. During periods of drought, there was always a water scarcity. In 1917, the interested parties requested the Department of Irrigation to investigate the possibility of a storage dam. This was to obtain an assured supply of irrigation water on certain farms. The investigation was carried out and on the advice and recommendations of the Department an irrigation district was established (RSA, 1961f:3).

The Bon Accord Irrigation District was established by Proclamation No. 135 of 1918. The district was established in order to construct a system of waterworks comprising a storage dam on the Apies River and a system of canals laid out to serve irrigable land on both banks of the river (RSA, 1961f:3).

In 1918, an investigation of a proposal to construct an irrigation project, was undertaken by the Irrigation Department. An irrigation district was established by Proclamation on 18 September 1918. The scheme was considered by a Select Committee in 1920, and parliament authorised a loan of £70 000. A contract of £45 000 was awarded to a contractor, who started work on the Bon Accord Dam in 1921. The dam was completed in 1925 and filled the same year. The construction of the dam did not proceed without difficulty, though. The sum advanced to the Bon Accord Irrigation Board, that constructed the dam, was £115 000. This was far more than the £75 000 estimated at the beginning of the project. The control of construction was "exceedingly difficult". The engineer that was recommended by the Department was not accepted by the Board. The contractor did not complete the project and the Department of Irrigation was requested by the Board to complete the project. Farmers were also dissatisfied by the project: they complained that it was too large, and a smaller scheme would have suited their needs better (Union of South Africa, 1926a:18-19; Union of South Africa, 1926b:3, 4).

When the scheme was constructed in 1924 the water was conveyed to the left bank canal in a reinforced concrete conduit laid on a gradient of 1 in 238 along the downstream toe of the dam. The canals throughout were unlined and were constructed to a grade of 1 in 3 000 with the exception of the lower portion of the right bank canal, which had a gradient of 1 in 2 500 (RSA, 1961f:4).

In 1926, the Irrigation Finance Commission found that the scheme was a "failure". In its Third and Final Report, on a number of private, small and government irrigation schemes, the Commission noted that: "In many respects this is the most unsatisfactory scheme which we visited". They found that the water supply for the Bon Accord irrigation project was inadequate, and that the promoters of the scheme and government "were in so great a hurry to get the scheme launched that no opportunity was afforded the technical advisers to collect the

relative hydrographic data". They, however, stated that "an excuse may be made for this". On the poverty of the soil, for irrigation purposes, the Commission stated that "there can be no excuse". For instance, the Select Committee that initially investigated the scheme did not consider "objectors" to the poverty of the soil. The Committee also accused the Director of Irrigation, at that time, of not asking the Department of Agriculture to give him advice on the quality of the soil. The Commission was also doubtful regarding a return on the moneys invested in the scheme. The reason for this was that produce from the Hartebeespoort irrigation project was starting to flood the market, which made foodstuffs from the Bon Accord scheme unprofitable (Union of South Africa, 1926b:11-12).

In 1953 the Bon Accord Board asked the Department of Irrigation to survey the distribution canals with a view to improve the distribution of the available water. The survey was completed and the Board was advised to line the canals with concrete and to provide standard type calibrated sluice gates. These sluice gates were installed so that the water could be divided equitably amongst all the irrigators (RSA, 1961f:4).

During 1954, the Board was granted a loan of R27 300 and a subsidy of 33.3% to line the upper reaches of the canal system with concrete. A lining programme was commenced during February 1955 and completed in the same year. The Board was impressed with the simplicity, effectiveness, and relative cheapness of the works. It consequently decided to extend the lining programme to include the canals then under control and for this purpose applied for a further loan of R26 700 and a subsidy of 33.3%. This further loan was granted, bringing the loan commitment up to R54 000 (RSA, 1961f:4).

Having succeeded in lining all the canals formerly under its jurisdiction, the Board decided to extend its control over all canals. At a monthly meeting held on 4 April 1957 it adopted the following resolution: "That the Board screen-line all the canals now in use to supply water to all listed ratepayers and that after the completion thereof the Board take over all control as stipulated in the Water Act, No. 154 of 1956, Sections 63, 83, 92(3a) and (4)." This extra work involved the lining of the Waterval Canal, the Russel Farm Canal, the Talmar Farm Canal, the Velcich's Farm Canal, and the subsidiary canal to the Pyramid Estates. To do this work a further loan of R18 200 was granted, with a subsidy of 33.3%. The latter loan was sufficient to complete all the works except the Russel Farm Canal and Talmar Farm Canal, estimated to cost R2 140 and R2 930 respectively (RSA, 1961f:4).

In 1961 the Board submitted a request for a further loan of R5 000 to cover the cost of the lining programme already approved (RSA, 1961f:4).

6.4.10. Raising of the Bospoort Dam

In 1962, the DWA decided to raise the Bospoort Dam. This dam is situated on the Hex River (a tributary of the Elands River), 19 km north of the town of Rustenburg. The proposed raising of the dam was to enable it to provide an increased assured supply of water to the Rustenburg Municipality and the Bospoort Irrigation Board (RSA, 1962e:3).

The Bospoort Irrigation District lies downstream of the dam and includes land riparian to the Hex River. The district is served by a covered pipe aqueduct feeding concrete-lined community furrows. In 1962, the area scheduled for irrigation under the dam amounted to

730 morgen. The main crop grown was tobacco, but wheat, maize, and lucerne were also cultivated (RSA, 1962e:3).

The Rustenburg Municipality drew water from the Bospoort Dam. Water was also supplied to the Rustenburg Platinum Mines. The capacity of the dam was 3 730 morgen-feet and the annual supply of water available from it was divided between the Bospoort Irrigation Board and the Rustenburg Municipality in the ratio of 1 670 to 2 080 (RSA, 1962e:4).

The history of the dam can be traced back to 1909. In this year, a reconnaissance survey was made to determine the possibilities of a dam on the Hex River at Bospoort to serve the area. In 1910, two occupants of the Farm Rooiwal unsuccessfully petitioned for the constitution of a river district. In 1921, a further petition was served, but at a subsequent inquiry the proposal was again rejected (RSA, 1962e:4).

In October 1931, the Irrigation Commission recommended that a dam should be constructed at Bospoort as a relief scheme and after a further petition had been presented the area was finally proclaimed an Irrigation District by Proclamation No. 132 of 1932. The construction of the dam was started in August 1932, and was completed in October 1933. It was built at a cost of R92 000. The Board was responsible for the repayment of R30 000 (RSA, 1962e:4).

By Act No. 24 of 1949, control of the undertaking was vested in the government and, in order to improve the operation of the scheme, the canals were re-aligned and faced with concrete. To provide supplementary water for the Rustenburg Municipality the dam was raised by 15 feet in 1953-54. The additional supply that was created by this action was allocated to the municipality (RSA, 1962e:4).

Due to the unexpected growth of Rustenburg, and the increased water demand of the Rustenburg Platinum Mines, the available assured water supply proved inadequate. On 23 November 1960, the municipality made a formal application to the DWA for the dam to be raised. This was to permit the municipality an increased quota of water (RSA, 1961e:4).

The dam was to be raised by ten radial crest-gates, 22 feet long by 8 feet high, installed in the overspill section. The non-overspill section was to be raised by 4.5 feet and the three auxiliary earth embankments also by 4.5 feet. The estimated cost of the scheme was put at R120 000. Interestingly enough, "In terms of Act No. 24 of 1949 no further rate and/or charge may be levied on the Bospoort Irrigation Board in respect of the additional water provided. Yet the Board is required to maintain and administer the works, although the undertaking remains a Government Water Scheme" (RSA, 1962e:4).

6.4.11. Raising of the Klein Maricopoort Dam

The DWA proposed in 1962 to raise the Klein Maricopoort Dam in the Klein Marico River, near Zeerust, by 14 feet. This was to improve the water supplies available to the 582.2 morgen of irrigated scheduled land under the dam (RSA, 1962f:3).

Irrigation development along the Klein Marico River dates back to the time of the settlement of the Voortrekkers along the river. The water was entirely derived from springs and seepage. As development proceeded water shortages began to be the rule, especially in the lower

portion of the valley. From 1906 onwards various proposals were put forward and investigations made with the objective of improving water supplies, or ensuring a more equitable distribution of the available water (RSA, 1962f:3-4).

In 1933, during the economic depression, the Klein Maricopoort Dam was constructed as an unemployment relief scheme. At the same time the existing canal system, consisting of nine canals fed by eight diversion weirs, was extended to serve about 600 morgen. On its completion, the scheme was handed over to the Klein Maricopoort Irrigation Board. This Board, however, has never functioned very well (RSA, 1962f:4).

The irrigable land was sub-divided into smallholdings, which made profitable farming difficult. The lack of proper measuring devices, because the Board held no servitudes, added to the difficulty of exercising control. A large portion of the cost of the dam had eventually to be written off by the government. In 1950, the Board resigned and the control of the scheme was handed over to a new Board, appointed by the Minister of Irrigation. This new Board also consisted of two members of the Department of Irrigation. In 1954, the canal system was completely modernised. It was realigned and lined with concrete. The necessary bridges, superpassages, and gauging weirs were built and the canals fenced off (RSA, 1962f:4).

In 1962, the capacity of the dam was 1 324 morgen-feet. The DWA proposed that the dam be raised to increase its capacity to 3 293 morgen-feet. The estimated cost of the works came to R150 000 (RSA, 1962f:4, 5).

6.4.12. Betterments to the Driehoek Canal

The Blyde River Irrigation District was proclaimed in 1954 by Proclamation No. 178. Shortly after, the Blyde River Irrigation Board was elected. At that time, there were no existing works in the possession of the Board or under its control. The following three private canals were, however, already in operation:

1. The Moriah Canal, situated on the right bank of the Blyde River, with a head capacity of 70 cusecs;
2. The Driehoek Canal, situated on the right bank, with a head capacity of 27 cusecs;
3. The Blyde Canal, situated on the left bank, with a head capacity also of 27 cusecs (RSA, 1962g:2).

The Blyde River Government Water Control Area was proclaimed in 1957 by Proclamation Nos. 276 and 277, and the Irrigation District was sub-divided into four sub-districts with a total scheduled area of 9 608 morgen by Proclamation No. 353 of 1960 (RSA, 1962g:2).

The Driehoek Canal remained in the possession of the group of private persons who had originally constructed it. The control over the distribution of the water in the canal by the owners themselves was, however, ineffective and properties at the lower end of the canal often received no water. This was unsatisfactory, and the affected persons asked the Irrigation Board to assume control over the canal and to undertake the distribution of the water (RSA, 1962g:2, 3; RSA, 1964e:4).

The Board, to rectify the situation, undertook to carry out certain betterments to the Driehoek Canal, to increase its capacity from 27 cusecs to 95 cusecs. This would have made efficient distribution of the water by the Board possible. The Board also proposed to install a turbine-driven pumping station. This was at a suitable point on the Driehoek Canal for the purpose of pumping water to the new high-level canal. The estimated cost of the proposed betterments, including the purchase price and erection of the hydraulic turbines, pumps and pipelines, amounted to R63 000 in 1962. In 1964, this amount had increased to R125 000 (RSA, 1962g:2, 3; RSA, 1964e:4).

6.4.13. The Pusela Irrigation Board Water Scheme

The Pusela Irrigation Board Water Scheme was proposed in 1962 by the DWA. A concrete diversion weir across the Groot Letaba River on the farm Redbank and Burrah Nulla was envisaged. From this scheme 1 500 morgen of land on the farms Pusela, Hamawasha and Yamorna was to be irrigated. The estimated cost of the project was R510 000, which represented a capital outlay of R340 per morgen irrigated (RSA, 1962h:3, 5).

The history of the irrigation of the Pusela area can be traced back to 1902. Various surveys and investigations were carried out, and in 1928 the Pusela Irrigation District was established by Proclamation No. 40 of 1929. It included only those properties that were the sub-divisions of the original Pusela farm. An irrigation board was subsequently elected for promoting the construction of a scheme, which had been designed and staked out by the Irrigation Department in 1928. Tenders were invited for the work. These were higher than the estimated cost of the Department of Irrigation. The Board eventually became moribund (RSA, 1962h:3).

In 1953, it was resuscitated with a view to constructing the proposed canal scheme. In view of the fact, however, that the construction of the Ebenezer Dam had been placed on the programme of government works for the following year, and that it would affect the supply of water to the Letaba Valley, the Board was told to postpone the works. In 1960, as the result of a petition by the Board, and a statutory inquiry, the Pusela Irrigation District was extended. This extension was to include the sub-divisions of the original farms Hamawasha and Yamorna, which lie immediately downstream of the farm Pusela (RSA, 1962h:3).

6.4.14. Polokwane's Water Supply

In 1963, the DWA proposed the construction of the Pietersburg (now Polokwane) regional water supply scheme. The proposal envisaged the construction of a pipeline from the Ebenezer Dam in the Groot Letaba River. The intention was to supply purified water of 9 million litres to Pietersburg, the Bantu University College at Turfloop, and a new Bantu township called Moletsi (RSA, 1963e:2).

Before 1957, the town, situated 270 km north of Pretoria, developed slowly. Notwithstanding this slow development, in 1958 provision was made for the delivery of good quality water to the town, and rapid expansion took place. The Bantu University College of the North was built before 1963. The Moletsi Township was built in 1963. This township catered for 12

000 houses. It was proposed that all the Bantu in the Pietersburg location be moved to Moletsi (RSA, 1963e:2-3).

In 1963, Pietersburg used an average of 11.25 million litres of water per day. In 1963, it was estimated that this would increase to 21.6 million litres per day, and in 1978 to 37.35 million (RSA, 1963e:3).

Pietersburg was originally entirely dependent on boreholes for its water supply. The water resources from these sources were "hard", and the supply expensive and inadequate. In 1956, the Broederstroom Water Supply Project was embarked upon by the Municipality. This scheme consisted of a dam with a capacity of 664 morgen-feet on the Broederstroom. The dam was known as the Dap Naude Dam. A pipeline of 60 km was also laid. This pipeline had a capacity to supply 18 million litres per day (RSA, 1963e:3).

In terms of a Water Court Order, dated 27 April 1954, Pietersburg was to abstract water from the Broederstroom in excess of 4 950 million litres of water per year and to store in the dam a total 1 665 million litres. This was to be done on condition that during the three months from 16 August to 15 November each year, the entire volume of the Broederstroom must be passed down the river. The total abstraction during this critical three-month period was thus limited to the capacity of the dam and in effect to an average of some 13.5 million litres per day, which could be used. The boreholes were used to augment the supply at times of peak demand (RSA, 1963e:3).

In 1963, Pietersburg was approaching the limits of its water supplies. Two new consumers also had to be catered for. Both the Department of Bantu Administration and the Municipality of Pietersburg approached the DWA to construct the regional water supply scheme. At some future date, the project was to be enlarged. The estimated cost was R1.3 million and it was envisaged to reach completion by 1966 (RSA, 1963e:3, 4).

In 1966, the DWA proposed that the scheme be expanded to supply 18 million litres of water per day. This was the estimated volume of water that the Municipality of Pietersburg needed by 1980. This quantity of water was twice the quantity envisaged in the original 1963 report. This was done by increasing the capacities of the purification works, pumping station, pipeline and terminal reservoir. The estimated cost of the scheme had been increased by R2 050 000. This brought the revised estimated cost of total construction cost to R 3.25 million (RSA, 1966f:3, 4).

In 1966, after a revised estimate of the future water requirements of the Pietersburg complex had been made, it was decided by the DWA to construct the scheme for an increased delivery capacity of 18 180 m³/d. This extension was approved by parliament and an additional R2 million was allocated for the increased cost of the larger works. A further amount of R3.25 million was requested and approved. In 1971, the DWA asked for another R4.2 million to complete the scheme (RSA, 1971a:3, 5).

The scheme was completed in 1973. In 1984 the DEA proposed to enlarge the existing purification works and pumping station at the Ebenezer Dam, with capacities of 31 000 m³/d and 28 800 m³/d, respectively, to 74 000 m³/d each. It also proposed to double the existing 600 mm diameter pipeline between the Ebenezer Dam and Pietersburg with a second pipeline with an inner diameter varying from an initial 800 mm to 600 mm at the end of the line. The

estimated cost at March 1983 unit prices was R34 million. The estimated final construction cost was R54.7 million after allowing for a 15% inflation rate over the expected construction period. It was envisaged that the first phase of the new scheme would supply water towards the beginning of 1986 and the entire scheme was to be completed by the end of 1989 (RSA, 1984d:3).

Regarding the environmental impacts of the new scheme, the DEA stated in 1984 that: "The proposed works comprise only the extension of the existing works of the Pietersburg Government Regional Water Supply Scheme and should have no additional detrimental effect on the environment. The proposed pipelines will be laid underground within the present pipeline servitude and the site will be restored" (RSA, 1984d:11).

In 1995, DWAF decided to implement a pipeline connection from the Sand River to the town of Pietersburg. This was after the Olifants-Sand Water Transfer Study indicated the necessity of the scheme and after the water supply of the town ran low due to the severe drought. This pipeline was to be followed by the construction of a major storage dam on the Olifants River. The pipeline was Phase I of the scheme and the construction of the storage dam would be Phase II. The study was accompanied by extensive public involvement programmes entailing public meetings, steering committees, newsletters and press releases (DWAF, 1995:21, 27).

6.4.15. The Njelele Irrigation Board Water Scheme

In 1963, the establishment of the Njelele Irrigation Board Water Scheme was proposed by the DWA. The DWA proposed to construct a weir in the Njelele River and a canal distribution system to serve some 3 000 morgen of irrigable land commanded by the Njelele Dam (RSA, 1963f:3).

The purpose of the proposed scheme was to provide a more economical and assured water supply to the existing (1963) irrigated area of 2 000 morgen of land and to make possible the development of a further 1 000 morgen. The desired result of the scheme was to improve the quality of the crops. These crops were affected by contaminated water from a tributary of the Njelele River (RSA, 1963f:3).

The history of the Njelele Irrigation District can be traced back to the Voortrekkers. Yet they confined their agricultural activities to ranching. It was only towards 1930 that farmers began using the water of the Njelele River to irrigate crops. After investigations dating back to 1931, the Njelele Irrigation District was proclaimed in 1945 and the Njelele Dam was completed in 1948. The dam is about 48 km northeast of the town of Louis Trichardt on the Njelele River. This structure consisted of a concrete arch 121 feet high, which impounded 8 480 morgen-feet of water. This assured a water supply in the dry winter months to irrigate the scheduled area of 2 000 morgen of land. This land was mainly devoted to the cultivation of citrus and winter vegetables (RSA, 1963f:3).

In 1954, a serious reduction in the quantity and quality of the citrus crop was experienced. Investigations by the Citrus Board revealed that the trouble originated from the high concentration of boron salts contained in the low flow of the Matamba River, one of the Njelele's tributaries. The matter was referred to the Department of Irrigation. This led to an investigation of the possibility of constructing a concrete-lined canal on the right bank of the

Njelele River. This canal was to run from a diversion weir at a point upstream of the confluence with the Matamba River. This was to ensure the elimination of the contaminated water source (RSA, 1963f:3).

The proposed 1963 scheme also envisaged certain additional developments. This was rendered possible by the higher location of the canal and the more economical use of water. The estimated cost of the canal project, together with the pipelines, weir, etc. amounted to R600 000. This amount was equivalent to an average capital cost of R200 per morgen of land. In 1964, the cost of the scheme had already increased to R1 million. This was due to an increase in excavation cost of the canal and a new design for it as well (RSA, 1963f:3, 5; RSA, 1964f:3, 4).

In 1964, the DWA proposed that the Njelele Dam be raised by 20 feet. The proposed raising of the dam was to make available a more assured supply of water for the existing irrigation development along the river. This was to cope with periods of the drought, such as the one experienced in 1964. The raising of the dam was also proposed due to a reduced run-off into the dam because of irrigation development in the catchment area upstream of the dam (RSA, 1964g:2).

The raising of the dam was to be made possible by raising both the spillway section and the non-spill section of the wall. To increase the height of the dam wall, the thickness of the downstream portion of the wall was to be increased by 7 feet. A buttress was to be constructed on the right flank and the existing (1964) buttress was to be enlarged. The estimated cost of the raising was R350 000. A levy was not to be charged by the government. This was because of the direct and indirect benefits the Republic accrued from the scheme and because of the setback the scheme experienced because of the severe drought (RSA, 1964g:3, 4).

6.4.16. The Klipvoor and Roodeplaat Dams

The construction of the Klipvoor Dam was proposed by the DWA in 1963. This storage dam was to be situated in the Pienaars River at a site on the farm Klipvoor, some 60 km north of the town of Brits, Transvaal (RSA, 1963g:3).

The purpose of the scheme was to regulate the flow of the Pienaars River. This was to provide an assured water supply for irrigation development along that part of the Pienaars and Crocodile Rivers, which was to be served by the scheme (RSA, 1963g:3).

The proposed dam was also to assure an adequate supply of water for use at the Bantu townships of Ga-Rankuwa and Elandsfontein. These townships are situated between Pretoria and Brits. The Bantu townships of Temba and Leboneng near Hammanskraal were also to receive water from the proposed dam. It was also possible for the Bantu training depot of the South African Police at Hammanskraal and the Department of Prisons to receive water. The farm Klipvoor, on which the dam was to be constructed, was property of the Native Trust (RSA, 1963g:3).

Since 1909, the Department of Irrigation has already investigated some 18 dam sites in the Pienaars River and its tributaries. During the period 1910 to 1913, a site on the farm

Haakdoringfontein was investigated but it was only in 1918 that the riparian owners began to show an interest in an irrigation scheme (RSA, 1963g:4). The outbreak of the First World War is a possible explanation for this delayed interest because many South Africans were directly involved in this armed conflict.

The Pienaars River Irrigation District was established in January 1920 and again in 1936. It was disestablished in 1921 and 1942 respectively. A site on the farm Klipdrift and several other sites were investigated in the meantime. They were found to be uneconomical or lacked suitable foundation for a dam (RSA, 1963g:4).

In 1923, the Bon Accord Dam was built. Two smaller dams, the Bischoffs and Warmbaths Dams, were built in the upper reaches of the Plat River and supplied water to the Warmbaths Irrigation Board and the town of Warmbaths for municipal use (RSA, 1963g:4).

During 1947, investigation of dam sites in the Pienaars River was resumed. Two sites received attention, one on the farm Zeekoegat, and Roodeplaat. The Roodeplaat site was decided on and in 1955 the area was proclaimed a Government Irrigation Area. Thereafter a start was made on the construction of the Roodeplaat Dam. This dam had a capacity of 17 000 morgen-feet. The dam was completed in 1959. Canals were built and the dam supplies water to approximately 2 000 morgen of land (RSA, 1963g:4).

Water shortages in the area that was not served by the Roodeplaat Dam started to occur. In 1962 a topographical survey of the dam site proposed for the Klipvoor Dam was carried out and foundation drilling undertaken. The site was found suitable for the construction of the proposed earth wall, with a concrete spillway on the right bank. The estimated cost of the dam was R2.5 million. This was equivalent to a unit storage cost of R147 per morgen-foot (RSA, 1963g:4-5).

6.4.17. The Magalakwin River Government Waterwork

The Lindleyspoort Government Water Scheme's, situated on the Elands River in Rustenburg district, history can be traced back to 1908. In this year, extensive investigations were conducted into the establishing of the scheme. It was only in 1937 that it was decided that a storage dam be constructed in the Lindleyspoort. Construction of a concrete arch dam and canals, 64 km long, was started in 1939. Despite the outbreak of W.W.II, which retarded construction, the dam was eventually completed during the 1942/43 financial year (RSA, 1964h:2).

From a soil survey in 1936, it was found that about 85% of the irrigable land was situated on the right bank of the river. It was therefore decided to construct the main canal on the right bank of the Elands River and to serve irrigable land on the left bank by means of a syphon across the river (RSA, 1964h:2).

In 1963, the DWA proposed the construction of a storage dam (Glen Alpine Dam) on the Magalakwin River (at tributary of the Limpopo) at a site on the farms Glen Alpine and Papagaai in the districts of Potgietersrus and Pietersburg, Transvaal (RSA, 1963h:2).

The purpose of the dam was to stabilise the flow of the Magalakwin River to provide an assured water supply for cattle-drinking and irrigation development downstream of the proposed dam. Few, if any, good dam sites exist on the Magalakwin River. Investigations were carried out in 1937 and again in 1946 but no promising site was found (RSA, 1963h:2, 3).

The site proposed in 1963 was recommended by the Circle Engineer during 1959. In 1961 a topographical survey and foundation drilling were undertaken. The site limited the full supply level of the proposed dam to a height of about 60 feet above the riverbed. It was found to be suitable for a concrete gravity type spillway section with earth embankments on either side (RSA, 1963h:3).

Ranching is the main activity in the Magalakwin River area. During dry years, this is curtailed by the shortage of water for cattle-drinking purposes. During the few years before 1963, this shortage was relieved, to a large measure by water released from the Doorndraai Dam into the Sterk River. The increasing demand for water from the Sterk River Settlement resulted in a position where practically all water in the Doorndraai Dam had to be reserved for Settlement purposes (RSA, 1963h:3).

In addition, in 1963 about 900 morgen of land was under irrigation below the proposed dam. Crops that were cultivated were mainly citrus, tobacco, lucerne, potatoes, and groundnuts. At that time, the cultivation of citrus was curtailed by a shortage of water. It was estimated that about 3 000 morgen of land was suitable for irrigation. The proposed dam was to supply about 2 176 morgen-feet of water per year, and had an estimated cost of R1.5 million. This was equivalent to a unit storage cost of R163 per morgen (RSA, 1963h:3, 4).

In 1967, the DWA stated in a report that the cost of the dam had increased to R1.95 million. Reasons for the cost increase were as follows:

1. Clearing of the dam's basin of vegetation was more than initially expected. The additional cost to this endeavour was R45 800;
2. Cost of construction material and the cost of constructing the construction camp increased by R35 200;
3. More construction roads had to be built. The additional cost was estimated at R19 000;
4. Excavation of the foundation was taken further than expected. The increased cost was R128 400;
5. Because of the deeper foundation and the lengthening of the concrete portion of the wall, there was an increase of R182 000;
6. More efficient radial type sluices were installed instead of the scour sluices. This increased the cost to R70 000;
7. Construction costs increased by R71 600 (RSA, 1967d:3-4).

6.4.18. Raising of the Lindleyspoort Dam

In 1935/36, the Minister of Irrigation asked the Irrigation Commission to undertake an investigation into the Lindleyspoort Irrigation Project. The Commission reported that a preliminary report and plans were drawn up by the Department of Irrigation. The

Commission also visited the area and held meetings with some of the landowners along the river (Union of South Africa, 1937d:17).

They reported to the Minister that conditions along the river had worsened over the past couple of years before 1936. These difficulties were ascribed to prolonged droughts in the area. Because of these drought conditions, many farmers could not make a livelihood and sought relief work in other places. Many also received government rations and other assistance. Many of the owners depended upon a small income from stock, but the periods of drought reduced their herds to such an extent that they were unable to receive an income from this source. The Commission said that an irrigation project would provide water for the raising of stock and the production of fodder. Tobacco would also be produced (Union of South Africa, 1937d:17).

Thus, environmental conditions (prolonged droughts), with their subsequent negative socio-economic impacts on farmers, were the main incentives for this project. Work on the dam, situated 16 km north of Swartruggens, started in April 1939 (Union of South Africa, 1939:34).

Labour on the project came mainly from casual labourers, until the Department of Labour started with a recruitment drive in November 1938. The maximum number of white and "native" labourers was 255 and 45 respectively, with the average of white and "native" labourers being 153 and 16 respectively. The native labourers were employed "solely on sanitary services, etc" (Union of South Africa, 1940b:29).

In 1964, the DWA proposed that the Lindleyspoort Dam, on the Elands River near Swartruggens, be raised by five feet. The purpose of the raising of the dam was to improve the water supplies to the Lindleyspoort Government Water Scheme. This water scheme faced water shortages even prior to the raising of the dam (RSA, 1964h:2).

In 1964 a main canal from the dam, together with a system of tributaries, supplied irrigation water to 1 658 morgen of land under the scheme. About 129 irrigation farmers were to benefit from the proposed raising of the dam (RSA, 1964h:2).

In 1969, the DWA proposed that the dam be raised by another three feet. The estimated cost of the raising amounted to R250 000. This was on top of the R536 254 that was originally envisaged to be spent on the raising of the dam (RSA, 1969d:2, 5).

6.4.19. Raising of the Albasini Dam

It was proposed by the DWA in 1964 to raise the Albasini Dam, on the Levubu River, by 10 feet. The proposed raising of the dam was to ensure a better water supply to the scheduled area under the Levubu Government Water Scheme. This assured supply of water was needed especially during times of drought, like the one experienced in 1964 (RSA, 1964i:2).

The history of the Albasini Dam dates back to 1935. In this year, the Department of Lands purchased land for settlement purposes. This land was divided into 70 smallholdings, each with approximately 15 morgen of irrigable land. Diversion weirs were constructed in the

Levubu and Lantonyanda Rivers and in the Luhvingspruit. The purpose of the weirs was to divert water for the irrigation of about 1 080 morgen of land (RSA, 1964i:2).

In 1942 the Department of Lands purchased the farm Beaufort for placing a further 900 morgen under irrigation. Investigation of the water resources by the Department of Irrigation showed that this additional area could be irrigated only if a storage dam was constructed. At the beginning of 1942, the Department of Irrigation was instructed to take over the control of the water distribution of the Levubu Settlement. The Levubu Government Water Scheme was proclaimed on 21 July 1947, by Government Notice No. 273 (RSA, 1964i:2).

The Albasini Dam, with a storage capacity of 8 107 morgen-feet, was completed early in 1953 on the farm Goedehoop. Irrigable land is served from the dam, the Levubu, Lantonyanda and Barotta diversion weirs and their respective canal systems (RSA, 1964i:2).

As regards the proposed raising of the dam, the DWA stated the following in its report on the matter: "After the proposed raising the dam will have a storage of 11 000 morgen-feet and it will be possible to maintain an assured net supply of 5 600 morgen-feet per annum, in comparison with a similar supply of 4 940 morgen-feet for the existing plan. It would be unwise to increase the scheduled area under the scheme, which is at present experiencing a shortage of water, after the raising of the dam. This may result in the scheme reverting to its present unsound water supply position. The raising of the dam is, in fact, intended to safeguard the present development. No extension under this Government dam will therefore be allowed, except on the explicit instruction of the Minister" (RSA, 1964i:3).

The cost of the proposed raising of the dam was estimated at R400 000. Regarding the finances of the scheme, the DWA stated in its report that: "In view of the direct and indirect benefits which will accrue to the Republic as a whole as a result of increased and more assured production after the proposed raising of the dam, and considering the set-back experienced by the scheme as a result of the protracted serious drought, it is not intended to levy a Government rate at the outset in respect of the cost of the raising of the dam. The Minister may in due course, when the present state of financial distress has come to an end, levy an appropriate rate" (RSA, 1964i:4).

6.4.20. Potgietersrus's Water Supply Scheme

It was proposed in 1964 by the DWA to construct a pumping station at the Doorndraai Dam on the Sterk River. A pipeline was also to be constructed from the dam to the town of Potgietersrus (now Mokopane). This pipeline was to traverse the watershed between the Sterk River and the Magalakwin River. A reservoir on the watershed and a departmental reservoir were also constructed (RSA, 1964j:2).

The purpose of the scheme was to supply additional water to the town of Potgietersrus for industrial and domestic purposes, for both present (1964) requirements and proposed extension (RSA, 1964j:2).

The town required more water due to the following proposed extensions in its vicinity:

1. A new Commercial High School and a second Primary School;

2. A new Bantu Location was planned, four kilometres outside the town's boundaries. Provision was made for 850 houses;
3. A residential area for Indians was to be laid out south of the proposed Bantu Location;
4. Industries regarding (homeland) border areas in the vicinity of the town were also possible developments; and
5. Further expansion of the Tobacco Cooperative. This cooperative had already doubled in size during the five years before 1964 (RSA, 1964j:2).

In 1964, before the implementation of the scheme, the water resources of the town were the Dorp River and certain boreholes. These had a combined yield of 2.2 million litres per day. During 1963, the municipality constructed a dam with a storage capacity of 350 morgen-feet on the Dorp River to supplement the yield. This dam was not serving as a permanent solution to the water shortages of Potgietersrus. The future water requirements of the town were estimated to be as follows:

- 1970 3 321 000 litres per day.
- 1980 5 458 500 litres per day (RSA, 1964j:2).

The water requirements of the Bantu township in Valtyn Makopaan Location had been assessed as follows:

- 1963 675 000 litres per day.
- 1970 1 350 000 litres per day.
- 1975 2 025 000 litres per day (RSA, 1964j:3).

For many years before 1964, the Dorp River and the boreholes had been inadequate for the provision of water to the town. The distribution system, which the municipality constructed, also caused serious problems to the consumers. This was especially the case in the dry winter months. During these months the flow of the river dropped to as little as 990 000 litres per day. In addition, the new proposed sewage system required an assured water supply of at least 2.2 million litres of water per day (RSA, 1964j:3).

In 1950, possible sources of additional water had already been investigated by the Department of Irrigation. These were as follows:

1. The construction of a dam in Rooisloot which, on investigation, appeared to be entirely uneconomical;
2. The abstraction of water from the Magalakwin River which passes near the town but which, in view of its irregular flow, could not be recommended;
3. The abstraction of water from the Doorndraai Dam. This was proposed in 1950 but would have been fairly costly and would therefore be recommended only after the possibility of a supply from boreholes had been eliminated by a geologist. It was also necessary to prove that the demand would justify a connection with the Doorndraai Dam (RSA, 1964j:3).

The supply of water from boreholes was considered a doubtful solution in light of the limited underground water supplies. During September 1952, the Circle Engineer reported on a proposed combined water supply scheme that would supply water to Potgietersrus and Naboomspruit from the Doorndraai Dam. Such a combined scheme, which was estimated to

cost R600 000, could not be recommended. This was because it was found that the proposed Welgevonden Dam Scheme could supply water inexpensively to the town of Naboomspruit (RSA, 1964j:3).

At the request of the Town Council of Potgietersrus possible supplementary water resources were investigated by consulting engineers in 1957 and again in 1960. Although water from boreholes would apparently have been the least expensive, the Doorndraai Dam Scheme was again recommended. This was in view of the fact that the potential yield of boreholes could not be established with certainty (RSA, 1964j:3).

From the investigations carried out by the DWA, it was evident that for Potgietersrus there was no suitable source of water other than the Doorndraai Dam. The estimated cost of the proposed 1964 scheme was put at R750 000. The scheme was to be completed in 1966 (RSA, 1964j:3, 4).

6.4.21. The Phalaborwa Water Board Scheme

In 1964, the DWA proposed to supply water for the town of Phalaborwa and industrial area under the control of the Phalaborwa Water Board Scheme. This area is adjacent to the Olifants River, immediately west of the Kruger National Park. The town is situated 104 km east of Tzaneen. It forms the economic centre of the area that was to be supplied by the proposed scheme (RSA, 1964k:3).

Phalaborwa owes its existence and rapid rate of growth to the great expansion of mining and industrial development in the area. The town was originally founded by the Phosphate Development Corporation (Phoscor). In 1964, the Department of Bantu Administration and Development was engaged in the laying out of a Bantu township at the Makusha Location, about 10 km from the town. It was expected that about 7 000 erven were to be available by 1975 in this township (RSA, 1964k:3).

Mining development took place to the east of the Murchinson Mountain range, which is rich in minerals. In 1964, there were already signs that copper had been mined here before the settlement of whites in the area. Gold was discovered in the area in 1870. Since then this metal, and silver, has been mined in the area. Emeralds and other related gems have been mined by prospectors and small companies since 1927. Other minerals occurring here are mica, chromium, platinum, vermillion (from which mercury is derived), antimony, *etc.* (RSA, 1964k:3).

In the years before 1964 there was a rapid expansion of mining activities. This took place to the eastern side of the Murchinson Mountain range at Loolekop. The most important deposit of apatite in the Republic, from which phosphate fertilisers are manufactured, occurs here. This deposit was, at that time, exploited by Phoscor, a state-aided undertaking (RSA, 1964k:3).

Vermiculite has also been mined here since the Second World War by the Transvaal Ore Company. In 1964, the Palabora Mining Company was engaged in a large layout for the mining of copper. This company was also endeavouring to extract iron from the magnetite, which occurs as a residue of its own activities and that of Phoscor (RSA, 1964k:3-4).

In 1964, water was extracted from the Olifants River by Phoscor. This river supplies water to the Phalaborwa area. Two installations had been erected to supply water for domestic and industrial purposes, respectively (RSA, 1964k:4).

The scheme to supply water for domestic purposes includes a pumping station, situated at the river. The water was delivered by means of a pipeline to the Phoscor works, and was then delivered, also by pipeline, to Phalaborwa. Water for the industrial area is also supplied by a pipeline from the river. In 1964, these waterworks had the capacity to supply 22.5 million litres of water for industrial and 6.3 million litres for domestic supplies. These works cost R968 023 to built (RSA, 1964k:4).

Phoscor obtained the right to abstract water in terms of a mandate issued by the then governor-general in terms of the Precious and Base Metals Act of 1908. The company was entitled (in 1964) to abstract 16.2 million litres of water per day from the Olifants River (RSA, 1964k:4).

In view of the considerable potential of the area for mining and industrial development, the possibility of extending the water supply was investigated. After investigation, the conclusion was drawn that a regional water supply scheme to supply the town and industrial areas would be the most advantageous. The Water Act, No. 54 of 1956, provided for the establishment of statutory bodies in the form of Water Boards to construct and administer such schemes. It was decided to make use of this provision (RSA, 1964k:4).

Consultations between the interested parties and the DWA took place, and the Phalaborwa Water Board was subsequently established by Proclamation No. 88 of 10 May 1963, in terms of Section 108 of the 1956 Water Act. This Board was to provide a regional water supply scheme for the area (RSA, 1964k:4).

In 1963, it was the intention to declare the farms between the Drakensberg and the Kruger National Park a Government Water Control Area. This was to ensure firstly that the water resources of the Lower Olifants River were utilised to the best advantage of all the interested parties, and secondly that the necessary allotments of water could be made to the Water Board (RSA, 1964k:4).

From data from Phoscor, the Palabora Mining Company, the Transvaal Ore Company, the Phalaborwa Health Board, the Department of Bantu Administration and Development and other bodies, it was established that water consumption in the area of the Water Board was to increase from 21.15 million gallons per day (1963) to 135.18 million gallons per day in 1971 (RSA, 1964k:4-5).

The yield of 28.8 million litres per day was expected to be insufficient for the expected demand in 1964. It was therefore seen as essential that additional water purification installations be constructed. This was seen as an urgent matter because the Palabora Mining Company's copper installation was to come into operation at the beginning of 1966 (RSA, 1964k:5).

From a water resources perspective, a problem was foreseen. The DWA states in its 1964 report that: "An analysis of the river flow data has shown that the flow of the Olifants River

above its confluence with the Blyde River may drop as low as 35 cusecs. On the assumption that the entire low flow of the Blyde River will be used up in its own catchment area in the foreseeable future, it is evident that the flow of the river at Phalaborwa will sometimes be insufficient to meet the expected demand of 42 cusecs, or 22.78 million gallons [102.51 million litres] a day, in 1967" (RSA, 1964k:5).

To eliminate future shortages it was proposed that a barrage type of weir, 36 feet high, with a capacity of 2 000 morgen feet, be constructed on the Olifants River. A major storage dam, controlled by the state, was eventually to be required on the Olifants River. The DWA therefore proposed a construction programme, extending over a period of four years (1964 to 1967), to supply water to Phalaborwa and surrounds. The works to be constructed during this period were to consist of pipelines, purification plants, reservoirs and the barrage type weir. The estimated cost of the programme was over R4 million. Yet due to accumulated interest, it was estimated at R5.2 million (RSA, 1964k:6).

6.4.22. Raising of the Rooikraal Dam

In 1964, the DWA proposed the raising of the Rooikraal Dam, situated on the Blood River, about 32 km southeast of Groblersdal, by five feet. This was to result in more water being made available for agricultural purposes under the Blood River Scheme. The intention was, however, not to increase the scheduled area but to increase the water quota per morgen. This was to place the 1964 development on a sounder and more economical footing (RSA, 1964l:2).

The history of the Rooikraal Dam dates back to 1917. The dam was designed by the Department of Irrigation for Messrs. Darras and Patrojohn in the same year. A government loan of R2 400 was granted to them in May 1919. Before completion of the dam, the applicants decided to construct the earth wall of the dam four and a half feet higher than planned. An additional loan of R1 600 was granted to them in 1920. The scheme was completed in 1921 (RSA, 1964l:2).

In 1930, however, the partnership was dissolved and Darras became the sole owner. In 1935, the Rooikraal Dam was empty and riparian owners below the dam approached the government to supply water from the Steelpoort River Valley but the proposal had to be abandoned because of opposition to it. In the same year, the dam was offered to the government by Darras. The offer was accepted by the Department of Lands with the view to placing settlers on the scheme. Twenty-five plots were surveyed, but, by 1944, only 14 of the plots had been allotted, each plot being scheduled for 10 morgen. An area of 752 morgen could be served by the canals but the limiting factor was the shortage of irrigation water (RSA, 1964l:2).

In January 1946, the wall of the dam was breached and repaired. The empty reservoir brought to light that a large volume of silt had been deposited in the dam basin. This deposit of silt had a negative impact on the reservoir's capacity. Proposals were advanced in 1946 to raise the dam by six feet and an amount of R200 000 was voted for the purpose. Of this amount, R116 000 was expended on canal betterments and the balance of R84 000 was found to be insufficient to raise the dam by six feet. It was therefore raised by only three feet (RSA, 1964l:2).

This work was carried out by the DWA and was completed in 1958. The raising of the dam by three feet increased the gross capacity to 489 morgen-feet. The net capacity, after allowing for silt deposits, amounted to 410 morgen-feet. On the strength of this raising the balance of the plots were allotted. This brought the total to 25 plots with a combined scheduled area of 250 morgen. Before 1964, it became evident that a further raising was essential if the scheme was to be placed on a sound and economical footing (RSA, 1964:2).

The cost of the raising of the dam in 1964 was estimated to be R69 000. The capacity of the dam was to increase to 972 morgen-feet. Yet it was envisaged that the net capacity was only 755 morgen feet. The reason for this was that soil erosion, especially in the Bantu trust area, was anticipated to lead to considerable silt deposits in the reservoir (RSA, 1964:3).

6.4.23. Raising of the Hartebeespoort Dam

A dam was built on the Crocodile River, some 30 km west of Pretoria, before the establishment of the Union of South Africa in 1910. This dam was built from concrete, some nine metres high. It did not impound any water, used for the leading out of water and the irrigation of adjacent land. The dam was washed away in a flood on 9 January 1909 (Hurley, 1909:92). It is not clear whether this dam was the precursor of the Hartebeespoort Dam. Yet indications are that this is the case.

In the late 1890s, General Hendrik J. Schoeman saw the potential of the *poort*, through which the Crocodile River flows, as a site for a potential dam. He started with construction of a dam at the site, which was completed in 1898. At the opening ceremony of the dam on 28 May 1898, Schoeman made a pledge to President Paul Kruger to build a dam using government funds. The purpose of such a project would be to irrigate a few plots of land on which poor whites could be settled. On 1 April 1899, Schoeman wrote a letter in which he stated that he was willing to sell a portion of his farm for the above-mentioned project. President Kruger welcomed the idea. However, the outbreak of the Anglo-Boer War in October 1899 put a hold on the implementation of the project. After the war had ended in 1902, the total reconstruction of South Africa got underway. It was in the same year that the viability of the site, for the construction of a dam, was investigated. However, this investigation was conducted with the view to providing urban water to Pretoria and Johannesburg and not for irrigation or settlement purposes (De Beer, 1975:383; Mulder, Date Unknown :4; Du Plessis, 1989:37).

Before 1904, a number of gauging stations were built in the Magalies and Crocodile Rivers, to measure the MAR of the two rivers. During 1904, the Transvaal Department of Irrigation undertook an investigation of the Crocodile River up to its confluence with the Groot Marico River. The report, published in 1907, was very pessimistic about the construction of a dam at Hartebeespoort. Despite this pessimism, Hurley, the head engineer in the Department, continued with investigations regarding the possible construction of the dam. A more thorough investigation was conducted of the entire catchment area of the dam. In his report, Hurley asked if he could continue with the investigations. Permission was granted (Union of South Africa, 1914:5; Mulder, Date Unknown, 23; Du Plessis, 1989:37).

Drilling to investigate the suitability of the rock on which the dam would be built was conducted during the period 1909 to 1910. Notwithstanding the initial work on the Hartebeespoort Dam during this period, the establishment of the Union of South Africa in 1910 postponed further work on it. The reason for this was the new Department of Irrigation's work in other parts of the Union (Du Plessis, 1989:38).

In 1913, legislation regarding the construction of the Hartebeespoort Dam was investigated. It is noticeable that from 1910 to 1913 no work on the dam was conducted. In 1914, legislation (Act 32 of 1914) was suddenly passed to construct the dam. A possible reason for the sudden flare-up of interest in the Hartebeespoort Dam is the political occurrences during 1913 and 1914. Eighteen months before the passing of legislation, large-scale dissatisfaction leading to unrest occurred among whites. During 1913, there was a miners' strike and uprisings on the Witwatersrand. During 1914, industrial unrest broke out. Twenty thousand workers went on strike, including nine thousand miners and six thousand railway workers. During the same time, martial law was proclaimed in South Africa. Together with the economic and political unrest, restlessness among the Indian community also started to emerge. This was because of Ghandi's demand for more equality in South African society. This did not help to calm whites (Union of South Africa, 1919:23; Du Plessis, 1989:37-38; RSA, 1977e:3). According to Andrews (1931:28-29), the government launched the Hartebeespoort irrigation scheme to appease the white electorate.

From this it can be deduced that the poor white issue was not only a socio-economic measure, but also had political undertones. Yet the Hartebeespoort scheme should not only be seen in the light of the political events of 1913-1914. It should also be seen as a policy of rural settlement against the backdrop of rehabilitation. The poor white issue was very important for the white electorate and the director of irrigation stated that the Hartebeespoort irrigation scheme's sole purpose was irrigation (Mulder, Date Unknown:6; Du Plessis, 1989:38).

Nonetheless, the scheme should also be seen against the backdrop of colonisation of Transvaal. The Minister of Lands stated in 1915 that that the scheme offered a welcome change for colonisation. He also said that colonisation in the northern parts of Transvaal was almost impossible due to the occurrence of drought. Another reason for the implementation of the scheme was the presence of markets in Johannesburg and Pretoria. The soil was fertile and enough rain fell in the basin to supply water to the dam. However, the poor white issue took precedence over all other considerations. General Louis Botha, the Prime Minister, said in parliament in June 1914 that: "...the main purpose of the scheme is to mitigate the problem of the poor white issue" (Du Plessis, 1989:39).

Not all members of parliament were for the scheme. The opposition contended that a proper investigation into the matter of financing of the project had not been conducted. Yet on 16 June 1914, the House of Assembly voted on the matter of the implementation of the Hartebeespoort irrigation scheme. The result of the vote was 63 for and 22 against. There was also uneasiness about the number of people to be resettled on the land to be irrigated. Some members of parliament stated that other schemes where poor whites were resettled had been huge failures (Du Plessis, 1989:40).

Start of construction of the irrigation scheme was planned for the end of 1915. This had to be postponed due to South Africa's involvement in the First World War. This gave the Department of Irrigation enough time for further investigations into the viability of the

scheme. This is an indication that, before the passing of legislation in 1913, no detailed investigations were conducted (Du Plessis, 1989:40).

The implementation of the irrigation scheme did not go as planned. A number of obstacles were in the way of implementation. These can be summarised as follows:

- The Department of Irrigation was not prepared for the rising costs of the project, due to the difficult terrain through which the canals were constructed;
- Some of the rock formations on which the dam wall itself was constructed had to be excavated deeper than was thought previously;
- There were also some gaps in the legislation, which led to litigation regarding the expropriation of land;
- South Africa's involvement in the First World War led to a decrease in state funds for the construction of the scheme. Funding for a number of government departments was slashed to pay for the war effort. These departments were Public Works, Justice, Agriculture, Foreign Affairs, and a host of others (Du Plessis, 1989:40-42).

Despite these hitches in the implementation of the Hartebeespoort irrigation scheme, the scheme was completed in 1923. In 1928, the Brits magisterial district was proclaimed. This was as a direct consequence of the increased activity in the Hartebeespoort area, and rapid development that took place under the scheme. A railway line also constructed to serve the settlement on the right bank of the Crocodile River (Union of South Africa, 1930c:24).

By 1920, the Hartebeespoort irrigation scheme was one of the major schemes implemented in the Transvaal. The dam filled on 11 March 1925, and a maximum flood of 2 700 cusecs passed down the spillway on 26 March 1925. The reservoir had a capacity to hold 6 000 million cubic feet of water, and was constructed at an estimated cost of £400 000. By 1925, 97 farmers and 65 lessees made use of the water from the Hartebeespoort Dam (Union of South Africa, 1920:517; Union of South Africa, 1926a:17; RSA, 1977c:3).

In 1964, the DWA proposed that the Hartebeespoort Dam be raised by 8 feet. This was to increase the capacity of the dam and to make a larger volume of water available for irrigation purposes. The irrigators under the Hartebeespoort Government Water Scheme had experienced periodic water shortages before 1964 (RSA, 1964m:3).

The raising of the dam was to be done by means of 10 radial crest sluices, each 33 feet long, and 8 feet high. These sluices were to be installed in the spillway section to increase the full supply level. After the raising, the dam had a gross storage capacity of 81 220 morgen-feet and a net storage capacity of 75 060 morgen-feet (RSA, 1964m:5).

The estimated cost of the raising of the dam amounted to R350 000. Regarding the financial aspects of the proposed plan the DWA states in its 1964 report that: "In accordance with the existing policy of subsidizing irrigation schemes by which the country, in view of increased production, benefits directly and indirectly, it is not intended that irrigators should repay the full cost of raising the dam. It is, however, proposed to levy an additional Government rate of 30 cents per morgen per annum, in terms of Section 66 of the Water Act, No. 54 of 1956, on the scheduled area in respect of the cost of the raising of the dam, upon completion of the construction" (RSA, 1964m:6).

6.4.24. Raising of the Jan Wassenaar Dam

In 1964, the DWA proposed that the Jan Wassenaar Dam (now the Klaserie Dam) be raised by 10 feet. This dam is situated on the Klaserie River, a tributary of the Olifants, which eventually flows into the Limpopo River. It was the intention of the DWA to raise the dam to provide a more assured water supply to the Klaserie River Irrigation District, and to cope with the periods of drought, such as the one experienced in 1964. This assured water supply was to be achieved by the elimination of the curtailment of the annual water quota because of water shortages. The estimated cost of the works was put at R300 000 (RSA, 1964n:2).

Irrigation development along the Klaserie River dates back to 1921. During the Second World War the government decided to buy the farm Guernsey and five other farms known jointly as the Guernsey Block. The farm was divided into 20 sub-divisions, each measuring 1 300 and 2 000 morgen. These sub-divisions were allotted to ex-soldiers as cattle farms under the Land Settlement Act. To supplement their income the settlers practised irrigation from the Klaserie River. The main crops that were cultivated by 1964 were citrus, vegetables, tobacco and, to a lesser extent, cotton (RSA, 1964n:2).

The Guernsey Irrigation District was established on 26 May 1950, with a total scheduled area of 339 morgen. The Board which was subsequently established apportioned the water to six of the farms. These farms were included in the Klaserie River Irrigation District in November 1950, with a combined scheduled area of 757 morgen at that time (RSA, 1964n:2).

Because of the expansion of irrigation development water shortages were experienced during winter months. Shortly after the establishment of the Irrigation District, representations were received for the provision of storage in the Klaserie River. Three possible dam sites were investigated. In 1960, the Jan Wassenaar Dam, with a capacity of 1 280 morgen-feet, was completed as an Irrigation Board Dam. The dam was constructed with the aid of an irrigation loan (RSA, 1964n:2).

Because the diversion weir of the Guernsey furrow is situated upstream of the dam on the farm Fleur de Lys, all the irrigators were not deriving direct benefits from the dam. Indirect benefits were derived, however. A hydrological investigation conducted before 1964 indicated that the normal flow of the river during the winter months was sufficient to meet the water needs of the irrigators below the Guernsey furrow. During these months, the irrigators below the dam were supplied with stored floodwater from the dam (RSA, 1964n:3).

The DWA decided that it was not intended to levy an additional government rate for the raising of the dam. This was because of the direct and indirect benefits the Republic derived from the increased production and the setbacks the scheme had because of the serious drought. Yet the Minister may have levied an appropriate government rate regarding the raising of the dam when the state of financial distress had been alleviated (RSA, 1964n:3).

6.4.25. Raising of the Buffelspoort Dam

In 1964, the DWA proposed that the Buffelspoort Dam be raised by 10 feet. The dam is situated on the Sterkstroom, a tributary of the Crocodile River, in the district of Rustenburg (RSA, 1964o:3).

The rationale behind the raising of the dam was to make available a more assured supply of water to the scheduled area under the Buffelspoort Government Water Scheme to alleviate periods of drought. The region that the dam serves suffered from a severe drought in 1964. The alleviation was to be obtained by eliminating as far as possible curtailments of the annual water quota because of water shortages (RSA, 1964o:3).

Irrigation development in this area is among the oldest in the then Transvaal Province of South Africa. The Water Court apportioned the water of the Sterkstroom in 1917 and the Department of Irrigation investigated a proposed storage dam in 1919. The Buffelspoort Irrigation District was established in November 1927. Since 1930, several representations had been received for the construction of the dam (RSA, 1964o:3).

After investigation, the Buffelspoort Dam was completed in 1937 by the Department of Irrigation. The Irrigation Board was taken over by the government in 1942. The dam was raised by eight feet in 1954 and in 1964 it had a storage capacity of 2 715 morgen-feet. The main crops cultivated under the scheme were citrus, tobacco and wheat. The estimated cost of the raising of the dam was put at R125 000. In 1964 the irrigators under the scheme paid a levy of R2 per morgen per year on the scheduled area of 2 289 morgen. Yet the government stated that no levy was to be charged from the farmers regarding the cost of the raising of the dam. This was due to the direct and indirect benefits to the Republic due to an increased and more stable production of agricultural crops after the raising of the dam. The severe drought has also had a negative impact on the scheme, and many farmers were in a difficult financial position to pay a levy (RSA, 1964o:3, 4).

6.4.26. The Palala River Weirs

The construction of a number of weirs on the Palala River was proposed by the DWA in 1964. Before 1964, seven sites had already been identified for this purpose. One of these sites, on the farm Moerdyk, was suitable for the construction of a dam in future. Yet in 1964 the topographical surveys and foundation test drilling of the sites had not yet been completed. It was therefore not possible to determine on which of the seven sites weirs were to be constructed (RSA, 1964p:3, 4).

The purpose of the project was to control the flow of the Palala River to some extent. This was to make provision for a more assured supply of water for stock watering and, to a minor extent, for existing irrigation along the river (RSA, 1964p:3).

The Palala River rises in the Waterberg, north of the town of Nylstroom. From there, the river flows northwards to its confluence with the Limpopo River. The main tributaries of the Palala River are the Klein Melk, the Melk, the Koedoeshoop, the Gold and the Tongaat Rivers (RSA, 1964p:3).

Before 1964, irrigation along the Palala was practised by means of pumping plants erected by the farmers. Water shortages during the winter months had led to interested parties along the river appealing, since 1930, to the government to investigate proposals for the improvement of the water supplies. Sites on the farms Richards Lager, In Den Berg, Doornleegte, Tafelkop, Kwarriehoek, and Buffelshoek, had been investigated since 1930, and it was recommended that weirs were to be constructed on two or three sites. In 1964 the DWA stated that: "The urgency of the water shortages now experienced necessitates the submission of this report before the topographical surveys and foundation drilling of the above-mentioned sites are completed" (RSA, 1964p:4).

The future storage dam was to control and store floodwater so that it could feed the proposed weirs in future. An amount of R300 000 was to be made available for the construction of the weirs. The government did not intend to levy a government rate on the cost of the construction of the weirs. This was because of the direct and indirect benefits the country received from an increased production of agricultural commodities and the severe water shortages because of the 1964 drought (RSA, 1964p:4).

6.4.27. The Watervals River Government Waterwork

In 1965, the DWA proposed the construction of a storage dam on the Watervals River, on the farm Buffelskloof in the district of Lydenburg. The purpose of the proposed dam was to catch and regulate the floodwaters of the Watervals River. This was to provide an assured water supply to 1 715 morgen of land. This land was situated between the proposed dam and the confluence of the Watervals and Spekboom Rivers. Before 1965, water shortages occurred in the area every year during the spring and early summer months (RSA, 1965d:3).

Owners of land riparian to the Watervals River and upstream of the dam were also to benefit indirectly from the dam. This was because on completion of the dam it was possible to effect a redistribution of the normal flow of the river. This was to make a larger portion of the normal flow available to higher lying riparian land than was the case in 1965 (RSA, 1965d:3).

The DWA stated in its 1965 report on the proposed dam that: "It will be a prerequisite for the construction of the scheme that riparian owners must give up their existing rights under Water Court Orders and accept a fair apportionment of the water resources by the Minister of Water Affairs. For this purpose the area will be proclaimed a Government water control area" (RSA, 1965d:3).

Regarding irrigation development, the first farmers settled in the area in 1845. Originally, 18 riparian farms were issued along the Watervals River. On these farms and their sub-divisions 84 families made a living, prior to 1965, mainly on 2 630 morgen of irrigated riparian land. Seven of the original 18 farms, on which 1 715 morgen of land had been irrigated before 1965, were situated below the proposed dam. Since 1845, irrigation has been practised by means of direct diversion of the normal flow of the river. This was done by means of diversion weirs and earth canals. Optimal utilisation of the water resources of the river was hindered by the occurrence of regular water shortages (RSA, 1965d:4).

At around 1918, the interested parties applied to the Water Court for an apportionment of the normal flow of the Watervals River. The practical application of the provisions of the Water

Court Order posed many problems. Because of their upstream location on the river, the owners of the upper 12 farms could divert the entire normal flow and leave the lower five farms without water (RSA, 1965d:4).

During 1949, the River District was proclaimed and in 1956, by the promulgation of the Water Act, No. 54 of 1956, this was converted into an Irrigation District. Thereafter, the Irrigation Board persevered in its endeavours to create water storage facilities. The drought from about 1960 to 1965 provided convincing proof that a storage dam was necessary to ensure the social security of the irrigation farmers in the Watervals River valley (RSA, 1965d:4).

Since 1929, nine separate dam sites had been investigated on the river. Eight of these sites were found unsuitable and had been rejected. The site on the farm Buffelskloof, which was discovered by the DWA in 1964, appeared to be more promising. Topographical surveys were made and a preliminary geological investigation was undertaken. Testing of the foundations by means of a diamond drill was already in progress by 1965. A dam, with a gross capacity of 1 200 morgen-feet, had been designed with an estimated cost of R2.35 million. An amount of R1.219 million was asked by the DWA for provisional construction of the dam. Because of the policy of subsidising irrigation, the irrigators were not to repay the entire cost of the scheme. A levy of R10 per morgen was to be charged for the 1 715 morgen which was to be scheduled under the dam (RSA, 1965d:5).

6.4.28. The Vaalkop Dam

In 1965, it was proposed that a dam be constructed on the Elands River on the farm Bulhoek, district of Lichtenburg, Transvaal. The proposed dam site was situated about 10 km upstream from the confluence of the Elands and Crocodile Rivers and about 45 km northeast of Rustenburg (RSA, 1965e:2).

The purpose of the proposed dam was to regulate the flow of the surplus water of the Elands River. This was to provide an assured supply of water for use by the Municipality of Rustenburg and the platinum mines and other border industries. Water was also to be released for irrigation use further downstream along the Elands and Crocodile Rivers (RSA, 1965e:2).

The development of the town of Rustenburg and the mines in the vicinity had been retarded during the drought years of the early to mid-1960s because of a lack of an adequate water supply. The establishment of border industries near the town was also contemplated by the municipality. The Municipality of Rustenburg had been abstracting supplementary water directly from the Bospoort Dam in the Hex River since 1958. This dam was to be raised in future. After this, Rustenburg's allotment of water from the dam was to be 1.462 million litres per year. The drought of the early to mid-1960s resulted at times in practically no water being available from the Bospoort Dam. Rustenburg was therefore dependent on water from boreholes and from the "Kloof" which supplied about 540 million litres of water per year. Boreholes at the platinum mines supplied a maximum of about 1.215 million litres per year. These water supplies were deemed inadequate (RSA, 1965e:3).

In 1965, the water consumption by Rustenburg and the platinum mines was estimated at about 5.4 million litres per year. The estimated consumption by 1985 was put at about 7 million litres per year. This was if industrial development came up to expectations. To overcome the serious water shortages it was decided that a storage dam would be constructed on the Elands River. A site had been investigated on the farm Onderstepoort, but it was rejected because of poor foundation rock. It was therefore decided that the proposed dam would be constructed on the farm Bulhoek. The dam was to have a gross capacity of 3 296 morgen-feet. It was also envisaged that the dam be raised in two stages of 15 feet each in the future. This was to make more water available for irrigation purposes. The dam was to consist of a concrete gravity wall, with a right flank of earth and was to cost an estimated R3 million. A provisional sum of R1.6 million was asked for by the DWA for the first stage of the dam (RSA, 1965e:3, 4).

From 1965 to 1968, a number of platinum mining undertakings were launched near Rustenburg. The Iron and Steel Corporation (ISCOR) also came forward with an application for supplementary water from the proposed Vaalkop Dam for its Thabazimbi undertaking. It became therefore necessary to re-cast the entire scheme and to substitute a new cost assessment for the one given in the 1965 White Paper. The dam that was proposed in 1968 had a capacity of 26 000 morgen-feet (RSA, 1968d:2).

Thus the revised proposal envisaged that a dam be constructed to provide an assured water supply for municipal use, irrigation requirements and industrial needs. The platinum undertakings needed about 35.1 million litres of water per day. ISCOR and Rustenburg needed 4.5 million and 7.42 million litres of water per day respectively. Water for irrigation purposes was to be allocated under permit to the riparian lands along the Elands and Crocodile Rivers. The annual requirements of irrigation water in the area were tentatively set at 600 mm net at the field edge. The estimated cost of the proposed Vaalkop Dam was R6 million and the dam was completed in 1972 (RSA, 1968d:2, 3, 5, 6).

In 1982, the DEA proposed the construction of a 4 m³/s canal from the Roodekopjes Dam to the purification works of the Vaalkop Water Board, downstream from the Vaalkop Dam. The purpose of the scheme was to supply bulk water to the Vaalkop Water Board. Irrigators along the canal were also to benefit by being supplied with their quota from the canal at a higher level than the river from which the pumped water until 1981. The provisional estimated cost of the project was R7.6 million after allowing for inflation at 15% per year, while the estimated completion cost at March 1981 prices was R5 million (RSA, 1982c:3).

The Vaalkop Water Board supplied water to mines and industrial users as far as Thabazimbi and certain areas in Bophuthatswana near Heystekrand. The demands on the Board were growing at an average rate of 6.1% per year and were, in 1982, almost equal to its 1980/81 allocation of 12.79 mcm/yr from the Vaalkop Dam. This allocation from the dam could not be increased because the total net yield of the dam was committed. The possibility of raising the dam was investigated but the economical alternative source was found to be a canal from the Roodekopjes Dam. The recommended tariffs were 9.6 cents per m³ for water delivered to the Vaalkop Water Board and R48.50 per ha per year for irrigation water supplied from the canal, after completion of the augmentation scheme (RSA, 1982c:3).

Regarding environmental impacts, the DEA reported in 1982 that: "The greater part of the proposed canal will traverse cultivated farmlands. The area is therefore not viewed as an

ecologically sensitive one and the impact of the proposed scheme on the environment is not serious. The canal does cross certain game farms and precautions will be taken to ensure a minimum of disturbance. Game-proof fencing will be used where necessary and game crossings will be provided". Sufficient funds were also provided to ensure that all areas disturbed by the construction of the canal would be restored in such a way as to be visually pleasing and at the same time prevent the canal from causing increased erosion (RSA, 1982c:8).

6.4.29. The Vergelegen Government Waterwork

In 1965, the DWA proposed the implementation of the Vergelegen Government Waterwork. This work was to comprise the construction of a balancing dam in a tributary of the Politsi River, district of Letaba. A supply canal was also to be constructed in due course to divert water to the balancing dam from a proposed storage dam that was constructed for the Tzaneen Irrigation Board. The proposed balancing dam was to make available a more assured quantity of water for use by the tea company Sapekoe (Pty.) Limited (RSA, 1965f:3).

Sapekoe (Pty.) Limited was founded under the auspices of the Industrial Development Corporation for establishing a tea industry in South Africa. Three farms, Vergelegen, Grenshoek and Middelkop, which were forest reserves belonging to the Department of Forestry, were taken over by Sapekoe during 1963. Although it had no abstraction rights, Middelkop is a farm riparian to the Politsi River. A tributary of the Politsi River, on which the proposed balancing dam was to be constructed, forms the boundary between the farms Vergelegen and Grenshoek (RSA, 1965f:3).

The seed of the tea plant was grown in the nursery on Grenshoek. In 1965 this nursery occupied 46 morgen and was envisaged to expand to 110 morgen. The tea plants were to be taken from here and were bedded on the farm Middelkop, Vergelegen, and Grenshoek. It was proposed that tea-planting eventually be extended to 470 morgen on Grenshoek and Vergelegen and 660 morgen on Middelkop. Tea factories were also to be built for the processing of the tea leaves. The nursery required about 25 mm of water every 10 days. If evaporation and other losses were taken into consideration, the tea nursery on Grenshoek would require about 1.25 cusecs of water per year for the 110 morgen under cultivation (RSA, 1965f:3).

Sapekoe also intended to irrigate the tea after bedding out and estimated that the bedded-out tea plants would require about 1 425 mm of water per year including rainfall. During years of rainfall, with an effective rainfall of about 787.5 mm, an additional irrigation of 637.5 mm per year was therefore necessary. On the area of 470 morgen to be developed on Grenshoek and Vergelegen about 1 000 morgen-feet of water would have to be supplied. It was estimated that the proposed tea factories would use about 90 000 litres per day. The total water requirements on Grenshoek and Vergelegen were put at 1 898 morgen-feet per year or a constant stream of 5.5 cusecs. Requirements for domestic use and consumption in the tea factories and the irrigation requirements of the proposed 660 morgen of tea cultivation on Middelkop were to be met from the proposed irrigation board dam in the Politsi River. The estimated cost of the dam was R300 000 (RSA, 1965f:4).

As regards the financial arrangements in relation to the dam, the DWA stated in its report that: "As the tea cultivation forms a border industry and yields a product which up to now has had to be imported, there is justification for heavily subsidising the undertaking and therefore it is proposed to levy no interest and redemption charges in respect of the said 6-inch pipeline, balancing dam and supply canal" (RSA, 1965f:6).

6.4.30. The Magoebaskloof Dam

In 1965, the DWA proposed the construction of the Turksvygbult Dam (now Magoebaskloof Dam), in the District Letaba, on the Politsi River. The purpose of the proposed dam was to regulate the flow of the Politsi River and to make an assured supply of irrigation water available for scheduled land under the Tzaneen Irrigation Board. Water was also to be made available for irrigation of the tea nursery and tea plantations under control of Sapekoe (RSA, 1965g:3; RSA, 1968e:3).

The Tzaneen Irrigation District was established in terms of section 80 (1) of Act No. 8 of 1912 by Proclamation No. 146 of 1918. A Water Court Order of 26th June 1926, allocated 99% of the normal flow in the Politsi River to the Irrigation Board (RSA, 1965g:3).

An earth canal with a capacity of 20 cusecs, which abstracts water from the Politsi River immediately below the proposed dam-site on the farm Turksvygbult, was constructed by the government and completed in 1912. The canal was 16 km long. By 1965 certain sections of the canal had been concrete-lined and have had the necessary measuring devices installed (RSA, 1965g:3).

In 1912, the scheduled area of the irrigation district was 89 morgen. This had been increased to 1 380 morgen by 1965. Water shortages were encountered during drought years (RSA, 1965g:3).

To alleviate these water shortages the Turksvygbult Dam was to be constructed at an estimated cost of R330 000. The dam was to be financed by a government loan and subsidy (RSA, 1965g:4, 5; RSA, 1966f:2).

In 1968, the DWA revised its report on the construction of the Magoebaskloof Dam. It was originally envisaged that the dam would be constructed in two stages. The first stage was to construct a dam with a capacity of 700 morgen-feet only. This was to be sufficient to compensate the Tzaneen Irrigation Board for diversion by the government of water from the Board's catchment on to the farm Grenshoek. The second stage was planned for a latter date. This was to provide for future increased requirements of the government-assisted tea industry of Sapekoe (Pty.) Ltd. Notwithstanding these stages, in the period 1967 to 1968 a drought led to severe water shortages experienced by the Sapekoe tea company (RSA, 1968e:3).

It was therefore decided to construct the dam to its ultimate capacity of 2 100 morgen-feet immediately. This dam was to ensure that both the Tzaneen Irrigation Board and Sapekoe had sufficient water at all times to meet their requirements. The estimated cost of the Magoebaskloof Dam amounted to R2.5 million. This was R400 000 higher than the estimate made in 1965. The increase was attributed to the subsequent general increase in cost structures (RSA, 1968e:3, 5).

6.4.31. Waterwork for the Selons River Irrigation Board

In 1967, the DWA proposed the construction of a storage dam in the Selons River on the farm Roodepoort, in the district of Groblersdal. The site of the proposed dam was about 12 km east of Loskop Dam. The purpose of the dam was to store sufficient water from the summer flow of the river to irrigate 360 morgen of irrigable land. This land is located below the dam and riparian to the Selons River (RSA, 1967e:2).

The Selons River is a tributary of the Olifants River. It joins the Olifants some six km below the Loskop Dam. The recommended irrigable area lies on the farms Roodepoort, Ringer, Kruisrivier, and portions of Laagersdrift. These farms, or portions of them, are situated within the boundaries of the Selons River Irrigation District. The farm Laagersdrift lies within the Loskop Government Water Control Area. The relevant portions to be commanded under the proposed scheme were not to be served by the canals of the Loskop Scheme (RSA, 1967e:2).

The area scheduled for irrigation by the Board was 360 morgen. For the crops to be grown (groundnuts and tobacco in summer and wheat in winter), it was calculated that a water application at field-edge of 600 mm per year would be sufficient for satisfactory cropping. Taking 25% of transit losses and 10% for seepage and evaporation losses into account, the gross quantity of water required from storage was 1 050 morgen-feet. Of this volume, 450 morgen-feet was to be required during the critical months of July, August and September (RSA, 1967e:3).

The proposed storage dam was to be created by constructing a rolled-fill earth embankment across the Selons River. A side-spillway was also to be provided on the left flank. The estimated cost of the work was R60 000, representing a capital outlay of R167 per morgen scheduled (RSA, 1967e:3).

6.4.32. The George's Valley Irrigation Board Water Scheme

In 1967, the DWA proposed a water scheme for the George's Valley Irrigation Board. This scheme was to supply water to the farms from Stylkop to Burrah Nullah, located on the South Bank of the Great Letaba River, southwest of the town Tzaneen. The proposed scheme provided for a low diversion weir in the Letaba River and a concrete-lined canal system to command the maximum area of irrigable land (RSA, 1967f:2).

The possibilities for irrigation in the George's Valley area by an unlined canal taking water from the Letaba River were first investigated in 1936. Later, in 1952, a larger canal, located on a higher contour, was considered by a group of irrigators, who were considering the formation of an Irrigation Board. In 1956, the Great Letaba Government Water Control Area was proclaimed. This area included the entire area to be covered by the proposed Irrigation District. This was followed by the construction of the Ebenezer Dam in the headwaters of the Great Letaba River, during the years 1958 to 1960. This was to stabilise the flow of the river's upper reaches. In 1960, the George's Valley Irrigation District was proclaimed. The area, within its boundaries, included the farms George's Valley, Stylkop, Letaba Drift,

Diggers Rest, Red Bank, and Burrah Nullah. The Board, which was subsequently elected by the irrigators, initiated the 1967 proposed scheme (RSA, 1967f:2).

The Board is adjacent to the Pusela Irrigation Board's district. The Pusela Irrigation Board's canal takes water from the Letaba River within the George's Valley Irrigation Board's district. This canal was constructed in 1962 (RSA, 1967f:2).

Subsequent to the date of proclamation of the Great Letaba Government Water Control Area, the abstraction and use of water from the Great Letaba and its tributaries within the area have been controlled by permit allocations. Investigation into the resources of the area revealed that there was sufficient water for the irrigation of only 12 500 morgen out of 37 000 morgen of irrigable land estimated to be riparian to the river within the Great Letaba Valley. It also became apparent that a basis of one cusec of water per 40 morgen of land irrigated was the maximum acceptable for the valley area as a whole. An efficient water distribution system was therefore essential if the maximum area of land was to be irrigated from the available water resources (RSA, 1967f:3).

The proposed canal was designed to irrigate 417 morgen at a duty of one cusec per 40 morgen, as determined by permit allocations, the required full supply capacity at its inlet being 11 cusecs. The annual application, also in accordance with the permit allocation, was to be 20 cusecs of irrigation water. The total estimated cost of the project was R200 000. This represented a capital outlay of R480 per morgen scheduled for irrigation (RSA, 1967f:3).

6.4.33. The Nwanedzi River Irrigation Board Water Scheme

In the Financial Year of 1964/65, the Nwanedzi Government Waterworks were completed at a cost of R754 441 and consisted of two storage dams, one on the Nwanedzi River and the other on the Luphephe River. During the three years after the completion of the dams, extreme drought conditions prevailed and the water released from the dams had been insufficient to reach the lower farms. The lower owners complained about the inequitable distribution of the water and even under normal conditions this would not be rectified without the construction of a concrete-lined canal system. The reasons for this were that the losses in the riverbed are extremely high and the abstraction by pumping plants difficult to control (RSA, 1967g:2).

This formed the backdrop for the proposed construction of certain concrete-lined canals with the Nwanedzi River Irrigation District. The irrigation district extends from the aforementioned storage dams down the valley of the Nwanedzi River up to its confluence with the Limpopo River. The distance is about 48 km. In 1967, the water was released from the dams into the riverbed and was abstracted by a system of private earth furrows and pumping installations (RSA, 1967g:2).

The area to be served is exclusively owned by whites, except for the section on the right bank of the river, extending some 12 km below the confluence of the Nwanedzi and Luphephe Rivers, which belongs to the Bantu Trust. The irrigation district was established by Proclamation No. 77 of 1961 (RSA, 1967g:2).

In 1967, it was estimated that there was about 2 5000 morgen of potentially irrigable soil. Yet the water resources of the valley limited the extent of land that could be developed under irrigation to a total of about 1 000 morgen (RSA, 1967g:3).

The envisaged canal scheme consisted of three parts:

1. A small weir in the Nwanedzi River, immediately downstream of the confluence with it of the Luphephe River, which was to feed into a concrete-lined canal on the left bank, about 19 km long. This canal was to carry all the water needed for the entire district as far as the gorge section. This canal was to supply the farms Gaandrik, Ziska, and Trivena directly.
2. A large weir in the gorge. This weir was to act as a balancing reservoir for conserving the night flow in the upper canal, and for any freshets which may reach the river between the storage dams and the weir.
3. Concrete-lined canals on both sides of the river below the gorge, consisting of a right bank canal about 35 km long which was to carry the water to the nearest irrigated lands on the farm Bali. A left bank canal, about 19 km long, was also to be constructed to supply water to the irrigated lands on the farm Wendy (RSA, 1967g:3-4).

The estimated cost of the canal system was in the region of R1.25 million. The Board applied for a loan of R300 000. This was sufficient for the construction of one of the weirs and about 19 km of concrete-lined canals (RSA, 1967g:4).

6.4.34. The Selati River Irrigation Board Water Scheme

In 1967, the DWA proposed the construction of the Selati River (a tributary of the Olifants River) Irrigation Board Water Scheme. The objective of the scheme was to supply water for the irrigation of 1 200 morgen of land on the farms Schelem, Paris, Calais, Pretoria, and Luxemburg. These farms are all located along the Selati River, Letaba District, in the neighbourhood of Ofcolaco, Eastern Transvaal (now Mpumalanga) (RSA, 1967h:2).

In 1967, about 16 properties were to be served by the proposed scheme. This scheme was to provide for the construction of a low diversion weir in the Selati River and a distribution system of concrete-lined canals designed to serve the area (RSA, 1967h:2).

In 1952, a G.J. Kimble, of the farm Luxemburg, made an application for an investigation into a possible irrigation scheme. During 1954 and 1955, investigations into the proposed scheme were carried out for the Ofcolaco Farmers' Association, formed to investigate the matter. A report and estimate were drawn up and finally in 1964 the Selati River Irrigation District was established by Proclamation No. 338 of 1964. In 1966, more investigations were carried out to adjust the 1955 report to the requirements and conditions then obtained (RSA, 1967h:2).

Irrigation development in the upper valley of the river had generally been carried out by means of private furrows and pumping plants, which abstracted water from the Selati River and its tributaries. The crops that were to be grown were mainly sub-tropical fruit, like citrus, bananas as well as sisal (RSA, 1967h:3).

To deliver water to the area efficiently, the main canal was to be split into branch canals, from which off-takes were to distribute the water to the individual properties. The total combined

length of the canals was to be 24 km. A major and minor syphon was necessary to convey the water across the Selati River. The estimated cost of the project was R120 000. This represented a capital outlay of R100 per morgen (RSA, 1967h:3).

6.4.35. The Vygenhoek Dam

In 1968, the DWA proposed the construction of the Vygenhoek Dam in the Vygenhoek River, a tributary of the Ohristad River, which eventually flows into the Olifants River. The purpose of the proposed dam was to regulate the flow of the Vygenhoek River and, by doing so, to provide a more assured water supply to the area already under irrigation in the valley below the dam (RSA, 1968f:2).

In 1968, when sufficient water is available, an area of 448 morgen of land was irrigated by diverting water from the river into earth furrows. There was also an additional 200 morgen of irrigable land available for future development. The dam that was proposed, however, did not allow for the expansion of the area developed in 1968. The purpose of the dam was merely to bring stability of the water supply to the area developed. During the drought of the 1960s 21 out of 26 owners were forced to leave their farms and to seek temporary employment elsewhere. There was a growing anxiety in the community that this would eventually have led to a total depopulation of the area. An assured water supply would allow the farmers to establish themselves permanently, and this would have a beneficial effect on the entire district (RSA, 1968f:3).

In 1968 the Vygenhoek River was not fully exploited. The reason for this was that the run-off occurred as flood flow and could therefore not be utilised without storage. The proposed dam was to store the floodwater and thus provide a regulated supply for the irrigators (RSA, 1968f:3).

The dam was to be an earth dam with a side-channel spillway. The dam wall was to have a crest height of 92 feet and a spillway level of 80 feet above the riverbed. The dam was to have a storage capacity of 560 morgen-feet. It was to cost an estimated R1 050 000, representing a capital outlay of R2 350 per morgen on the land (RSA, 1968f:3, 4).

6.4.36. The Tzaneen Dam

In 1968, the construction of the Doornhoek Dam (later Tzaneen Dam) was proposed by the DWA. This dam was to be situated in the Great Letaba River, at a point just upstream of the town of Tzaneen and below the junction of the Great Letaba and the Ramadiepa Rivers. The dam was to be situated on the farms Doornhoek and Tzaneen. The main purpose of the dam was to make a greater portion of the flow arising from the catchment below the Ebenezer Dam available for use in the valley of the Great Letaba River downstream (1966 was a very dry year in this region) (RSA, 1968g:2; RSA, 1968h:2).

The organised development of irrigation in the Letaba Valley commenced in 1905. In this year, at the request of the Department of Agriculture, an investigation was made into the area of land that could be irrigated from the Debenegi River, a tributary of the Politsi River. This was done by a diversion weir with a canal constructed on the right bank. This scheme was

subsequently constructed in 1911 and, in 1968, formed a portion of the area of 1 380 morgen scheduled under the control of the Tzaneen Irrigation Board. The Tzaneen Irrigation District was established in 1918 (RSA, 1968g:4).

In 1911 investigations were made into a project to divert water from the Great Letaba River for irrigation of land lying on the right bank of this river, below the present Redbank gauging station, in what was known as the Pusela Block. Further surveys were made in 1916 and eventually the Pusela Irrigation District was proclaimed in 1929. The Pusela canal was eventually constructed for the Board by the DWA in 1965 (RSA, 1968g:4).

The Masalal Irrigation District was proclaimed in 1944. Water is diverted from the Great Letaba on the farm Prieska by means of a canal located on the right bank. This canal serves the farms Masalal and Waterval. A total area of 725 morgen was, by 1968, scheduled for irrigation under the Masalal Irrigation Board (RSA, 1968g:4).

After 1944, the Letaba North Irrigation District was proclaimed. This district had a scheduled area of 3 470 morgen of land. The canal system serving this irrigation scheme on the left bank of the Letaba River was constructed in 1964 (RSA, 1968g:4).

The N and N Irrigation District, by 1968, had a scheduled area of 1 500 morgen. This district is situated on the right bank of the Great Letaba. The canal scheme serving this district was constructed in 1966 (RSA, 1968g:4).

In 1926, the Water Court made an apportionment of the flow of the Great Letaba and its tributaries, on the application of the Union Fruit and Citrus Farms Ltd on condition that certain measuring weirs should be constructed in the Great Letaba River. These were never built and no records were kept. It was therefore doubtful whether the judgement is valid (RSA, 1968g:4).

A further order was made by the Water Court in 1937, whereby the Consolidated Murchinson Goldfields and Development Company Limited was authorised to abstract the normal flow of surplus water from the Great Letaba River on the farm Deeside at the rate of one-half cusec (RSA, 1968g:4-5).

Construction of the Ebenezer Dam was started in 1955 and completed in 1960. This after it became apparent that there was insufficient water in the river. This insufficiency was due to the representations made previously. This dam was to augment the normal flow of the Great Letaba River (RSA, 1968g:5).

When the Water Act No. 54 of 1956 came into operation, it was decided to proclaim the valley a Government Water Control Area. Section 62 of the Water Act was applied to ensure a proper division of the available water resources. After detailed investigations had been made, the total potentially irrigable area of the riparian farms within the valley was assessed at 38 288 morgen. This included 1 280 morgen on the tributaries. The total available water resources were found to be sufficient for the irrigation of only 12 500 morgen (6 500 from the normal flow of the river and 6 000 from the release of surplus flow stored in the Ebenezer Dam). On this basis, permits for the abstraction and use of water from the Great Letaba River and its tributaries were allocated to every individually registered property existing at the date of proclamation of the water control area (7 December 1956) (RSA, 1968g:5).

With the town of Pietersburg (now Polokwane) approaching the limits of its available water supplies from boreholes and from its Broederstroom Water Supply Project, certain investigations were undertaken. These showed that the most suitable solution would be for Pietersburg to obtain water from the Ebenezer Dam. This scheme was implemented in 1968. Provision had been made for the raising of the Ebenezer Dam by 10 feet. This would increase the capacity to 30 600 morgen-feet. This was not, however, to assist the lower riparian owners on the Great Letaba River (RSA, 1968g:5).

In 1968, other existing or projected dams within the catchment were the Merensky Dam on the Ramadipea River, built in 1937, and the Vergelegen and Magoebaskloof Dams that were under construction (RSA, 1968g:5). Thus, irrigation and other developments in the Great Letaba were already well established by 1968. These developments had already taken up much of the water resources of the Great Letaba River and its tributaries.

The critical months as regards the demand for irrigation water in the valley are from August to December. In 1968, the quantity of water required during this period was 17 000 morgen-feet. The Doornhoek Dam, with a gross capacity of 20 616 morgen-feet and a gross assured draft of 13 000 morgen-feet per annum was to make sufficient water available for the irrigable area below Tzaneen. The total cost of the dam was projected at R4.9 million. This represented a capital outlay of R470 per morgen irrigated. This dam took some time to be constructed. This meant that the immediate and urgent needs of the irrigators in the Valley for supplementary water were not met by 1968. For the purpose of immediate water requirements, a number of weirs were proposed by the DWA (RSA, 1968g:6; RSA, 1968h:2).

In 1969, the DWA proposed that the capacity of the Tzaneen Dam be increased from 20 616 morgen-feet to 60 000 morgen-feet. The dam that was proposed in 1968 was to have a net assured draft of 10 700 morgen-feet per year. This, together with the supply of 1 800 morgen-feet from the tributaries, was sufficient to supply only 37.5% of the scheduled area of 10 378 morgen-feet. By increasing the capacity of the dam, it was possible to irrigate 58.5% of the scheduled area (RSA, 1969e:3).

The increased capacity was to be obtained by changing the design of the dam and including gates on the spillway. This was to raise the dam by 15 feet. The estimated cost of the dam, after redesign, was R12.5 million. It was envisaged that the dam would be completed within five years of the date of approval by parliament. By 1971, the R12.5 million proved to be insufficient and the DWA requested a further amount of R8.5 million for the completion of the dam. This increased still further to R21 million, an increase of R10.5 million (RSA, 1969e:6, 7; RSA, 1971b:3; RSA, 1974g:3).

6.4.37. The Great Letaba River Storage Weirs

Some 29 289 morgen of irrigable land downstream of the proposed Doornhoek Dam was already in existence riparian to the Great Letaba River in 1968. Of the 29 289 morgen of irrigable land, an area of 10 002.7 morgen had been developed under irrigation. To supply water to the area, it was proposed to construct a storage weir on each of the farms Ledzee, The Junction, Janetsi and Jasi. The total storage capacity of the four weirs was to be 2 000 morgen-feet. Every one of the four weirs was to be provided with sluices large enough to

release a stream of 200 cusecs into the river below. The purpose of the sluices was to pass silt, and to release water for irrigation purposes into the reaches of river below and to supplement the water supplies in other weirs located downstream. They were also to act as balancing reservoirs for water released from the Ebenezer Dam. Floodwater was also to be intercepted by these weirs. The weirs were eventually to promote the socio-economic development of the Great Letaba Valley and were to be constructed at an estimated cost of R500 000 (RSA, 1968h:2, 3).

In 1970, three of the four proposed weirs had been partially completed and the fourth, on the farm Jasi, was to be completed in the 1972-1973 period. There was difficulty in providing the storage required – 5.2 million m³. For this reason, other sites had to be found and the structures were larger than anticipated. The Ledzee site was abandoned and another was found three km upstream on the farm Yamorna. The Junction site was employed as intended and the weir was completed without any setback. The Janetsi site was abandoned and replaced by a site 36 km downstream from the farm Prieska. To complete the works the DWA requested a sum of R600 000 (RSA, 1970g:2, 3).

6.4.38. The Blyde River Poort Dam

The Blyde River Poort Dam was proposed in 1969 by the DWA. This dam was constructed on the Blyde River (a tributary of the Olifants River) on the farm Blyde River Poort in the district Pilgrim's Rest. This dam was to serve two purposes: (1) to stabilise the water supply to the irrigators in the Blyde River Irrigation District and (2) increase the quantity available to the Phalaborwa Water Board (RSA, 1969f:2).

In 1969, an area of 9 400 morgen of land was scheduled under the Blyde River Irrigation Board. It was intended that the scheduled area would be increased by 20% once the dam was built. The scheduled area was then to be 11 280 morgen. Severe water shortages from 1961 to 1967 were experienced by the Irrigation Board. The maximum water demand by the area of 11 280 morgen proposed for scheduling was to be about 3 780 morgen-feet per month. The proposed dam was to meet this requirement. The Phalaborwa Water Board, on the other hand, drew its water from the Phalaborwa Barrage in the Olifants River. Making allowances for upstream development on the Olifants River, such as the raising of the Doornpoort and Loskop Dams, and the construction of the Blyde River Poort Dam, the Barrage was to have a net assured draft of 17 100 morgen-feet per year (120.15 million litres per day). The Phalaborwa Water Board had the right to extract 126 million litres per day from the Olifants River. This quota was to be reached by 1972. The additional water required was to be supplied from the Blyde River Poort Dam (RSA, 1969f:5, 8, 9).

The estimated cost of the works in the Blyde River Poort amounted to R7.2 million. The proposed dam was to be completed by 1975. A rate of R15 per morgen per year was to be levied from the irrigators under the Blyde River Poort Irrigation Board. The tariff imposed on the Phalaborwa Water Board was to be three cents per 4 500 litres of water. This rate was to be changed at any time by the Minister of Water Affairs (RSA, 1969f:8, 9).

In 1973, the DWA sought authority for an additional R1 million to complete the works. This was due to, *inter alia*, additional excavation from the adverse geological conditions; river sand, used for the stone aggregate, had to be brought in from another location; the concrete mix

had to be changed to fit the design change of the dam; further instruments were placed in the wall to check on the performance of the completed wall; and the floods of 1971-72 (the biggest (1 200 m³/s) in living memory) delayed construction of the dam wall (RSA, 1973c:3, 4).

6.4.39. The Hans Strijdom Dam

In 1970, the DWA proposed the construction of the Wildebeestfontein on the Mogol River (a tributary of the Limpopo River) on the farm Wildebeestfontein and Witbank in the Waterberg district. The dam (eventually called the Hans Strijdom Dam and now the Mokolo Dam) was necessary for both the establishment of mining operations (coal and iron ore) and the stabilisation of irrigation along the Mogol River (RSA, 1970h:2; RSA, 1979d:3).

According to a survey undertaken in 1970, there were about 2 480 ha under irrigation along the Mogol River downstream from the proposed dam site. It was accepted that about 70% of the land was irrigated at the time (about 1 710 ha). The main crops that were irrigated at that time were maize, sorghum, tobacco, groundnuts, citrus and cotton. Wheat was also cultivated in winter. Sprinkler irrigation was used on a large scale. The available flow of the river was used for irrigation, without any storage. Downstream from Ellisras, water was also pumped from the sand bed of the river. Thus, periodic water shortages were experienced, especially along the lower reaches of the river (RSA, 1970h:2-3).

It was also estimated that, with the available flow in the river, about 15.6 mcm of water was usually abstracted annually from the river and the sand bed downstream of the proposed dam site. This was enough to irrigate 70% of the land. In good years about 2 484 ha was irrigated, but serious water shortages occurred from time to time (RSA, 1970h:3).

The Ellisras area has also had a large potential for the development of natural resources, mainly coal. It was in 1919 that the Department of Lands started with the sinking of boreholes to supply water for the ever-increasing need of stock-farmers along the Mogol and Crocodile River. It was during sinking of one of the boreholes, in 1920, that coal deposits were discovered on the farm Grootgeluk (literally 'great fortune'). The drilling for coal samples was completed in 1952 and ISCOR bought the land rights of six farms in 1957 (RSA, 1970h:3; *Beeld*, 28 February, 2003:10).

In 1973, ISCOR started with an extensive exploration programme and in 1975 the company decided to develop the Grootgeluk coalmine. The development of the mineral resources was dependent on an assured water supply for its effective exploitation. The planning of mines in the area was, in 1970, only tentative. Yet preliminary initial water requirements by 1974 were 9 100 m³/d. By 1976 it was estimated that the requirement would be 18 200 m³/d. This was to increase to 109 000 m³/d after 10 years. The DWA stated in its 1970 report that: "Since water is in short supply in the area, methods requiring large quantities of water will not be considered and an allocation of 45 500m³ (10 million gallons) per day for future requirements is therefore considered to be reasonable" (RSA, 1970h:3; *Beeld*, 28 February, 2003:10).

In this case, the development of water resources led to the discovery of minerals, whereas on the Witwatersrand and Kimberley water resources development started after the discovery of minerals.

Very little water was used for towns or industries in the area. However, with other developments, a considerable demand could have arisen and it was possible that water was also required for stock watering purposes. It was therefore deemed necessary that water be held in reserve for this and other similar possible future requirements (RSA, 1970h:3).

This formed the rationale for the proposed Wildebeestfontein Dam. This dam made an assured supply of 47 mcm water available. The dam was to be constructed at an estimated cost of R12 million and it was estimated that the dam would be completed in five years (RSA, 1970h:5, 7, 8).

In 1979, the DWA requested funds for a further R4 million to complete the dam. The reasons for this were, *inter alia*, that the costs was based on unit prices that ruled in 1969 (the provision for inflation was therefore inadequate); the borrow area was situated further from the dam than originally envisaged, which increased transport costs; 23 600 m³ more concrete was necessary; and the coffer dam was washed away in 1976 during abnormal floods and repair cost amounted to R204 000 (RSA, 1979d:9-10).

6.4.40. The Duiwelskloof Government Regional Water Supply Scheme

The town of Duiwelskloof had for many years before 1970 relied for its essential water supplies on the resources of a small dam on a tributary of the Brandboontjies River. Because of drought conditions over the years before 1970 and increasing demand, this supply became inadequate. During the rainy season of 1969/1970, the dam received negligible inflow. The result was that, by March 1970, no water was available from this source and the entire town supply was based on the diminishing yield of two boreholes. In spite of extensive drilling operations, no further sources of groundwater could be found to relieve the situation (RSA, 1970i:3).

It became therefore essential to provide an additional water supply. After extensive investigations, first by the municipality and then by the DWA, it was found that a regional water supply scheme, which could also serve other consumers, would provide the best solution. This scheme was to consist of a pump station, pipelines and purification works. The water was to be supplied from the Vergelegen Dam to Duiwelskloof, the Meidingen Bantu Township, and Northern Cannons (Pty.) Ltd., at Politsi. This was Phase I of the Duiwelskloof Government Regional Water Supply Scheme. The estimated cost of Phase I was R1 million. The proposed scheme is also intimately associated with the Magoebaskloof Dam, Tzaneen Dam and Vergelegen Dam and canal. In 1972, the DWA requested a further R600 000, bringing the total cost of the scheme to R1.6 million (RSA, 1970i:2; RSA, 1972b:2).

6.4.41. Raising of the Doorndraai Dam

In 1971, the DWA proposed that the Doorndraai Dam on the Sterk River be raised by four metres. This dam is situated on the Sterk River on the original farm Doorndraai in the district Potgietersrus. It provided water for the Sterk River Settlement, Potgietersrus, and riparian

owners below the dam. The main purpose of the raising of the dam was to increase the assured water supply (RSA, 1971c:2, 5).

Construction of the dam started in 1950 and the dam wall was completed by the end of 1952. Storage of water commenced in January 1953. In September of the same year storage was already 95% of the total initial capacity of 27 mcm. On completion of the dam wall a start was made on the construction of a canal distribution network, which was completed early in 1955. The total cost of the dam and additional works was R1.34 million (RSA, 1971c:2).

At that stage, the first group of settlers took occupation of plots on the Sterk River settlement, for which the works were constructed. These plots averaged about 25 ha in size and each was scheduled for 17.1 ha. The annual water quota amounted to 711.2 mm and the total scheduling on the Sterk River Settlement came to 1 700 ha (RSA, 1971c:2).

After ten years, it became obvious that some of the plots were too small to allow for any supplementary farming. Certain farms also had inferior irrigation soil and in 1963 the then Department of Lands adopted a policy of consolidation which involved purchasing some of the poorer plots and adding them to adjoining plots. As a result, in 1971 the average size of irrigation plots was 60 ha. Each was still, however, scheduled for 17.1 ha of irrigation land. In 1971, the 92 farms were still receiving water from the Doorndraai Dam; 78 of these belong to plot holders and 14 to private owners, while scheduling totalled 1 710 ha (RSA, 1971c:2-3).

Due to domestic water shortages experienced by Potgietersrus, it was decided to supply the town with a daily quantity of 4 540 m³ from the Doorndraai Dam. This volume of water has been supplied to Potgietersrus since August 1969. From 1969 to 1971, irrigation along the upper reaches of the river was also increasing and the run-off at the Doorndraai Dam had therefore decreased. In 1971, it was estimated that some 3.12 mcm of water was used annually along the upper reaches for the irrigation of about 440 ha of irrigation land (RSA, 1971c:3).

It was continual water shortages on the Sterk River Settlement during the years before 1971 that had given rise to representations for the raising of the dam wall to create a more assured water supply. The dam was to be raised by using nine 9 m x 4.25 m and two 4.5 m x 4.25 m radial crest gates installed on the crest of the dam and held in position by means of ten 1.5 m concrete columns. The estimated cost of these was R1 million. The irrigation levy was not raised immediately after completion, for the irrigators have had a difficult time due to the water shortages during the eight years before 1971 (RSA, 1971c:3, 4, 6).

6.4.42. The Loskop Dam

On 20 April 1929, the Irrigation Commission recommended that the Loskop Irrigation Project, on the Groot Olifants River, be investigated. The scheme was placed on the Loan Estimates for the year 1934-35, without any recommendations of the Commission having been obtained as to whether it should be constructed or not. The estimated cost of the entire project was £1.5 million (Union of South Africa, 1935b:21).

In 1934, work on the Loskop Irrigation Scheme started. The dam site is situated about 60 km north of Middelburg on the Olifants River. Labour that was used in the construction of the Loskop Dam was again white only, as was the case with many other government projects at the time. At the Loskop Irrigation Scheme, married white men were used, and, as was the case with the Rust der Winter Scheme, they were paid 5s per day and provided with free accommodation, food, and medical attention. The number of labourers employed at the end of March 1935 was 460 men (Union of South Africa, 1936:35).

Throughout 1935 and 1936, the Director of Irrigation noted in his report that there was a shortage of labour, especially concerning the construction of the Loskop Dam. The same situation that prevailed at the construction of the Vaalbank Dam was therefore occurring at the Loskop Dam. The agreement at the construction site of the Loskop Dam was that married white men only would be employed. However, the Department of Irrigation asked the Department of Labour that single white men should also be employed (Union of South Africa, 1937b:29).

The same situation occurred with the construction of the canals. The labour shortage was so acute that serious consideration was given to the recruitment of "native" labourers to carry out the work (Union of South Africa, 1937b:29). By the end of 1937, the dam was nearly complete, except for a number of minor tasks on the superstructure. Good rains fell in December 1937 and January 1938. This resulted in the dam being filled and on 28 January 1938 it overflowed (Union of South Africa, 1939:32).

In 1971, the DWA proposed that the Loskop Dam be raised. The reason for the raising of the dam was given by the DWA as follows: "When the development in progress in the upstream catchment area has been completed, the present [1971] capacity of the Loskop Dam will no longer be sufficient to provide an assured water supply to the areas scheduled under the Loskop Government Water Scheme. Consequently, in order to assure the future supply, it is necessary that the existing dam be raised by 9 metres" (RSA, 1971d:2).

The history of the Loskop Dam can be traced back to the 1840s. It was during this decade that the Voortrekkers settled in the Kruis River Valley not far from the present Loskop Dam. The first farms in the Olifants River Valley, such as Lagersdrift and Kalkfontein, were pegged out as long ago as 1886. In 1971, these two farms were part of the Government Water Control Area. Notwithstanding the establishment of these farms, due to malaria and cattle diseases like East Coast Fever, initial development was slow until after the turn of the nineteenth century. In the early twentieth century, many farmers trekked with their cattle from the Highveld to the Olifants River Valley during the winter. Because water was plentiful and the soil fertile, the farmers began to plant wheat. Each winter they stayed a little longer until they eventually settled in the area in greater numbers. This was particularly during the years between 1917 and 1924. The natural vegetation gradually gave way to homesteads and patches of wheat lands, which were cultivated under dry land conditions (RSA, 1971d:2).

Consequently, the possibility of making use of the Olifants River for irrigation was realised early by the old Transvaal Irrigation Department. A reconnaissance survey was undertaken between 1905 and 1907. It was recommended in the report which followed that an irrigation scheme should not be implemented until the valley was more densely populated and not before there was the prospect of a railway service to the area. It was decided that, in the

meantime, irrigation from the perennial stream was to be encouraged to determine both climatic effects and soil fertility (RSA, 1971d:2).

In 1917, the first private dam was completed on the farm Rooikraal with government assistance. With irrigation the yield of wheat on this farm increased from 150 to 8 000 bags per year. At around 1925, other small irrigation schemes were completed involving both weirs and pumping water from the river. Because of their success, the Hereford Irrigation Board was established to serve an area located about 10 km downstream of Loskop Dam. The proposed Hereford Scheme included an improvement of the diversion weir at Kameeldoring and a 51 km canal extending as far as the Moses River, to irrigate 2 140 ha. After a loan of R70 000 was granted by the Land Bank, work started during 1928 under the supervision of the Department of Irrigation. The various contracts, which were awarded were completed in May 1930. The actual cost of the construction totalled R62 060 and this loan was redeemed within 20 years (RSA, 1971d:2-3).

The early success of the formation of the Hereford Scheme encouraged the Loskop farmers. They petitioned the government for the establishment of the Loskop Irrigation District. In 1929, the minister instructed the Irrigation Commission to investigate the possibility of the Loskop Scheme. After studying the position, the Commission recommended that the Hereford Scheme, which was then under construction, be studied further together with other private schemes, which were developing, before approval was given to a larger scheme at Loskop. A topographical and soil survey of the dam basin, together with an area of 90 000 morgen which could be commanded by it, was undertaken during 1933. Eventually the Irrigation Department and the Irrigation Commission brought out various reports on the success of agricultural crops under the Hereford Scheme and a special sub-committee of cabinet decided to recommend the scheme to parliament (RSA, 1971d:3).

Provision on the loan estimates was finally made for the year 1934-35. Construction of the dam on the farms Loskop and Vergelegen began during 1934 and was completed by 1938. In June 1935, a start was made on the canal system, which was eventually completed in 1948, after an interruption in the work from 1940 to 1943 during the Second World War (RSA, 1971d:3).

By 1971, the Loskop Dam a served system of canals commanding about 25 600 ha, most of which was irrigable and of which the scheduled area totalled 16 264 ha on 667 plots. The scheduled area of the majority of these is 25.7 ha. The crops grown are mainly wheat and vegetables in winter, and tobacco, groundnuts and lucerne in summer. The water quota for the irrigators was, in 1971, fixed at 760 mm per year. This was equal to a quantity of 7 600 m³ per ha per year (RSA, 1971d:3).

In 1981 the demand for water from the Loskop Dam was 144 million m³ per year. It was probable that the water supplies to Middelburg were to be augmented by increasing the storage at the Rondebosch Dam in stages to a maximum capacity of 54.5 mcm. This would assure Middelburg of a supply of 13.3 mcm per year. The raising of the Rondebosch Dam will reduce the net annual yield of Loskop Dam by about 4.6 mcm (RSA, 1971d:6).

To allow for expected future development in the Witbank-Middelburg area, it was estimated that a further 40 mcm per year could be made available for these towns by the provision of additional storage in the vicinity. This was to cause an increase in the yield of the Loskop

Dam. To meet the annual demand of 144 mcm from Loskop Dam, it was necessary to increase the capacity of the dam to about 47 mcm by a further raising of four metres. This raising was to be achieved by the installation of crest gates (RSA, 1971d:6).

By 1971, the actual construction cost of the Loskop Dam totalled R4.4 million. The estimated cost of the proposed raising was put at R6 million. In 1975, the DWA requested a further R6 million to complete the raising of the dam (RSA, 1971d:7; RSA, 1975b:3).

This increase in cost was mainly due to price increases which were not foreseen in 1971 when the raising of the dam was proposed. Poorer geological conditions were also found during excavation work below the apron and on the flanks, which also raised the costs (RSA, 1975b:6).

6.4.43. The Roodekopjes Dam

In 1974, the DWA proposed to build a storage dam (Roodekopjes Dam) on the Crocodile River on the farm Roodekopjes in the district Brits. This storage dam became necessary to stabilise irrigation on the Crocodile River between the dam and the confluence with the Pienaars River. However, the main purpose was to provide water for the growth in demand from domestic and industrial purposes further to the north and west of the proposed dam. Regarding this development, existing and proposed mining activity is of particular importance (RSA, 1974h:3).

To satisfy the urban, industrial, and irrigation requirements in 1974 the annual demand on the water sources was to be as follows: urban and industrial 22.01 mcm and irrigation 68.85 mcm per year (RSA, 1974h:6).

Were the Roodekopjes Dam to be constructed, it would have been possible to increase allocations for mining and industrial use from the Vaalkop Dam. It was also intended to operate the existing Klipvoor, Vaalkop, Bospoort, and proposed Roodekopjes Dams as a unit to gain the maximum advantage. In 1974 there was already a water shortage in the region, and supplies were unable to meet the expected population growth and mining and industrial development (RSA, 1974h:3).

For the design of the Roodekopjes Dam, an earth embankment with a gated concrete spillway was found the most economical. The dam was to have a capacity of 55.152 mcm. This capacity was to assure a draught of 12.5 mcm/yr. The estimated cost of the dam, to be completed in 1978, and allowing for cost escalation, was R5 million (RSA, 1974h:7).

In 1981, the DWAFEC requested further funds for the completion and raising of the Roodekopjes Dam. Because tender prices and other general costs were much higher than the 1974 estimates and also since the initial design was changed considerably to provide, amongst other things, for the raising of the dam wall, the total estimated cost of the scheme rose by R4 million. This brought the total of the estimated cost to R9 million. Increased water requirements because of new growth points in Bophuthatswana and serious shortages of irrigation water along the Crocodile River made the raising of the Roodekopjes Dam highly desirable. The raising of the dam wall by 3.5 m depended largely on the successful conclusion of discussions between the DWAFEC and the Bophuthatswana Government in

1981. These discussions centred on the acquiring of additional land for inundation of the raised dam. The expected completion costs of this raising amounted to an additional R9 million. This was largely attributed to road, bridge and railway deviations. The estimated cost of the raised Roodekopjes Dam was therefore R18 million at 1980 prices (RSA, 1981f:3).

6.4.44. The Thor Dam

In 1975, the DWA intended to construct a storage dam on the farm Thor, in the district of Messina. The proposed dam was to be sited on the Limpopo River, which forms the international border between Rhodesia (now Zimbabwe) and South Africa. If the dam were to be constructed, therefore, the northern portion of the dam would be situated in Rhodesia (RSA, 1975c:2).

The proposed dam was originally to have been a joint venture by the DWA and the Rhodesian Ministry of Water Development. The dam was to provide an assured water supply to the Municipality of Messina, the local mining industry, the experimental farm of the Department of Agricultural Technical Services, private irrigators alongside the dam, and possibly later for domestic and mining needs in the vicinity of the town of Beit Bridge in Rhodesia (RSA, 1975c:2).

Yet the Rhodesian Ministry of Water Development had decided, mainly for economic reasons, not to take part in the project in 1975. In the meantime undergroundwater sources and off-channel storage were being investigated as an alternative solution for Rhodesia. Interestingly enough, the DWA stated in its 1975 report on the proposed dam that: "It has been decided, however, that notwithstanding Rhodesia's withdrawal, the construction of the dam will be proceeded with" (RSA, 1975c:2).

Developments in the main stem of the Limpopo River date back to 1938. In this year the existing weir in the Limpopo River at Beit Bridge was constructed by Southern Rhodesia. This was after permission had been granted by South Africa. Since 1955 the Department of Irrigation and later the DWA had used this weir as a river gauging station. The South African customs post at Beit Bridge purchased from Southern Rhodesia water abstracted from the weir until 1958 when a pumping scheme was installed upstream of the weir on the South African bank. This was necessary because of the water shortages that had been experienced since 1955 (RSA, 1975c:2).

The Messina (Transvaal) Development Co. Ltd., known as M.T.D., meanwhile used the sand bed downstream of Beit Bridge as a source of water for the mine and for supplying domestic water to the town of Messina. Water is abstracted from the sand bed by means of nine well points stretching from a point 4.5 km downstream of Beit Bridge over a distance of 12.5 km further downstream (RSA, 1975c:2).

As long ago as 1958, the increasing demand for water in the vicinity in both Rhodesia and South Africa was the subject of discussions at technical level between officers of the DWA and the Ministry of Water Development of Rhodesia. The raising of the existing weir and the construction of a storage dam elsewhere on the Limpopo River was discussed. After the water shortages that were experienced in Messina and the town of Beit Bridge during 1962, further discussions led to the joint investigation of six possible dam sites on the Limpopo

River by engineers of both countries during 1964. Topographic surveys of these dam sites were undertaken as a joint task (RSA, 1975c:2-3).

It was decided in 1969, after further discussions that only two dam sites, one on the farm Thor, 6.4 km upstream of Beit Bridge, and the other on the farm Antonvilla, 16.2 km downstream from Beit Bridge, justified further investigation. After further detailed investigation and foundation drilling at the Thor site by Rhodesia and at the Antonvilla site by South Africa, the Thor site was found to be more suitable for providing storage (RSA, 1975c:3).

In the meantime, the water situation at the town of Beit Bridge had become so critical that the Ministry of Water Development of Rhodesia embarked on an interim scheme to relieve the position. This scheme consisted of a storage dam, which was next to the Limpopo River and could be pumped full from the river. It was estimated that sufficient water could be supplied to Beit Bridge to meet its needs until 1986. The latest estimate, before 1975, however, showed that the demand could be satisfied only to 1979-80. Rhodesia decided not to go ahead at that stage with participation in the construction of a storage dam on the Limpopo River (RSA, 1975c:3).

The DWA consequently suspended further investigation as the demand from South Africa alone did not justify the construction of a storage dam. Accelerated development in the area, especially at Beit Bridge, the extension of the South African Railways (SAR) railway line network to connect with that of the Rhodesian Railways from Beit Bridge, and the need for the creation of infrastructure for black homelands development had made additional water supply essential (RSA, 1975c:3).

Discussions were therefore resumed during 1974. These gave rise to a conditional agreement at a technical level between the DWA and the Rhodesian Ministry of Water Development for the joint construction of the proposed Thor Dam. At that time, the cost of the proposed dam was estimated by the DWA at R11 million and by Rhodesia at about R12 million. A further detailed design and estimate of cost undertaken jointly by the two countries showed that, owing to the high rate of inflation, this estimate might be too low. Mainly because of this possibly higher cost estimate the Ministry of Water Development of Rhodesia decided not to have any share in the proposed dam in 1975, but to investigate other alternative sources for Beit Bridge first (RSA, 1975c:3).

The water demand from the proposed dam in South Africa and Rhodesia was 6 800 m³/d and 4 000 m³/d respectively. However, because Rhodesia withdrew from the proposed project, only South Africa's needs had to be taken into account. The DWA expressed the view that Rhodesia might purchase water from the dam in the future (RSA, 1975c:6).

The proposed dam was to have a storage capacity of 17.3 mcm. It was hoped that by the judicious use of the floodgates silting would not exceed the sill level of the sluice gates on the concrete crest. This would represent a reduction in capacity of 0.6 mcm. The assured draft of the proposed dam was estimated at 20.3 mcm/yr. Provision was also made in the design of the dam to raise it by 3 m at a later stage to a gross capacity of 35.1 mcm. The assured draft of the raised dam was estimated at 45.1 mcm. This raising was to be effected if unforeseen expansion, further mining development, or demand in black homelands along the Limpopo River justified it (RSA, 1975c:4).

The proposed dam was to be a barrage type concrete structure provided with 22 floodgates, 18.3 m wide and 6.1 m high, for the discharge of floods and prevention of silting of the dam basin. Two smaller automatic gates would have been provided on either side of the barrage for the discharge of minor floods. These two gates would be 6 m wide and about 10.3 m high. Two outlet pipes provided with valves, one metre in diameter, were to be provided on both flanks of the barrage. These outlets were to supply water to Rhodesia and South Africa. They could also be used to release water into the river if necessary. With the withdrawal of Rhodesia from the joint undertaking, it was decided to revise the design of the proposed dam. An attempt was made to simplify the structure to keep the cost as low as possible (RSA, 1975c:7).

As regards the design of the dam, the DWA stated in its 1975 report that: "It may be possible to build the proposed dam somewhat lower than is proposed herein [the report]. Rhodesia and South Africa have a preferential right to the flow in the river which is at present being used and which meets their present needs downstream of the proposed barrage. In the nature of things, the dam will be so operated that when the river is flowing, the downstream requirements of both Rhodesia and the Republic will be satisfied before storage starts. Such water as is let through will consequently not be available for storing in the proposed dam. Negotiations are at present under way to reach an agreement on this aspect and other related matters. An analysis of the expected supply cannot be proceeded with before these discussions have been finalised" (RSA, 1975c:7).

It was envisaged that the proposed dam would be completed by 1979-80. Land was also needed for the construction of the dam. In South Africa, the acquiring of land for the proposed dam was estimated at R20 000, while in Rhodesia it was estimated at R30 000. In 1975, negotiations regarding this were already underway (RSA, 1975c:8).

Because Rhodesia withdrew from the scheme there was to be a surplus of water available. This surplus was to be utilised for the development of black homelands and for the expansion of the infrastructure in the area. It was not the intention of the government that consumers should pay the full cost of the scheme. The cost of the water, however, was so high that it was not to be used for irrigation purposes. Irrigation development along the Limpopo River was therefore not to be included in the scheme. Irrigation was only to be allowed with the approval of the Minister of Water Affairs. When the water was ultimately released from storage it would be fully controlled and would not be abstracted for irrigation purposes without the Minister's approval (RSA, 1975c:10). The dam was never constructed, due to Zimbabwe's independence and consequent worsening relations between the two countries.

6.4.45. Concrete Lining of Hartbeespoort's Old Furrows

In 1977, the DWA proposed the lining of the so-called seven old furrows (also known as the Eckard Old Furrows) in the Hartbeespoort Government Water Control Area. These furrows are situated downstream of the Hartbeespoort Dam, and had been providing water to 2 000 ha of land for more than 100 years over a distance of 42 km on both the left and right bank of the Crocodile river. All of these seven furrows were built by private initiative and had since been operated and maintained by the private owners concerned (RSA, 1977e:3).

The condition of the old furrows had gradually deteriorated to such an extent that representations were made to the DWA for assistance in the betterment thereof. A series of meetings were held with various groups and at a joint general meeting in 1973 the interested parties decided by an overwhelming majority to request the DWA to take the furrows over as a government waterwork (RSA, 1977e:3).

This request was granted and it was intended in 1977 to line the furrows with concrete and to provide the necessary weirs and housing. Approval was thereby sought by the DWA for the proposed betterments at a provisional estimated cost of R3 million. Since the estimate was prepared, there were, however, indications that the cost was more likely to be R4 million (RSA, 1977e:3).

6.4.46. The Soutpansberg Government Water Supply Scheme

In 1978, the DWA proposed the construction of a storage dam (Stockford Dam) in the Sand River, a tributary of the Limpopo in the Messina District. The necessary pump station and a pipeline to convey the water to the canal of the Njelele Government Water Scheme was also proposed (RSA, 1978e:3, 11).

The ultimate purpose of the scheme was to make water available from the Njelele Dam to the proposed coking coalmines in the Soutpansberg area. The water abstracted from the dam for the mines was to be replaced from other sources so that irrigators on the Njelele Government Water Scheme would not receive less water than when the dam supplied water to them only. At the same time, water was to be made available from the proposed Stockford Dam for the town of Messina (RSA, 1978e:3).

The discovery of high-grade coking coal reserves was made during 1977 by ISCOR. The importance of exploiting these coking coal reserves was stressed by ISCOR, and the provision of water to make it possible to start mining operations was essential (RSA, 1978e:3).

Three mines, called the C, D, and E mines by ISCOR, were envisaged. The C and D mines lie west and northeast, respectively, of the existing Njelele Dam. Mine E is near the confluence of the Pafuri and Mutale Rivers in Venda (RSA, 1978e:3).

Development of mine C was to commence in June 1980 and the water requirements for the mine were estimated at 2.146 mcm/yr. Mine D was to be started in June 1981, and was to need between 0.7 and 1.124 mcm/yr. Mine E was to commence with operations a year after mine D in June 1982, and needed between 0.543 and 1.06 mcm/yr. The E mine was to be supplied with water from either the Pafuri or Mutale River (RSA, 1978e:3-4).

In addition, to provide water for the growing domestic demand in Venda, in the catchment of the Njelele Dam, the Department of Plural Relations and Development (formerly the Department of Bantu Administration and Development) proposed the construction of a storage dam on the farms Mondale and Tondondwe in the upper reaches of the Njelele River (RSA, 1978e:4).

This proposed storage dam was to have a capacity of 2.2 million m³ and water from this dam was to be purified and distributed throughout the area by means of a pipeline distribution

system with terminal reservoirs. This distribution system was able to supply an average of 1.2 mcm/yr to consumers. Some 0.08 million m³ of this water was to be for stock watering purposes, 0.32 million m³ for the Siloam Hospital and 0.80 million m³ for domestic use (RSA, 1978e:4).

This first phase of development was expected to supply domestic and stock-watering needs until 1985. Thereafter the water resources of the Mutale River were to be developed and water pumped over the watershed into the Njelele catchment area to meet the increasing demand. The water requirements towards the end of the century were estimated at 2 mcm/yr (RSA, 1978e:4).

There is also a link between this proposed regional water scheme and the 1975 proposed Thor Dam on the Limpopo River. With the withdrawal of Rhodesia from the joint venture, the unit cost of water for South African consumers became very high. The financial position of the Republic also meant that the construction of the proposed dam was delayed. With the development of the proposed new coking coalmines, attention was given to the possibility of a regional water source to provide water for the Municipality of Messina as well. The proposed Soutpansberg Government Water Supply Scheme therefore made provision for the water requirements of Messina. This was to make it possible to delay the construction of the Thor Dam indefinitely (RSA, 1978e:8).

In 1978, the estimated cost of the proposed works was R17.5 million. Allowing for cost escalation owing to the 1978 inflationary trend, and if the scheme was to be completed only by 1981-82, the final cost of the proposed works was estimated at R21.4 million. Originally, the scheme was estimated at R25 million. This was because at that stage detailed information was not available. The scheme was to be implemented rapidly (it was an urgent scheme), which made it possible for water to be available soon after completion. Inflation was therefore not to have such a huge impact. It was envisaged that the scheme would be completed during the 1981-82 financial year (RSA, 1978e:16).

6.4.47. The South Ndebele Water Distribution Scheme

During 1978, the DWA proposed the South Ndebele Government Regional Water Distribution Scheme. The purpose of the scheme was to supply purified water at suitable points to the inhabitants of South Ndebele. Provision was made for the extension of the scheme in future to supply water to part of Bophuthatswana and a coalmine that may be developed north of the area (RSA, 1979e:3).

The first phase of the project cost R7 million. This phase entailed the construction of a balancing dam near the tail end of the left bank canal of the Loskop Government Water Scheme. A pipeline was laid from this balancing dam to a weir in the Elands River on the farm Weltevreden, and the construction of a purification works on this farm on the right bank of the Elands River. From here the necessary pump stations and pipelines were to supply purified water to three consecutive service reservoirs, also located on the right bank of the Elands River. These pipelines consisted of the main pipelines for the bulk distribution of water only. From the service reservoirs, the water was to be distributed to the inhabitants by the Department of Plural Relations and Development, which was responsible for the construction of the distribution network (RSA, 1979e:3).

For phase two, the construction of a storage dam (Renosterkop Dam) on the Elands River on the farm Rhenosterkop was envisaged. The dam was to supply supplementary water to the purification works. The estimated cost of phase two was also R7 million (RSA, 1979e:3).

Further phases of the regional water distribution scheme were to entail an increase in the capacity of the first phase of the scheme. It also envisaged the construction of the distribution system on the left bank of the Elands River to supply water to the inhabitants of South Ndebele in that area and to the proposed coal mine near the Tuinplaas railway station. It was also envisaged that Bophuthatswana would be supplied with water from this extended scheme (RSA, 1979e:3).

The scheme was necessary because population increases in South Ndebele were in the region of 3% per year in 1979. There was therefore an increase of about 1% per year in the *per capita* consumption of water (RSA, 1979e:5).

During 1975, the Minister of Water Affairs allocated to the then Department of Bantu Administration and Development about 2.56 mcm of water per year from the Loskop canal. Only a small portion of this allocation was being used to supply water to Valschfontein in 1979. The cheapest method of relieving the water shortage in this area rapidly was to utilise this allocation as soon as possible. For this reason, the South Ndebele Water Distribution Scheme was proposed in 1978. The DWA furthermore stated in 1979 that: "Should water-borne sewerage be installed in the towns, this allocation of 2.56 million m³ per annum will be sufficient to meet the requirements of Valschfontein and Vlaklaagte only until 1980. Without water-borne sewerage, there will be adequate water to supply Valschfontein, Vlaklaagte, and Dennilton until 1985, as well as a quantity of 1.18 million m³ per annum for rural consumers. It is therefore clear that this source will be able to meet requirements on a short-term basis only and that the development of a considerably larger source will be necessary to meet the growing demand" (RSA, 1979e:7).

The Rust der Winter Dam, completed in 1934, was in 1979 the only large dam on the Elands River. The dam supplied water to downstream irrigators. Consequently, no surplus of water was available from this dam. It was therefore necessary to investigate the possibility of the construction of a second storage dam further downstream from the Loskop Dam to supply more water to the regions. The Rhenosterkop Dam was therefore proposed for this purpose at an estimated cost of R7 million (RSA, 1979e:7, 15).

In 1980, the DWA reported that the first phase of the South Ndebele Government Regional Water Supply Scheme was to increase from R7 million to R32.5 million. It also reported that the cost of the construction of the proposed Rhenosterkop Dam increased from R7 million to R10.5 million. The total estimated cost of the scheme therefore increased from R14 million to R43 million. The increase in the original estimated cost was ascribed to the enlargement of the distribution system and purification works and to increased unit costs owing to the 1980 inflationary trend. On the estimates R40 million appeared, but the indications were that the cost was as high as R43 million, mainly because of inflation (RSA, 1980d:3).

6.4.48. Betterments to the Rust der Winter Canals

During the early 1930s, many irrigation projects in the Limpopo River basin, like those in the Orange River basin, were implemented not only to develop irrigation but also to alleviate unemployment. Another such project was the Rust der Winter Irrigation Scheme, situated on the Elands River in the district of Pretoria. This scheme was placed on the estimates for irrigation projects for the year 1930-31 (Union of South Africa, 1935b:19). The storage dam was completed in January 1934. It was filled to capacity even before its completion, due to good rains. In his report, the Director of Irrigation, A.D. Lewis, stated that "white labour only is employed" on the project. The labourers even received food, free of charge (Union of South Africa, 1935a:25).

The history of the Rust der Winter irrigation settlement dates back to 1906. In this year, an engineer of the Transvaal Department of Irrigation, in the course of an exploratory journey in the Olifants River catchment area, discovered a gorge in the Elands River. This gorge was suitable for the construction of a storage dam to supply water to an irrigation scheme. An earth-fill dam and about 16 km of canals at an estimated cost of about £68 000 (R136 000) were proposed (RSA, 1979f:4).

These initial proposals were not followed up until a further investigation was requested by the local landowners in 1929. A gauging station was established in the Elands River near the upstream boundary of the farm Rust der Winter. The Rust der Winter Irrigation District was established by notice number 302 in the *Government Gazette* of 13 December 1929 (RSA, 1979f:4).

After a topographic survey had been done in 1930, a rock-fill dam wall and a distribution network of earth canals were planned on the farm Rust der Winter. Provision was made in the 1930-31 estimates for an amount of £140 000 (R280 000) for the construction of the project. The Department of Irrigation started the construction of the scheme in June 1932 and the Rust der Winter Dam was completed in 1934 and the canals in 1935 (RSA, 1979f:4).

The scheme was originally built as an irrigation board scheme, but was later taken over by the state and a settlement was established there. In 1957 the irrigation area of this scheme and the properties bordering on the dam basin were declared a Government Water Control Area by Proclamation 201 of 15 July 1957. The rest of the catchment area was declared a Government Water Control Area by Proclamation 93 of 23 March 1967 (RSA, 1979f:4).

The original distribution system served a scheduled area of about 1 550 ha and consisted of about 65 km of earth canals. Seepage losses from the earth canals were partly responsible for the fact that a large part of the irrigated area experienced waterlogging problems. Portions of the canals were lined with concrete but, by 1947, distribution losses were still as high as 46%. In 1949, the further lining of the canals with concrete reduced distribution losses to 40%. During the period from 1950 to 1960, the rest of the canals system was lined with concrete (RSA, 1979f:4).

Because of a shortage of materials and equipment after 1939 (start of the Second World War), the concrete used to line the canals contained no coarse aggregate or wire netting reinforcement. These canals weathered excessively and, by 1967, losses were again as high as 40%. In 1969 a programme for the improvement of the canals was started (RSA, 1979f:4).

The right bank main canal, with a capacity of one cubic metre per second, was reconstructed as a rectangular canal above ground level over a distance of about 8.5 km. A new concrete-lined balancing dam with a capacity of 28 717 m³ was built. The left bank main canal, with a carrying capacity of 1.39 m³/s, was relined at a higher level over a distance of about 15 km, and an earth-fill balancing dam with a capacity of 63 530 m³ was built. In 1965 a concrete-lined balancing dam with a capacity of 6 500 m³ and the Vaalbank pipeline were built at the end of the left bank main canal for stock-watering purposes (RSA, 1979f:4).

Betterments and the construction of improved drainage to the existing Rust der Winter Government Water Scheme canals were proposed by the DWA in 1979. The scheme consists of the Rust der Winter Dam, which supplies water for irrigation purposes to riparian farmers, and an irrigation settlement downstream of the dam. An irrigation area of 1 859.6 ha was in 1979 served by an extensive canal system on both banks of the Elands River. Water for stock-watering purposes was also supplied downstream of the irrigation settlement through a pipe distribution system (RSA, 1979f:3).

Due to the deterioration of the main and branch canals after they were built, a programme for the improvement of the canals was started in 1969. By the end of 1979 about two-thirds of the proposed improvements to the main canal and about one-third of the proposed improvements to the branch canals were to be completed. It was estimated that the expenditure on these proposed works would have amounted to R980 703 by March 1979 (RSA, 1979f:3).

It became clear to the DWA that the cost of completing the proposed improvement programme was to exceed R1 million. The total estimated cost of the improvements was R2 million and these improvements were to limit distribution losses and reduce maintenance costs (RSA, 1979f:3).

In some parts of the irrigation settlement the natural drainage was also inadequate, because of the very gradual slope of the land. The existing drainage system, as it stood in 1979, which consists mainly of earth drainage canals, was subject to siltation and lands were often inundated during periods of high rainfall (RSA, 1979f:3).

Improvements to the drainage system were therefore needed to reduce maintenance costs and to limit flood damage and the formation of brackish ground, thereby increasing the productivity of the scheme (RSA, 1979f:3).

The estimated cost of diverting some of the drainage canals and lining them with concrete, including the cost of improvement work done over the years, before 1979, was estimated at R1.3 million. Of this amount, it was estimated that R281 350 would already be spent by the end of March 1979 (RSA, 1979f:4).

In 1976, a start was made with improvements to the distribution canals on the right bank, and in 1979 about 7 km of the 20 km of canals had already been reconstructed at a higher level. On the left bank one small distribution canal was rebuilt (RSA, 1979f:4).

Because of these improvements, the distribution losses have already been reduced to 22%, about 7% occurring in the main canals and 15% in the branch canals. The improvements

proposed in 1979 were to prevent the distribution losses from increasing in the future because of the deterioration of the canals lined with concrete without coarse aggregate and reinforcement (RSA, 1979f:5).

During the period from 1950 to 1960, a number of smaller earth drainage canals were built to carry run-off and drainage water. These have been maintained, but no large-scale improvement or extension of the drainage system has since been undertaken. The DWA was to do this in 1979 (RSA, 1979f:5).

6.4.49. Extension of the Loskop Distribution System

In 1980 the DWA proposed the construction of a new distribution system for the supply of irrigation water to a portion of the Loskop Government Water Scheme, scheduled as the Loskop social welfare settlement. The construction of this distribution system was to cost R2.25 million (RSA, 1980e:3).

The proposed consolidation of the uneconomical units of the settlement on the right bank into economical plots in 1980 meant that the water distribution system for the area concerned had to be replanned. The proposed works entailed the construction of about 7.6 km of pressure distribution pipelines that vary in diameter from 200 mm to 400 mm, three balancing dams with a combined storage capacity of about 91 000 m³ and a 1 000 mm diameter pipeline of about 450 m. This latter pipeline was to supply water to one balancing dam from the Loskop right bank main canal (RSA, 1980e:3).

The Loskop social welfare settlement is situated between six and 18 kilometres northeast of Groblersdal. This settlement was established after the Second World War for the temporary occupation of plots by physically handicapped war veterans. The greater portion of the settlement is situated below the right bank main canal of the Loskop Government Water Scheme. Here 613 ha are scheduled. On the left bank, a further area of 166 ha is scheduled under the Hereford canal (RSA, 1980e:3-4).

The settlement consisted of 147 plots of about 5 ha each. In accordance with the purpose of the welfare settlement, the government erected a house, outbuildings, and a tobacco kiln on each plot to meet the basic requirements of the occupiers. The distribution system consisted of a network of small concrete-lined canals, most of which were in a poor condition in 1980. By 1980, virtually all the original occupiers had retired or passed away. Consequently, the Interdepartmental Committee for Irrigation of the DWA, Agricultural Technical Services, Agricultural Credit, and Land Tenure and of Agricultural Economics and Marketing was instructed to investigate the consolidation of the existing plots into economical units (RSA, 1980e:4).

After economic and agricultural analyses, it was recommended that plots with 30 ha of scheduled irrigation land be accepted for consolidation purposes. The few inhabitants who still lived on the plots were to be moved to the left bank portion of the social welfare settlement, which was to continue to exist as such for the time being (RSA, 1980e:4).

The annual water quota of 7 700 m³ per ha for the Loskop Scheme had been retained. The 613 ha scheduling for the right bank social welfare settlement was to be consolidated into 15 plots (RSA, 1980e:4).

The Department of Agricultural Technical Services conducted an intensive soil survey in the area, after which an area of only 505 ha was recommended for intensive irrigation. This was mainly due to problems relating to the water logging of soils. Each plot was to be scheduled for 30 ha so that most of the plots had additional irrigable land. The scheduled area of the settlement on the right bank was therefore to be reduced from 613 ha to 450 ha. Each plot was to be served with water by a pipeline from each of the balancing dams (RSA, 1980e:4, 5).

6.4.50. The Molatedi Dam

In 1984, construction started on the Molatedi Dam. This dam has a capacity of 204 mcm (about 13% more capacity than Hartebeespoort Dam). The Molatedi Dam was constructed at a total cost of R16 million over a 30-month period, and supplied water to Botswana, Bophuthatswana, and South Africa, before the incorporation of the homelands in 1994. Today the dam still supplies water to both South Africa and Botswana. At the time of its completion, the Molatedi Dam was the only possible major scheme to be developed in the western part of Bophuthatswana (The Civil Engineering Contractor, June 1987:42).

The dam is situated in a narrow gorge at Eerstevoort in the Dwarsberge, downstream of the confluence with the Groot Marico River of the tributaries, Kgolane and Brakfonteinsspruit. Yet from a water management perspective, the dam has a shallow basin. This results in severe evaporation losses and the dam was therefore not built higher than its 27m. The dam was constructed using conventional construction techniques. A concrete gravity type embankment was found to be the most suitable for the site with its complex geology (The Civil Engineering Contractor, June 1987:42).

On 21 September 1988, the DWA, the Department of Water Affairs of Bophuthatswana, and the Water Utility Corporation of Botswana concluded a tripartite agreement. In terms of this commercial agreement, water from the Molatedi Dam was supplied to Gaborone and South African farmers along the Lower Marico River. Construction of the joint project, known as the Tswasa Scheme, had already started in 1989 (DWA, 1989:8).

Ironically, Bophuthatswana was one of those entities that was not recognised by the rest of the international community as a sovereign, independent state. Thus, entering into an agreement with Bophuthatswana and South Africa to receive water from the Molatedi Dam, Botswana had to recognise, in principal only, the sovereignty of Bophuthatswana. The reason for this was that the Molatedi Dam was constructed on the territory of Bophuthatswana. Botswana therefore also recognised, again in principal, the territorial integrity of the homeland. Close scrutiny of the agreement reveals that a government representative of Botswana did not sign the agreement. Instead, a representative of the Water Utilities Corporation in Botswana signed the agreement "... in terms of an authorisation conferred by the Board of the Corporation" (Agreement, 1988). However, and it is speculation at this stage, the Botswana government could have given its "blessing" to the agreement. Still, this government did not enter into an agreement with what it perceived as an illegitimate state (Bophuthatswana).

In 1990, construction of the first phase of the joint project, the Tswasa Scheme, was completed. The supply of water as set out in the agreement had already taken place by the same year (DWA, 1990:81).

Cooperation between South Africa and Botswana was further strengthened in 1990 when a joint study regarding the evaluation of the utilisation and supply of the water resources of the Upper Limpopo was launched. The objective was to study the potential and need for further developments of the water resources and the sustainability of a joint project (DWA, 1991:5).

6.4.51. Future Developments on the Olifants River

On 19 February 2003 the Minister of Water Affairs and Forestry, Ronnie Kasrils, announced further development plans in the Olifants River basin. These development plans will be implemented to support economic development in the Limpopo and Mpumalanga Provinces (MWAf, 19 February 2003).

The source of this economic development is the existing and new platinum mines in these provinces. A new platinum mine near Burgersfort and a new platinum smelter at Polokwane (formerly Pietersburg) are already being implemented. Other plans also include possible extension of the Potgietersrus Platinum Mine and a new mine at Mokopane. Moreover, the Steelpoort Valley and the area around Lebowaikgomo may be the next areas for the development of mines (MWAf, 19 February 2003).

These platinum projects will result in a sharp increase in water demand with a number of innovative projects have already been implemented to meet the need. Wastewater from Polokwane and Mokopane is being recycled to be used in the platinum refineries. A 56-km pipeline was recently completed at a cost of over R300 million. This pipeline was constructed by a public-private partnership under the "umbrella" of the Lebalelo Water Users Association to supply water from the Olifants River to the new platinum mines. To supply the increasing demands the Olifants River would need to be further developed. This will be done in a phased manner. During the first phase, the Flag Boshielo Dam (formerly the Mokgomo Matlana Dam), in the Marble Hall District, in Mpumalanga, will be raised by 5 m at an estimated cost of R180 million (MWAf, 19 February 2003; *Engineering News*, 28 February 2003).

The raising of the Flag Boshielo Dam will increase its storage capacity from 100 mcm to 188 mcm. This will allow for the use of 72 mcm to be used each year. Presently 56 mcm are used. Construction will commence by the end of 2003 and "must be completed by October 2005" (MWAf, 2003; *Engineering News*, 28 February 2003).

During the second phase of the development of the water resources of the Olifants River, a large dam will be constructed on the river, either at Rooipoort, near Mafefe and Mathabatha about 150 km downstream of Flag Boshielo, or on the Steelpoort River, a tributary of the Olifants. According to the Ministry of Water Affairs (2003): "The best option will be chosen when uncertainties about the future growth in water requirements and the locations of the new demand centres have been clarified with a decision expected by next year [2004]". Construction on this new dam will begin in 2006 and it will be completed by the end of 2010, at an estimated cost of between R700 and R900 million. The dam yield will be between 50

and 70 mcm, depending on its final design (MWAF, 2003; *Engineering News*, 28 February 2003).

In the meantime, the additional water from the raised Flag Boshielo Dam will be made available to the new mining undertakings near Burgersfort. "This will enable water entitlements, currently leased on a temporary basis by mining ventures, to be returned to small farmers on the irrigation schemes downstream of the Flag Boshielo Dam, which are being rehabilitated" (MWAF, 2003).

The rationale behind this further development is that the Olifants River is the "only remaining major source of surface water still available in the region". The DWAF is working closely together with the Limpopo Provincial Government on the initiative. This is to ensure that the water needs of the mines are met as they arise, because most of the mining development will take place in that province (MWAF, 2003; *Engineering News*, 28 February 2003).

6.5. The World Commission on Dams' Hearings

6.5.1. The Loskop Dam

Evidence was heard from Jerry Mariba, on behalf of the Moutse community which was affected by the construction of the Loskop Dam. In his opening address to the hearings, Mariba stated that: "We are here to lobby and advocate for an enabling legislative environment that will ensure that whenever any project or programme is embarked upon, our respective governments hear our inputs. A process of consultation needs to be adhered to" (Stott, Sack and Greeff, 2000).

He also told the hearings of the experience of the Moutse community when the Loskop Dam was constructed. He said that: "Our people [from the Moutse community] became cheap migrant labour for whites who occupied the farms next to the Loskop Dam. The previous government under the then so-called New National Party expelled most of our people on the farms close to the dam and we were obliged to utilise other land without compensation for our loss and pride. As a result, the dispossession forced our black successful farmers to seek employment as farm labourers, rather than continue to be owners of that particular land" (Stott, Sack and Greeff, 2000).

Because of the negative impact of the Loskop Dam on the Moutse community, this community is not very sympathetic to dam construction projects that do not benefit the members of affected communities. Thus, communities, whenever a large dam project is planned, must first be consulted – for, in this case, a project turned people from these communities into unskilled labourers. Mariba therefore recommended that: "Active participation in the planning, development and operation of dam facilities as well as in the management and distribution of the revenues and other benefits derived from the dam is of crucial importance". The Moutse community was also forcefully removed from the area. The Moutse community, in response to the negative impact the dam has had on them and to engage the state to come up with a development project in the area, established the Mmatoti Forum. This was to ensure that communities are able to benefit from any project the

government comes up with. What the Moutse community also wanted was that the name of the dam be changed to Mmatoti (Stott, Sack and Greeff, 2000).

This is not to say that dams are always rejected by the communities. In this regard, Mariba said that: "One might say we need dam projects. Nevertheless, the question is to what extent are we involved, and how much benefit do we get? We are being displaced from our land with a claim that development is coming. But we, as the people who suffer, don't benefit" (Stott, Sack and Greeff, 2000).

6.6. Conclusion

This chapter has shown the importance of the Limpopo River as a source of water within the South African political economy. The hydropolitical history trajectory of the Limpopo River started after a railway line was completed. Before this, ivory hunting in the basin dominated the economy.

The implementation of water resources development projects took off after the construction of the Hartbeespoort Dam in the late 1890s. This coincided with the closing of the frontier in 1900. Land was not as plentiful as in earlier times and farmers had to farm more intensively. The economic conditions prevailing under Afrikaners later became a stimulus for the implementation of more such projects in the basin. The depression and the drought of the 1930s were further stimuli for the construction of these projects on the river. During the course of the twentieth century, the discovery of minerals and the expansion of urban centres were further causes of water resources developments in the river basin. Tributaries of the Limpopo River, like the Olifants, will in future be likely sources of water for the mining industry. The exploitation of platinum reserves is the main stimulus for these future plans to develop the river basin further. These projects were not without controversy. This is illustrated by the World Commission on Dams Hearings held in 1999.

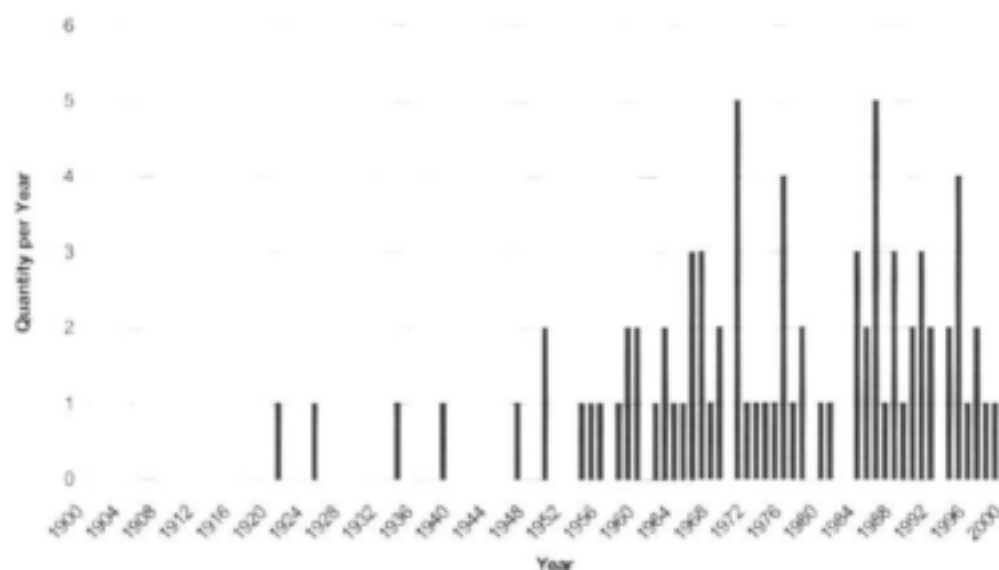
7. THE INCOMATI RIVER BASIN

7.1. Introduction²⁰

The Incomati and Maputo River Basins are managed as one entity, because the riparian states in both "international river basins" are the same. This fact is reflected in the signing of the so-called "Incomaputo Agreement" during the World Summit on Sustainable Development (WSSD), which served to formalise this natural arrangement (Turton, 2003a). This chapter deals with the description of the hydropolitical history of the Incomati River only. Chapter 8, on the other hand, deals with the hydropolitical history of the Maputo River.

The Incomati, like the Orange, is a highly developed river system (see Figure 8), although it is one of the smallest "international river basins" in South Africa. The river is important in that it supplies water to other adjacent river basins, the Orange in particular. The Incomati River is also a recipient basin for no IBTs; a source basin for one IBT; with no intra-basin transfers. After the Limpopo River, the Incomati is the second most important resource for Mozambique. The Incomati Basin in Mozambique lies in an area that is classified as being semi-arid, and the streamflow arising from "endogenous water" is equivalent to about 5% of the MAR (Vas & Pereira, 1998:114; Vas, 1999:62, 64). This means that Mozambique is highly dependent on "exogenous water" that crosses the border from South Africa (Vas, 1999:64). The Incomati Basin is also of great importance to Swaziland (Turton, 2003a).

Figure 8
Number of Large Dams Built in the Incomati River Basin between 1900 and 2002



²⁰ Part of the introduction to this chapter was taken, verbatim, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

This chapter describes the hydropolitical history of the Incomati River basin with the development of the water resources of the river dates back to the early part of the twentieth century. As with all the other international river basins, irrigation played a dominant role in the commencement of the development of the river's water resources. In the first part of the chapter the physical description of the river basin is outlined. This is followed by an account of the early developments that took place to exploit its water resources. This is followed, in the third part, by the history of a number of water resources development projects. A conclusion is drawn at the end of the chapter.

7.2. Physical Description of the Incomati River Basin²¹

The Incomati River has a total basin area of 50 000 km² with an MAR of 3 600 mcm. There are three riparians sharing the river, with 62% of the basin area lying in South Africa (upstream riparian), 5% lying in Swaziland, and 33% in Mozambique (downstream riparian). Contribution to MAR by each riparian has been disputed, with 64%-81% coming from South Africa, 13%-20% coming from Swaziland, and 6%-16% coming from Mozambique, depending on whose data is being used (Savenije & van der Zaag, 1998:30; Turton, 2003).

This is partly because Mozambique did not get fully involved in the Joint Incomati Basin Study (JIBS) due to institutional problems and political tensions at the time (Vas & Pereira, 1998:119; Vas, 1999:64). Annex I of the Incomaputo Agreement has stipulated the various hydrological parameters in detail, so the disputed nature of the data is likely to decline in hydropolitical relevance. It is simply too early to predict with any degree of certainty, however, given the history of basin-wide "regime" dysfunction in this "international river basin" (Turton, 2003a).

The Incomati Basin is of great strategic importance to South Africa, because it supports a large amount of economic activity in that country. One of the key elements of this basin is the fact that an IBT is used to sustain the generation of electricity in the adjacent Olifants catchment (a tributary of the Limpopo River) (Ohlsson 1995:51) on which a significant portion of the South African economy is dependent. There are consequently a number of dams in this basin, with 10 in excess of 12 mcm (Heyns, 1995:6). The combined storage capacity of 22 dams in the basin is 400 mcm, with two new dams under development, or having just been completed (Conley, 1995:22; Turton, 2003a).

The Sterkspruit Dam in South Africa has a storage capacity of 167 x 106m³ (Heyns, 1995:6). The streamflow in this basin is highly variable, ranging in recorded time from 4 926 mcm during the 1954/55 hydrological years, to 28 mcm during the 1982/83 hydrological year (Conley, 1995:22). One of the tributaries is the Sabie River, which sustains the Kruger National Park and is probably the most biologically diverse river in South Africa (Davies *et al.*, 1993:179). In Swaziland, water is diverted into the Umbeluzi River in order to irrigate sugar-cane (Heyns, 1995:7). An unusual aspect of this basin is that South Africa is both an

²¹ Part of the physical description of the Incomati River basin was taken, *verbatim*, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

upstream and downstream riparian relative to Swaziland, so dams built in that country increase the yield for subsequent release downstream, and are therefore to South Africa's advantage (Turton, 2003a).

7.3. Early Developments

Hurley stated in 1909 that, in the eastern parts of the Transvaal Colony, many farms were being laid out and that many dams were being built on these farms (Hurley, 1909:103). It can safely be assumed that some of these farms and dams were located in the Incomati and Limpopo River basins.

By the end of March 1920, ten years after the establishment of the Union of South Africa, only two irrigation districts had been established in the Incomati River basin. Both were in the district of Barberton, one at Gorge-Impala on the Crocodile River and the other at Ranch Karino on the White River. The irrigation works at Gorge-Impala were being investigated and were estimated to cost about £120 000. The works at Ranch Karino were already under construction at an estimated cost of £10 500 (Union of South Africa, 1920:519). In 1930 there were already five irrigation districts established in the Incomati River basin. Even so, malaria was a factor hampering the extensive development of the region (Union of South Africa, 1930b:361). This represents an increase of almost 150%, nearly the same increase as in the Limpopo River basin during the same period.

In 1927, the Irrigation Commission, at the request of the Minister of Lands, investigated the possibilities of irrigating Crown lands alongside the Incomati River, near Komatipoort. This land was known as the Lebombo Flats. The investigation was general and no detailed surveys were undertaken. The Commission recommended that a "flying reconnaissance" of the Komati Valley be undertaken to ascertain the possibility of irrigation development (Union of South Africa, 1928b:12).

7.4. Large Schemes, Small Schemes, the Raising of Dams and Betterments

7.4.1. The Ranch Karino Irrigation District

The Ranch Karino Irrigation District was proclaimed in July 1915 and in 1919 and 1920, the Board was granted loans of R9 000 and R17 000, respectively, for constructing an unlined canal from the Blinkwater Spruit, a tributary of the White River, to irrigate lands on the farm Ranch Karino. In 1935, due to the drought and depression of the early 1930s when both production and prices declined considerably, part of the loan, consisting of R12 386 capital and R6 663 interest, was written off. Part of the remainder was redeemed and, on 31 December, 1959, the Board's remaining indebtedness amounted to R5 462 (Union of South Africa, 1961b:4).

The diversion weir in the Blinkwater Spruit had long been abandoned. By 1961, the scheme was entirely dependent on its allotment of water from the supply diverted from the White River. This diversion was accomplished by a weir, which the Ranch Karino Board shared with the Curlew's Board. The Ranch Karino Board was at that time entitled to 60% of the flow, which gave the irrigators a maximum flow of 16 cusecs. The furrow, about 23 km long,

commanded an area of about 1 325 morgen of land of which 847 morgen was scheduled. The Department of Water Affairs therefore recommended in 1961 that it was possible to expand the scheduled land without extending the length of the furrows (Union of South Africa, 1961b:4).

In 1961, the Ranch Karino Irrigation Board concrete-lined the canal supplying the Board's water. Work funds had been raised by means of a government loan of R43 000, but proved insufficient. It was estimated that a further R25 000 was needed to complete the work. This brought the total expenditure to R68 000 (Union of South Africa, 1961b:3).

The scheme for lining the canal was first investigated for the Board by the Irrigation Department in 1950. Due to staff shortages in the Department because of the Second World War, nothing further work was done until 1955. The Board then assessed the seepage losses from the canal at 40% and decided that the lining could no longer be delayed. With a loan raised from the irrigators, an experimental section of pre-cast lining was carried out on the worst section. At the same time, the Department was approached for an irrigation loan to complete the work. Based on the cost of the experimental work, it was estimated that R43 000 would be required to finish the scheme, and the loan was therefore fixed at that sum (Union of South Africa, 1961b:4).

7.4.2. Gorge-Impala

In 1918, owners of land riparian to the Crocodile River presented a petition for the establishment of an irrigation district to the Minister of Irrigation. Because of the petition the Gorge-Impala Irrigation District was proclaimed. A scheme to irrigate some 9 000 morgen of riparian land and non-riparian land on the south bank of the river was investigated. However, because this found to be uneconomical the project was not implemented (Union of South Africa, 1961c:3).

Further investigations into the project were carried out in 1928. This was after the irrigation district had been reduced in size but it was again decided not to proceed with the project, because a more promising scheme for settlement purposes appeared possible near the confluence of the Inkomati and Crocodile Rivers. Because there was no longer any purpose for its existence, the Board requested that the district be disestablished and Proclamation No. 32 of 1933 affected this. During the years that followed several schemes were proposed by private owners, but none of these schemes came to fruition (Union of South Africa, 1961c:3).

7.4.3. The Malelane Irrigation Board Scheme

In 1947, Proclamation No. 21 of 1947 established the Malelane Irrigation District. This district comprised only a small part of the original Gorge-Impala Irrigation District. A diesel-pumping unit was installed for the abstraction of water and additional units were later added. Yet the cost of diesel fuel had been increasing prior to the 1960s, and maintenance costs were too high. This placed a heavy financial burden on the irrigators, who were required to meet the costs of operation of the scheme (Union of South Africa, 1961c:3).

Because of this, in 1955 the Irrigation Board and other interested persons approached the Irrigation Department regarding the construction of a canal system with a diversion weir in the Crocodile Gorge. This proposed scheme was situated roughly on the same lines as the original Gorge-Impala Scheme (Union of South Africa, 1961c:4).

A report was submitted by the Irrigation Department. Notwithstanding this report, the introduction of the new Water Act in 1956 and the subsequent proclamation of the Crocodile River Valley as a government water control area forced a postponement of further investigations until the basis for the allocation of water had been established. Once this had been determined and the permits issued, the scheme was redesigned to comply with the new system of apportionment. The DWA estimated the cost of the scheme at R1 740 000. The proposal was put to the Board, which, after acceptance thereof, requested the extension of the boundaries of the district. This included the entire area that could be served by the proposed canal. A petition to that effect, signed by the majority of the owners in the existing district and of those in the area to be included, was presented to the Minister in November 1960 (Union of South Africa, 1961c:4).

In 1961, the Director of Water Affairs, J.M. Jordaan, proposed the construction of the irrigation project. The proposal envisaged a scheme to irrigate 4 250 morgen of land on the south bank of the Crocodile River in the district of Barberton, Eastern Transvaal (now Mpumalanga). The purpose of the project was to provide a more economical and increased water supply to the existing irrigated area of more than 3 000 morgen in the Malelane Irrigation District. It also allowed for a further development of about 650 morgen within the district. Citrus was the main crop produced in the area, but bananas, pawpaws, mangoes and avocado pears were also cultivated. During winter vegetables such as tomatoes, beans and cabbage are grown. Cotton is also grown on a restricted scale. The canal capacity had to be as large as possible to meet the demand for water at critical periods during July and in the budding season of citrus in September and October (Union of South Africa, 1961c:3, 5).

The intake weir of the distribution system was situated about 9 km upstream of the "infall" of the Kaap River. The estimated cost of the scheme in 1961 was about R1 740 000, or about R410 per morgen served. On completion, the canal scheme was to be controlled and administered by the Malelane Irrigation Board (Union of South Africa, 1961c:5).

In 1965, a supplementary report on the scheme was tabled in parliament. Thereafter the House of Assembly approved an increased total expenditure for the scheme of R2 140 000. The reasons for the increase in the estimate were as follows:

- i. The increased cost of the weir, due to deep foundations resulting in increased excavation and concrete quantities;
- ii. The increased cost of access, due to the National Road not being completed on time, as originally anticipated;
- iii. The general rise in cost structure (RSA, 1965h:3; RSA, 1966h:2).

The works were completed in June 1966 and water was supplied to the irrigation lands. On 7 December 1966, one of the concrete pressure pipes, crossed by the Nelspruit-Komatipoort railway line, the Barberton-Kaapmuiden railway line, a provincial road to Nelspruit and a special road between Barberton and Kaapmuiden, burst. This put the scheme out of action for a short time. On 8 November 1967, a second break occurred on this section, which put the

scheme out of action and eroded the railway line. A third break occurred on 31 May 1968, washing away the Nelspruit-Komatipoort National Road. No serious accidents took place because of early warning. After the last breach, no breaks took place before 1969. However, the Malelane Irrigation Board did not feel comfortable with the condition of the concrete pressure pipes and did not wish to assume responsibility for a break that might endanger the Nelspruit-Komatipoort or Barberton-Kaapmuiden railway line (RSA, 1969g:3-4).

To prevent any future damage to road and railway infrastructure, it was recommended that the following portions of the scheme be taken over by government:

- i. The diversion weir in the Crocodile River;
- ii. The poort section down to chainage 33 000 feet; and
- iii. The extension of the poort section down to chainage 40 650 feet (RSA, 1969g:6).

The DWA came up with a number of safety recommendations to remedy the situation. The Department stated that: "The immediate need is the safeguarding of the pipeline where conditions dangerous to life may be created. The danger spots are:-

- (a) The National Road crossing at chainage 31 315 feet;
- (b) The Nelspruit-Komatipoort railway crossing chainage 35 500 feet, a Provincial Road crossing at chainage 35 825 feet and the Kaapmuiden-Barberton railway crossing at chainage 36 600 feet" (RSA, 1969g:6).

The safety measures that had to be undertaken in the public interest also had to consider the water supply to the Board and to ensure that supply. The DWA said in this regard that: "a long interruption could lead to considerable damage to crops". The Department furthermore noted that: "Except under the bed of the Crocodile River, pipes that burst can be replaced within a comparatively short period. In the light of the uncertain condition in which some of the pipes are, a chance cannot, however, be taken with the river crossing. An additional pipeline from bank to bank under the river is proposed. In case of a break in the pipeline in the river channel while the river is flowing strongly, the second pipeline can be connected to the existing pipeline within a comparatively short time". The total length of this high-pressure pipeline to be replaced was 5 333 feet, and the estimated cost was R375 000 (RSA, 1969g:6-7).

7.4.4. The Sand River Government Waterwork

Irrigation farming has been practised along the Sand River for a couple of years before 1925. The Sand River rises on the slopes of the Spitzkop about 8 km southeast of Sabie. It then flows in a southerly direction until it joins the Crocodile River near Nelspruit. A system of canals and diversion weirs had been constructed by the riparian owners of the farms Krokodilspruit and Heidelberg, before 1925 (RSA, 1962i:3, 4).

The normal flow of the Sand River was previously sufficient for the needs of the numerous irrigators. However, as the canal systems were improved and extended to irrigate the ever-increasing citrus orchards, it became evident that the normal flow of the river could not longer meet the demands, especially during the critical months of August to November, when the citrus trees urgently required water (RSA, 1962i:4).

The normal flows of the river, and its tributaries, were apportioned by the Water Court in December 1925. The total water of the river and its tributaries were made available to the two farms (Krokodilspuit and Heidelberg). Water was apportioned amongst the various owners in accordance with the irrigable area on each farm and the total irrigable area on the two farms was accepted by the court as 9 510 ha (or 1 800 morgen) (RSA, 1962i:4).

In 1962, 1 245 morgen was scheduled under the Sand River Irrigation Board. The area was, however, extendible to 9 510 ha, to include all the land allowed by the Water Court on the two farms (RSA, 1962i:4).

In 1962, the Department of Water Affairs proposed that a storage dam be constructed on the Sand River, on the farm Witklip, in the district Barberton. The purpose of the dam was to regulate the flow of the river and to increase the water supply to the existing Sand River Irrigation District, along the Sand and Crocodile Rivers, to irrigate the extendible area of 9 510 ha. The estimated cost of the scheme was R800 000 or R364 per morgen (RSA, 1962i:3).

In 1967, the DWA tabled a report before parliament stating that the cost of the storage dam would be more than that estimated in 1962. The reason for the increased cost was due to a rise in the "cost structure". In 1967, the construction cost of the storage dam was R500 000 more than the estimated R800 000 in 1962. This included a constant rise in construction costs and contingencies. Thus, in 1967, the revised estimate of the scheme was R1.3 million (RSA, 1967i:2, 3, 4).

7.4.5. The White River Estates Irrigation Board

The White River Estates Irrigation Board's origin can be traced back to 1903. In this year, an irrigation settlement was established in the White River Valley, during the time of Lord Milner, immediately after the Anglo-Boer War. The settlement received its water requirements from the White River by means of a diversion weir located about 5 km upstream from the town of White River (RSA, 1963i:2). This project later developed into the White River Estates Irrigation Board.

The project was not a success, but rapid expansion took place after the First World War. By 1927 five separate irrigation boards constituted in terms of the provisions of the Irrigation and Conservation of Waters Act, No. 8 of 1912, as well as several private schemes, were in existence (RSA, 1963i:2).

Among the undertakings was the White River Estates Irrigation Board, whose district of the same name was constituted under Proclamation No. 191 of 1927. The works of the Board consisted, at the time, of a simple diversion weir across the White River, with an earth furrow system serving the lands under cultivation (RSA, 1963i:2).

Increasing development in the valley led inevitably to a shortage of water and to inequitable distribution of the limited supplies available. The Irrigation Department undertook some investigations, which culminated in the construction of the Longmere Dam in the White River during the period 1938-40. The dam was constructed at a cost of R170 000. The water

stored, together with the normal flow of the river, assured the water requirements of the 2 500 morgen of land, then under development in the valley (RSA, 1963i:2).

A controlling body, known as the White River Valley Conservation Board, which, *inter alia*, would be responsible for arranging the bulk distribution of water from the river, was established in terms of Act No. 21 of 1944. This Board was instrumental in the arranging for the construction of the Manchester Balancing Reservoir in the White River by the Irrigation Department in 1951. This reservoir was constructed at a cost of R30 840. Representations by the same Board also led to the provision of further storage in the White River in 1961, when the Department of Water Affairs completed the Klipkopjes Dam. Construction of the Dam started in 1957 at a cost of R510 000. This dam is situated upstream from the Longmere Dam. It was constructed at a cost of R500 000. Because of the construction of the Longmere and Klipkopjes Dams, the total area in the valley which could be irrigated increased to 5 000 morgen (RSA, 1963i:2-3).

In 1963, the Department of Water Affairs, at the request of the White River Estates Irrigation Board, proposed the betterments of the Board's water scheme. Investigations into the betterments had already been carried out in 1959. This investigation showed that considerable losses of water occurred through seepage from the Board's system of unlined earth furrows and distributaries, and that improvements in the alignment of the main canal could also be made with advantage in certain areas (RSA, 1963i:4).

The programme of betterments, proposed by the DWA in 1963 included the following:

- a) The concrete lining of all canals and distributaries, beginning with those sections where the greatest loss of water at present is being experienced.
- b) The construction of cross-drainage works to protect the canals from damage by stormwater and the provision of road bridges where these are necessary.
- c) The provision of long-weirs and sluice gates to ensure close control over the flow through off takes.
- d) Improvements to the alignment of the main canal and in particular the replacement of the existing 7 200 feet length open canal over the Gabriels Loop section, where a marshy area to the south of the White River is traversed, by an 18 inch diameter concrete pipe siphon, 1 300 feet long (RSA, 1963i:4).

The estimated cost of the betterments, in 1963, was R198 000, equivalent to a net cost of R165 per morgen irrigated. Due to the restriction of the betterment work to times when irrigation water was not required on the scheme, it was anticipated that the progress would be slow and the programme might therefore take up to ten years to complete (RSA, 1963i:4).

In 1964, the DWA proposed that the Klipkopjes Dam be raised by 10 feet. The purpose of the raising of the dam was to make a more assured supply of water available for existing irrigation development and to cope with periods of drought, "such as the one now [1964] being experienced." Thus it was necessary to raise the dam by the stipulated height and to eliminate, as far as possible, curtailments of the water quota because of water shortages. The proposed work was estimated at R400 000 (RSA, 1964q:2).

In 1965, the DWA proposed the construction of an additional storage dam on the White River near the town White River. The purpose of the dam was to provide a more assured supply of

water to existed irrigation development along the White River, to counteract periods of drought and reductions in the water quota as a result of shortages as far as possible be reduced. During 1964, the raising of the Klipkopjes Dam was approved, after a report had been tabled before both Houses of Parliament (RSA, 1965i:3).

In 1965, the DWA proposed that the R400 000 approved to raise the dam be allocated for the construction of the new storage dam. The report on the raising of the Klipkopjes Dam was cancelled and replaced with Report No. W.P. AA.-'65 (RSA, 1965i:3).

The DWA argued that the developments in the White River Valley was of such a nature that the annual run-off had decreased considerably and that the existing dams were unable to meet all the demands of the irrigated lands during a prolonged drought. The additional work was to be situated upstream from the Manchester Balancing weir (RSA, 1965i:4).

7.4.6. The Louws Creek Irrigation Board Water Scheme

Proclamation No. 37 of 1936 established the original Louws Creek Irrigation District. This was the result of a petition submitted by certain riparian owners to the Louws Creek. The Board included the farms of Lilydale, Naude's Rust and Esperando Annexe on the left bank and Louieville, Louws Creek and Esperando on the right bank of the river. A subsequent Proclamation, No. 144 of 1960, included a portion of 22 370 morgen of the upstream farm Waaibeuwel (RSA, 1963j:2).

After a successful application to the Water Court, the Board proceeded with the investigation of a storage dam in the adjacent Shiya-lo-Ngubu catchment area with a view to diverting the water thus stored by means of a tunnel to the Louws Creek. This was to augment the water supply of the river. A loan of R38 000, together with a subsidy of 25% to finance the project, was obtained from government. The Irrigation Department undertook the construction of the work, which was completed in 1939 (RSA, 1963j:2).

The Shiya-lo-Ngubu River rises on the slopes of the Drakensberg immediately to the west of the Makonjwa Mountains, which form part of the border between South Africa (Transvaal, now Mpumalanga) and Swaziland. The river runs for about 12 km in a north-easterly direction, after which it alters course to the southeast through a narrow gorge in the Makonjwa Mountains. It is in this gorge that the Shiya-lo-Ngubu Dam is situated. The river crosses the Swaziland border about 4 km after entering the gorge, to join the Lomati River. In 1963, and according to the Secretary of Water Affairs, there were no irrigation practices below the dam and very little above it (RSA, 1963j:2).

The Louws Creek, on the other hand, rises to the north of the Shiya-lo-Ngubu River and flows in a general north-north-easterly direction for about 22 km until it joins the Kaap River between Louws Creek Station and Kaapmuiden. This is about eight km upstream of the Kaap and Crocodile Rivers (RSA, 1963j:3).

In 1963, the perennial flow of the Louws Creek was sufficient to supply the irrigation needs of the scheduled area of 1 440 morgen of land for the period November to July. Yet it needed to be supplemented by the release of water from the Shiya-lo-Ngubu Dam during the remainder of the year. There was also the problem of excessive water loss in the diversion

furrows, which brought the water to the irrigated lands. In 1963, it was proposed that betterment works should be conducted to reduce the distribution losses in the furrows to a minimum and thereby to place irrigation in the area on a sound footing. The works consisted of a concrete-lined canal on the west bank of the Louws Creek, and the concrete lining of the three existing furrows. The estimated cost of the works, in 1963, was R200 000 or about R140 per scheduled morgen (RSA, 1963j:3, 4).

In 1967 work on the scheme had not yet started. In a 1967 report, the DWA stated that: "Subsequent to 1963 certain significant changes affecting the district have taken place, which necessitate a reassessment of the previous [1963] proposals". These works were completed at around 1965 (RSA, 1967j:2).

This change was mainly affected by the construction of a sugar-cane mill at Malelane, resulting in a change in the crop patterns within the Board's irrigation district. About 1 000 morgen of land was after this devoted to sugar-cane only, out of 1 410 morgen of land that was planted with citrus before the establishment of the mill. The DWA said in 1967 that: "Thus, on the basis of a gross irrigation requirement of 66 inches of water per annum for cane, and 50 inches per annum for 410 morgen of other crops, the net irrigation requirements at field edge over the Board's area, with a mean annual rainfall of 36 inches, will be 26 inches average per morgen per year for the full 1 410 morgen". Thus, only 410 morgen of land was devoted to other crops, while the rest was planted with sugar-cane (RSA, 1967j:2).

The DWA furthermore stated that: "This requires an assured net mean annual supply of 3 020 morgen-feet at field edge, which exceeds the assured mean draught available to the Board from existing storage facilities by 1 770 morgen-feet per annum, but is less than the average mean annual run-off by 2 230 morgen-feet per annum". Because more water was needed to irrigate the additional production of sugar-cane, additional storage facilities were needed to ensure a full irrigation quota to the entire area for the expected crop pattern (RSA, 1967j:2).

In order to provide more water, and before additional storage was to be constructed, investigations were conducted to reduce distribution losses and to influence positively the distribution of water to the lands. For these purposes, a modified canal system was proposed "for immediate construction". The works were completed at around 1969 (RSA, 1967j:2, 4).

In 1968, the DWA said in a supplementary report that the amount voted for in 1963 (R200 000) and a further amount in 1967 (R160 000) for canal betterment works were insufficient. The betterment works had been largely completed by that year, but the eventual cost would be R450 000. The reason for the increase in costs was that excavation in the upper and middle reaches of the canal could not be satisfactorily "ripped", as had been anticipated. This resulted in larger excavation work requiring blasting, which increased the costs. In addition, certain modifications to the design were made to enable further areas to receive water under sufficient pressure for sprinkler irrigation. This required a larger proportion of pipes in the entire scheme than had been originally estimated for (RSA, 1968i:3).

7.4.7. The White River Conservation Scheme

In 1939, the Director of Irrigation, A.D. Lewis, reported on the White River Conservation Scheme. He noted, from the onset, that: "Geological conditions do not favour the

construction of storage dams on this [White] River". However, he also said in his report that: "After many years of consideration and exploratory work an admittedly poor site, but the best of a bad lot, was chosen for the construction of a storage dam on the White River about 5 miles north of White River town". However, the foundation of the dam was not adequate for a large reservoir, and plans for a smaller one were drawn up. The first dam would have had a capacity of 9 000 acre-feet, while the smaller one would have had a capacity of 3 000 acre-feet. Work on the smaller dam started in 1939. The dam was completed in March 1940, and on 19 March 1940, it overflowed for the first time (Union of South Africa, 1940b:30; Union of South Africa, 1941:31).

"Native" labour was mainly used for the construction of the dam. Furthermore, there was no shortage of "native" labour, according to the Director of Irrigation. The numbers of "native" labourers and white labourers were 181 and 60 respectively (Union of South Africa, 1940b:30). It is not stated in the Director of Irrigation's report for 1938-39 in which capacity the white and "native" labourers were employed. Nonetheless, deducing from other irrigation projects and the utilisation of different races for labourers during the late 1930s, it can be said, with an amount of certainty, that the "native" labourers were not used in a "skilled" capacity on this project.

7.4.8. The Crocodile River Irrigation District

In 1952, Proclamation No. 288 of 1952 proclaimed the Crocodile River Irrigation District. This was to enable the owners to undertake the construction of a communal irrigation scheme, which would make further development of the district possible. The Irrigation District comprised certain farms on the left bank of the Crocodile River near Nelspruit (Union of South Africa, 1961c:2).

Representations concerning the construction of a canal system were made to the Department of Irrigation. In 1954, surveys were made for a canal which would serve the entire district. Subsequently various other possibilities were investigated. One of these was a project to supply parts of the district with water from the Crocodile River by means of pumping installations. All of these proposals were rejected because of high costs and legal difficulties concerning water rights (Union of South Africa, 1961c:3).

Because of the proclamation of the Crocodile River as a control area by Proclamation No. 261 of 1957, and the issuing of irrigation permits under the Water Act of 1956, the legal difficulties had been solved. It also became possible, because of this, to abstract water for a part of the irrigation district from the Nels River, an important tributary of the Crocodile (Union of South Africa, 1961d:3).

The Department investigated the possibility of supplying certain farms to the east of the Nels River by gravity, thus eliminating the high costs of fuel and maintenance of pumping plants (Union of South Africa, 1961d:3).

In 1961, the Department of Water Affairs proposed the construction of a system of canals for the more beneficial irrigation of the existing development within the boundaries of the Crocodile Irrigation District. It also made provision for the development within this boundary of pieces of land which have received irrigation permits, but which were not yet (in 1961)

being irrigated. The rapid development in the Crocodile River valley necessitated the provision of efficient irrigation systems. This development had been met by private pumping schemes, but the cost of these increased to such an extent that it became uneconomical (Union of South Africa, 1961d:2).

The crops that are presently grown at the Gorge-Impala Irrigation District were being produced as early as 1961. The proposed scheme, in 1961, included the diversion of water from the Nels River into a canal system by means of a new diversion weir. The scheme proposed to irrigate 538.5 morgen of land. There was also a plan to later construct a storage dam on the Crocodile River to increase the area of land to be irrigated. The estimated cost of the canal system in 1961 was about R420 000. The Board applied for a subsidy of 33.3 per cent, which left a net repayable loan of R280 000. The cost to irrigate one morgen of land was R780. After deducting subsidy, it was possible to lower the cost to R520 per morgen of land irrigated. After completion the control and administration of the scheme was handed over to the Crocodile River Irrigation Board (Union of South Africa, 1961d:4).

7.4.9. The Burgershall Irrigation Board Scheme

In 1954, the Burgershall Irrigation District was proclaimed and an irrigation board was established. This Board took over existing works that were initially constructed by a farmer, Joubert, in the White Waters River in the Nelspruit district. Joubert constructed a concrete diversion weir in the river, and excavated an earth canal, to supply water to his farm Burgershall. When the Board took over the works, it installed suitable steel sluices with right-angled V-notch gauges at each plot (the canal crossed three farms before it reached Burgershall) to distribute the available water in a proper manner. The expenditure of the 1954 works was subsidised by the Irrigation Department in 1955 (RSA, 1962j:3).

The total scheduled area under irrigation in 1962 was 1 401.5 morgen, of which 746.5 morgen belonged to the Cooper group and 655 morgen to the Joubert group (the farm Burgershall was divided between Joubert and Cooper, hence the labelling of the two groups receiving water from the scheme in 1962). Both groups were entitled to the stream in the canal according to a 24-hour timetable (RSA, 1962j:3).

In 1962, the Board estimated that the seepage from the canal system was in the order of 50%. This was due to difficult sloping terrain, the numerous ravines that the canal crossed, and the porous nature of the soil. The loss was, according to the Board, excessive, and due to the low flow of the river during winter, seepage had to be kept to a minimum. Consequently the Board decided to line the entire canal length, of about 16 km, and to construct two siphons 3 200 and 890 feet long. The canal was to be provided with all necessary super passages, control sluices, measuring devices, drains, canal roads and fencing. At the diversion site the capacity of the canal and siphons was 20 cusecs. The estimated cost of the scheme was in 1962, R180 000. The board expected a loan from the DWA of this amount and a subsidy regarding the actual cost of the improvements (RSA, 1962j:4).

In 1962 the Director of Water Affairs, J.M. Jordaan, submitted a report regarding a proposal to line the existing canals with concrete. It was also proposed by Jordaan that proper measuring devices and division structures be provided to the Board. This, he argued, would ensure an improved water supply to the irrigators (RSA, 1962j:3).

7.4.10. The Da Gama Dam

In 1966, the DWA proposed the construction of the Witwaters River Dam. Since 1964, six sites on the Witwaters River were investigated with a view to the construction of the dam, for storage purposes. After a preliminary investigation two sites, on Da Gama and on Etna, appeared to be the most desirable. The Etna site is situated about 3 800 feet upstream from that of Da Gama (RSA, 1966i:3).

Up to 1966, the Burgershall Irrigation Board had been dependent on direct diversion of the uncontrolled river flow. However, the low flow, especially during droughts, such as the one during the period around 1961 to 1966, was inadequate for the purposes of irrigating the area. The DWA stated in its 1966 that: "Only by storage can the available water supply be improved" (RSA, 1966i:5).

The storage the DWA proposed to construct on the Witwaters River would have provided 21 inches of additional irrigation water on the lands of the Board during normal (non-drought) years, and 17.5 inches during the driest years. Together with the rainfall in the area, irrigation was to be put on "sound footing" (RSA, 1966i:5).

The proposed storage dam was designed to have a capacity of 1 500 morgen-feet. It was estimated that there would be a reduction in the capacity of the dam of five morgen-feet per year due to siltation. This would have resulted, as calculated by the DWA in the late 1960s, in a reduction in the capacity of the dam to 1 400 morgen-feet in 20 years. The total estimated cost of the dam in 1966 was R1 million (RSA, 1966i:5).

Apart from the financial cost of the dam, the DWA stated that: "In accordance with the accepted policy for the subsidizing of irrigation schemes which benefit the country both directly and indirectly as a result of increased production, it is not proposed to make the irrigators repay the full cost, [R1 million], of the proposed Government storage dam. In respect of the dam, it is proposed to levy an interest and redemption rate of R10 per morgen per annum in terms of section 66 of the Water Act (Act No. 54 of 1956). The said rate will be levied on the total scheduled area of 1 895 morgen of the Burgershall Irrigation Board and of the De Rust Irrigation Board. It will yield an amount of R18 950 annually, which will redeem a capital sum of R254 012 at the present Treasury rate of interest of 6.25 per cent over a period of 30 years". The main purpose of the Da Gama Dam was therefore to stabilise the supply of irrigation water for land scheduled under the Witwaters Major Irrigation Board (proclaimed by Government Notice 216, 3 September 1965) (RSA, 1966i:6; RSA, 1970j:2).

The total irrigable area in the Witwaters Major Irrigation District in 1970, was 2 616 ha, of which 2 182 ha could be commanded by gravity from the Da Gama Dam. During times of low flow of the Witwaters River, the water supply was inadequate to support the 1 607 ha of fully developed irrigable land (RSA, 1970j:2).

In 1970, the DWA stated that: "Although the present scheme will not permit an increase in the irrigated area, it will result in a greater assurance in supply with a resultant increase in production from the 1607 hectares (1878 morgen) of land already fully developed". To do this the DWA proposed that the height of the Da Gama Dam be raised (RSA, 1970j:2).

Although the dam had not yet been constructed by 1970, it was envisaged to change some of the design specifications to allow for a larger storage capacity. For instance, the "Crest level of non-overspill section" was originally designed to be R.L. 840 m. With the new design in 1970, this section was to be R.L. 878 m. With the new design, the dam had a capacity of 13.4 million m³, as opposed to the original designed capacity of 3.9 million m³ (RSA, 1970j:4).

With the new design, the construction cost also increased from R1.8 million to R2.8 million. The acquisition of land for the dam and the reservoir basin, which was debited to the loan vote of the Department of Agricultural Credit and Land Tenure, added another R40 000. Thus, the total cost of the dam was R2 840 000 (RSA, 1970j:5).

7.4.11. The Curlews Irrigation Board Water Scheme

In 1955, the Curlews Irrigation Board was established under Proclamation No. 67 of 1955. The Board at its establishment consisted of six members. Before the establishment of the Board, the district was owned by The Curlews Citrus Farms Ltd. This company divided the property into plots, of which a number were sold and transferred to private owners. The government acquired the remainder of the property and granted 15 portions to 15 settlers in terms of the Land Settlement Act of 1912 (RSA, 1965j:3).

In 1948, a Board of Control for the settlement was constituted which had jurisdiction, *inter alia*, over the division of water within the area of the settlement. This water was delivered by an existing (1965) earth furrow on the right bank of the White River, which served the original property. At around the same time the Irrigation Department carried out repairs and reconstruction on the furrow on behalf of the Department of Lands (RSA, 1965j:3).

In the mid-1950s, steps were taken to establish an irrigation board. The reasons for this were the lack of proper control over the entire irrigation works and the inadequacy of the existing earth furrow due to increasing development (RSA, 1965j:3).

This Board was the fifth member Board to fall under the controlling body for the valley, namely the White River Valley Conservation Board. One of the first responsibilities of the new Board was to investigate the possibilities of gaining control of its works, especially those sections of the canal that traversed non-riparian land outside the boundaries of its district. One such proposal was investigated by the DWA (RSA, 1965j:3-4).

Because of the investigation, the Board in 1959 constructed the Bellevue 25 inch diameter siphon at a total cost of R18 345, with the aid of a loan and subsidy from the state. A second siphon, the Cascades siphon (18 inch diameter), was investigated and constructed in 1962, at a cost of R4 908, to obviate a troublesome section of canal. Other minor works undertaken by the Board included short lengths of lining where seepage was excessive and the installation of sluice gates at the outlets serving the various irrigators (RSA, 1965j:3-4).

When the Curlews Irrigation Board was first proclaimed, the scheduled irrigation area was 704 morgen. This was the maximum area to be irrigated with the available water supply. With the completion of the Danie Joubert (or Klipkopjes) Dam in 1961, the scheduled area was increased to 800 morgen (RSA, 1965j:4).

In 1965, the DWA proposed that betterment works should be undertaken to the canal system of the Curlews Irrigation District at an estimated cost of R60 000 (equivalent to R75 per morgen irrigated). The works entailed the concrete lining of and improvements to the main canal falling under the jurisdiction of the Curlews Irrigation Board. The betterments became necessary to better utilise the water resources available to the Board. The works were completed c. 1968 (RSA, 1965j:3).

Yet the amount for the betterment works was re-estimated in 1967 to about R120 000. The reason for the rise in cost was that a better "class of concrete lining" was necessary for the type of work (RSA, 1967k:3).

7.4.12. The Kaalrug Irrigation Board Water Supply Scheme

In 1967, the DWA proposed a water scheme for the Kaalrug Irrigation Board. With this scheme it was proposed to supply water from the Mhlambanyathi River to some 1 200 morgen of scheduled land on the farms Singerton, Rusoord and Kaalrug. These farms together comprised the Kaalrug Irrigation District (RSA, 1967l:2).

Three loans in the total sum of R69 000 had before 1967 been granted to the Board by the Department for the construction of a diversion weir in Mhlambanyathi River and the excavation of a canal to "command" the irrigated lands. However, with the advent of the growing of sugar-cane in the district it became imperative to improve, enlarge and line the canal with concrete, to permit sufficient water being delivered to the lands to grow a full crop of cane (RSA, 1967l:2).

The DWA also considered it inevitable in due course that storage facilities would be required on the Mhlambanyathi River. This was to ensure the necessary minimum draft in the river for a reliable water supply to the full scheduled area (RSA, 1967l:2).

The Kaalrug Irrigation District included seven farms of a total gross area of nearly 10 000 morgen. It lay on both banks of the Mhlambanyathi River over the last 16 km of its length, before the river joins the Lomati River, which in turn runs into the Incomati River. The Incomati joins the Crocodile River at Komatipoort, as it flows into Mozambique (RSA, 1967l:2).

The major crop produced by the Board in 1967 was sugar-cane. About 80% of the land was under this crop, while the remaining 20% was planted with citrus and other fruit crops. These crops needed about 39 inches of water per annum. In 1967 the earth furrow was in a poor state and excessive losses were being experienced to such an extent that, with the river running in spate, it was proving impossible to get more than five cusecs through the lower end of the canal. Here most of the irrigated land was situated. The cost of the work was estimated at R60 000 or nearly R50 per morgen for a scheduled area of 1 215 morgen. The work was completed at around 1969 (RSA, 1967l:3).

7.4.13. The Sterkspruit Dam

In 1975, the DWA proposed that a dam be constructed in the Crocodile River on the farm Sterkspruit in the Nelspruit District. The proposed dam site was situated downstream of the confluence of the Crocodile River and its tributaries, the Buffelskloof and Schoemanskloof Rivers, and about 34 km upstream of the Elands and Crocodile Rivers at Montrose. The proposed dam had an envisaged cross storage capacity of 167 million m³, and the dam wall was to be 90m high (RSA, 1975d:2, 8).

The rationale behind the proposed dam was that increased irrigation development along the Crocodile River had resulted in water shortages. This was especially the case during times along the lower reaches of the river during the late winter months of dry years. Storage dams had already been constructed in its tributaries by 1975, but not in the Crocodile River itself. The objective of the dam was to regulate and stabilise the flow of the Crocodile River and thus provide an improved water supply for existing (1975) and expanded irrigation development, domestic use and for industries as well as for any international commitments which exist or which may be negotiated in future (RSA, 1975d:2).

Irrigation, using the Crocodile River's water resources, had been practised since the opening of the railway line between Pretoria and Maputo in 1894. The railway line opened the area to settlement and simultaneously brought products of the area within easy reach of the markets and more and more water was used for irrigation purposes. After the Second World War, agricultural development was further stimulated by the establishment of a large-scale citrus industry (RSA, 1975d:3).

Proclamation 21 of 1947 established the Malelane Irrigation District in 1947. The objective of this was the electing of a Board for the administration of the irrigation scheme on the right bank of the Crocodile River between Kaapmuiden and Malelane. Water was pumped from the river until 1966, when a diversion weir was constructed in the Crocodile River Poort to divert water into the canal. By 1975 this canal was supplying water to 3 640 ha of land, had a length of 43 km and a capacity of 2.8 cusecs. Until 1975, with the exception of the above-mentioned scheme at Malelane and several minor diversion schemes, riparian owners along the Crocodile River irrigated mainly by means of pumps along the river (RSA, 1975d:3).

In 1957, Proclamation 261 of 1957 proclaimed the area comprising the riparian farms along the Crocodile River a Government Water Control Area. A survey of irrigated and irrigable land was undertaken by the DWA. The survey divided the Crocodile River into five zones. Zones one and two were upstream from the proposed dam. The dam site is situated more or less on the boundary between zones two and three. The boundary between zones three and four is the confluence of the Elands and Crocodile Rivers and the boundary between zones four and five is Krokodilpoort (RSA, 1975d:3).

Furthermore, on the grounds of this survey, permits for irrigation purposes were issued to riparian owners in terms of section 62 of the Water Act, 1956. The quantity of water allotted in terms of these permits was sufficient to supply adequate water for about 70% of the time, during low flow periods (July to October) in the Crocodile River, for irrigation purposes. Permits could be issued for water to irrigate an area of 21 011 ha, of which 17 415 ha is situated downstream of the proposed Sterkspruit Dam. Of this 17 415 ha, 14 375 ha can be

irrigated from the Crocodile River and the remainder from tributaries of the river (RSA, 1975d:3).

In 1960, the entire Crocodile River Government Water Control Area was proclaimed, by Proclamation 264 of 1960, as the Crocodile River Major Irrigation District. This district was placed under the supervision of the Crocodile River Major Irrigation Board. This board had, by 1975, 21 076 ha of scheduled land. The Crocodile River (Minor) Irrigation Board was established by Proclamation 288 of 1952. It is situated entirely within the area of the Major Irrigation Board and controls a scheduled area of 11 832 ha (RSA, 1975d:3).

Another important development occurred during the period 1966 to 1968, when the cultivation of sugar-cane was commenced and the Malelane sugar mills were constructed in the lower Crocodile River valley. Water shortages occurred during September and October of dry years, particularly after this period. Increasing afforestation in the catchment of the river also aggravated the water shortages during the critical dry months. In 1975, according to the Department of Forestry, about 13.7% of the catchment area was under forest, causing a reduction of the low flow in particular (RSA, 1975d:4).

Of the main tributaries of the Crocodile River outside the control area, the White River was by 1975 the most developed. The White River Conservation Board had, by then, control over five irrigation boards with an area of 4 220 ha scheduled for irrigation. The White River therefore did not contribute much to the low flow of the Crocodile River (RSA, 1975d:4).

Moreover, along the Sand River the Sand River Irrigation Board controlled a scheduled area of 1 984 ha, whilst the Elands Valley Irrigation Board was scheduled for 2 447 ha by 1975. A further three irrigation boards along the Lower Kaap River were scheduled for 2 610 ha. Smaller irrigation schemes, without irrigation boards, existed along the Houtbosloop, Stad-, and Gladde Rivers by 1975 (RSA, 1975d:4).

All of these developments along the tributaries of the Crocodile River contributed to the water shortages in the main tributary because less and less water reached the Crocodile River during critical periods (RSA, 1975d:4).

Apart from the irrigation developments in the river, the municipality of Nelspruit also gets its water from the Crocodile River. A permit had been issued to the municipality for a quantity of 6.9 million m³ per year, which, with a growth rate of 6.75% per year, was expected to be the consumption by 1985. The estimated consumption (in 1975) by the year 2000 was about 15 million m³. In 1975, the Transvaal Sugar Company at Malelane was the only large industrial consumer, with a maximum demand of 1.3 million m³ per year (RSA, 1975d:4).

Permits had also been issued for the use of water from the river to the Department of Bantu Administration and Development and other smaller domestic and industrial consumers for 4.1 million m³ per year. All of these consumers required 4% of the total demand from the Crocodile River in 1975 and it was proposed to reserve 23.3 million m³ for this purpose (RSA, 1975d:4).

Also of importance, as stated by the DWA in its 1975 report on the proposed Sterkspruit Dam, is that the "Crocodile River is an international river because it crosses Mozambique on

its way to the sea. Provision will, therefore, have to be made to comply with any international agreement which may be possibly negotiated with Mozambique" (RSA, 1975d:4).

The purpose of the proposed dam was to serve irrigation along the river and its tributaries. In 1975, sugar-cane made up the bulk of crops produced by irrigation, about 65%, followed by citrus (20%), vegetables (10%) and cotton, tobacco and sub-tropical fruit (5%). The estimated cost of the dam, in 1975, was R26 million. Yet the DWA stated in its report that: "If it is assumed that a 7 year construction period is necessary for the completion of the proposed dam by 1982/83 and if the present inflationary tendency is taken into consideration, it is estimated that the eventual cost of the scheme will be R34 million . . .". This amount took into account the purchasing of about 700 ha of land for an amount of R84 000 (RSA, 1975d:5, 8).

However, in 1977, the DWA reported that: "Although approved by Parliament, the construction of the proposed Sterkspruit Dam was postponed because of limited funds. The riparian owners also made representations in regard to the cost of water from the proposed Sterkspruit Dam because they regarded this cost as high" (RSA, 1977f:3).

It was therefore recommended that a smaller dam be constructed upstream from the previously proposed Sterkspruit Dam, on the farm Sterkstroom. This dam was to be large enough to supply water for existing and potential irrigation development, as well as for domestic and industrial use, until the end of the twentieth century. Another storage dam was proposed on the Kaap River at Mountain View (RSA, 1977f:3, 8).

In 1980, the DWA proposed that the Elandspruit Dam's (originally the Sterkstroom Dam) capacity be increased from 13 million m³ to 163.4 million m³. This was to increase the estimated cost of the first stage of the development of the Crocodile River from R6.6 million to R53 million. The increase in the capacity of the dam was necessitated by the increase of irrigation development in the Crocodile River Valley. The cost of the Elandspruit Dam, estimated at R53 million, was more than the R34 million approved by parliament for the original scheme in 1975. This increase was caused mainly by the general and vast increase in construction costs (RSA, 1980f:3).

The second stage of the development (the Mountain View Dam) was affected by the proposed change in capacity of the Elandspruit Dam. The DWA decided that this stage "will also have to be revised at a later stage". The Mountain View Dam was to be built in two stages, with the first stage costing an estimated R18.8 million. The purpose of the dam was to make provision for additional irrigation land (RSA, 1980f:3, 4).

7.4.14. Storage on the Upper Inkomati: Water for Electricity Generation

From the late 1950s, there was increased and constant liaison between the DWA and ESCOM, in response to the rapidly growing demand for electricity, and the securing of a permanent source of water for the generation thereof. The Eastern Transvaal (now Mpumalanga), with its large and easily accessible reserves of coal, is a favourable area for the establishment of large power stations. In addition, the water resources of the Usutu and Inkomati Rivers, with a potential which could meet any demand for many years (estimated in

1967), were largely unused in 1955 when ESCOM was first considering the possibility of building a large power station in this area (RSA, 1967m:3).

In 1957, the first White Paper, W.P. D-57, for the construction of the Nooitgedacht Dam on the Upper Incomati River, near Carolina, was approved by parliament. This dam was completed towards the end of 1962 at a cost of R3 223 000, which was the first in a series of dams to be built with the main objective of supplying water for steam-operated power stations. In 1967, it supplied 72 million litres of water per day to the Komati Power Station, with a generating capacity of 1 000 megawatts (RSA, 1967m:3).

In 1965 and 1966, ESCOM decided to build two further power stations, at Hendrina and Arnot, with generating capacities of 2 000 and 2 100 MW respectively. These two power stations had a combined water demand of 288 million litres of water per day at that time (RSA, 1967m:4).

At the time of the investigations into the Nooitgedacht Dam, in about 1955, three other possible sites on the Incomati River were also investigated. These sites were situated on the farms Waterval, Rosetuin and Hooggenoeg. The first site was situated in the Carolina District and the other two in the Barberton District. Because of the construction of the Nooitgedacht Dam, the water supply at the neighbouring Waterval site was limited, while the other two sites had to be eliminated as economic sources of water supply for the Highveld due to excessively high pumping heads involved (RSA, 1967m:3-4).

Towards the end of 1964, a start was made on investigations at the Kafferskraal site, and at the beginning of 1966 intensive investigations were made at two further sites, on the farms Racesbaan and Boekenhoutrand, upstream and downstream of Kafferskraal respectively (RSA, 1967m:4).

The site on Racesbaan was eliminated because of inadequate potential, and comparative analyses showed that a dam on Kafferskraal, supplemented by diversion from two tributaries of the Incomati River, the Gladde and Zeekoei Spruits, possessed more sufficient potential. Although a dam could be built on Boekenhoutrand, about 11 km downstream, more economically than at Kafferskraal, the latter was able to supply cheaper water. This was mainly due to the difference in height between the two sites, which was about 410 feet. The Kafferskraal option was therefore chosen, because it was higher than Boekenhoutrand, and would have entailed cheaper pumping costs. The investigations also revealed that water could be supplied to the Hendrina and Arnot power stations more economically from the Incomati at Kafferskraal than from the Usutu system (RSA, 1967m:4). The Kafferskraal Dam (now Vygeboom Dam) was therefore proposed for construction.

Another rationale behind the construction of more dams for the supply of water to the power stations was that more future power stations were envisaged. These power stations lie outside the Incomati River's catchment. There were also, at that time, no industries worth mentioning within the basin. To deliver water from the Incomati Basin to the power stations, a diversion scheme was built to deliver water from the Gladdespruit to Vygeboom Dam (RSA, 1967m:5; RSA, 1970j:2).

The combined net draft of the Nooitgedacht and Vygeboom Dams amounted to 415.35 million litres of water per day, or 58 670 morgen-feet per year. The Vygeboom Dam would

be constructed to supply 279 million litres of water, because the Nooitgedacht Dam's draft was at that time 136.35 million litres per day. The estimated cost of the new dam was in 1967 R4 million, while the cost of the diversion canal and tunnel was estimated at R450 000. Regarding financial requirements, the DWA had the following to add: "It is proposed that ESCOM should pay the general tariff levied at other Government dams for industrial water, viz. two cents per 1 000 gallons [4 500 litres] of water, delivered at the outlets, which means that the full capital expenditure may possibly be redeemed within 40 years". Because ESCOM needed increased water resources for its new power stations, the dam had to be completed by the end of 1970 (RSA, 1967m:8).

Because the Incomati is an international river, shared by South Africa, Swaziland, and Mozambique, the two latter countries also have an interest in it. In the late 1960s the DWA said that: "Discussions are held from time to time with representatives of these neighbour states on the use of water of the international rivers in which they have an interest, and in due course an agreement will be reached on the apportionment of the water". The Department, furthermore, stated that: "As the total mean annual run-off of the Komati at the Swaziland boundary may be assumed to be 243 000 morgen-feet and as the net draft of the two dams amounts to only 58 670 morgen-feet, or 24 per cent of the total run-off, no problems in this connection are foreseen at present" (RSA, 1967m:8).

In 1970, the DWA proposed that additional funds for the completion of the Vygeboom Dam and Gladdespruit diversion works be granted by parliament. It also proposed that a weir be constructed on the Incomati River at Gembokhoek. The objective of the proposed Gembokhoek Weir was to reduce pumping costs by eliminating pumping between Vygeboom and Gembokhoek through a 32 km long pipeline. ESCOM would then construct a pump station at Gembokhoek. This station had the capability to pump 291 000 m³ of water per day to a booster station near Gembokhoek, on the pipeline from Vygeboom Dam to the distribution station at Nooitgedacht (RSA, 1970k:2).

Pumping from the Gembokhoek Weir to Nooitgedacht Dam, instead of from the Vygeboom Dam, was to save 0.237 cents per m³. The annual saving was R130 000, which translated into the pumping of 54.7 million m³. Over 40 years, at 1970 prices, the saving was R1 684 000. The construction of the Gembokhoek Weir and the completion of the Vygeboom Dam and Gladdespruit diversion works were estimated to be R9 million in 1970. The Vygeboom Dam started impounding water by the end of 1970 and the Gembokhoek Weir was completed during the winter of 1971 (RSA, 1970k:3, 5).

By 1975, these government waterworks on the Incomati were approaching the time when increasing demand was outstripping supply. To offset this, the DWA proposed in 1975 to construct a system of pipelines to link the Incomati and the Usutu Government Water Schemes. The objective was to develop the water resources of these two rivers more effectively than could be done by two separate schemes. By doing this, the supply of water was to be augmented, whilst valuable flexibility was to be introduced into the distribution system to meet the requirements of ESCOM's power stations and domestic and industrial demands in the area (RSA, 1975e:2).

In 1975, the following developments had already been implemented in the Incomati and Usutu Rivers. These were, for the Incomati, as follows:

- ESCOM's Komati, Hendrina and Arnot power stations, with a total installed capacity of 5 100 MW, which were supplied from the Incomati River.
- Nooitgedacht Dam, Vygeboom Dam and Gembokhoek Weir were constructed by the DWA to meet the water demand of these three stations.
- The Komati power station draws water from the Nooitgedacht Dam. Water is pumped from Nooitgedacht Dam to a reservoir at Klipfontein Towers via twin 710 mm pipelines with a combined capacity of 100 000 m³ per day. Twin gravity lines deliver the water to Komati power station from Klipfontein Towers.
- Hendrina and Arnot power stations are supplied from Wintershoek pump station downstream of Nooitgedacht Dam. Water is delivered from Vygeboom Dam and Gembokhoek Weir to Wintershoek pump station by twin 1 092 mm pipelines through which 290 000 m³ water per day can be pumped. One of these pipelines has been in use since 1972 and the second was to be completed in 1976.
- The rising main from Wintershoek to Arnot power station was to comprise three 813 mm pipelines, of which two had already been in use by 1975. They had a total capacity of 263 000 m³ of water per day delivered into a reservoir with a full supply level of 1 699 m³. Twin 914 mm pipelines delivered water from Arnot to a terminal reservoir at Hendrina power station with a full supply level of 1 644 m³. These two pipelines delivered 132 000 m³ of water per day (RSA, 1975e:3).

The following developments within the Usutu River basin had already been implemented by 1975. They were as follows:

- Camden and Kriel power stations with an installed capacity of 1 600 MW and 3 000 MW respectively. These power stations supplied electricity to the towns in the vicinity, such as Ermelo, and the demands of industries that might have developed after 1975 near Witbank and Middelburg.
- The water resources of the Usutu River had been developed in four phases to supply the needs of these power stations. These developments comprised the Jericho, Westoe and Morgenstond Dams, and a system of interconnecting pipelines and pump stations (RSA, 1975e:3).

These developments were implemented because of South Africa's high growth rate for electric power. Between 1968 and 1973, ESCOM reported that this growth rate was 10% per year, and assumed that it would continue in the future. For this purpose ESCOM, announced, prior to 1975, that it was intending to construct two more base-load thermal power stations on the Mpumalanga coalfields. These power stations were Matla and Duvha, with a capacity of 3 600 MW each. These stations were commissioned in 1978-79 and were to be completed by 1985. In 1975, the DWA said that it expected that one more power station in this area would be announced in the near future (RSA, 1975e:5).

The DWA proposed that dry cooling at some of the units of these power stations "will have" to be installed to keep pace with the limited water supply of the country, although there was at that time an economic advantage to wet cooling of power stations. The intention was therefore to install wet cooling systems with the first three units of 600 MW at Matla and the first three units of 600 MW at Duvha. The second half of each of these two stations was to be dry cooled (RSA, 1975e:5).

To supply water to the wet cooled units, water was withdrawn from the Komati and Usutu Rivers. With regard to the dams in these rivers and water releases from these dams, it is important to take into account discussions held at a technical level with neighbouring countries that already had an interest in these rivers (Swaziland and Portuguese ruled Mozambique). In 1976, a supplementary report from the DWA on the proposed link stated that: "Both the Komati and Usutu Rivers are international rivers and the claims of bordering countries must constantly be borne in mind" (RSA, 1975e:7; RSA, 1976h:10).

Nevertheless, the existing demands in the Incomati River for the water supply of the power stations in 1975 foresaw that the additional demands would have to be augmented by around 1985. For the Usutu River, on the other hand, it was estimated that the demands could be safely met until 1980 and the demands of new stations would not have been carried by the system. If the two systems were to be combined, the demands would have been met until 1981/82 (RSA, 1975e:7).

It was for this purpose that the DWA, in 1975, proposed that the two systems be linked. The main objective was to provide a link from the Hendrina power station to the Kriel power station. This allowed water available in the Incomati system, in excess of local demands, to be supplied in the Usutu system where shortages were already occurring by 1975. A major consideration in this proposed link system was to establish a central distribution reservoir at an elevation from which all existing and planned power stations and other future power stations on the coalfields were likely to be built could be commanded (RSA, 1975e:8).

It was therefore proposed that a balancing reservoir be built on the farm Geluk, with a total capacity of 200 000 m³. The advantages of this reservoir were that the link system would then be most effective, and that the various elements of the linked system could be operated for long periods at maximum capacity and the excess of water delivered over the demand which varies seasonally could be kept in storage for use later when demand peaks were experienced. A site in the Olifants River on the farm Kleinfontein was selected and found to be suitable for this dam (the Kleinfontein Dam). The selection of this site was that the reservoir would not inundate underlying coal reserves (RSA, 1975e:8).

However, in 1976 the proposal was amended and superseded by a new one. The reason for this was that the South African Coal, Oil, and Gas Corporation (SASOL) announced that it was installing a second plant (SASOL II) near Trichardt. This installation was to require water at about the same time that additional water was to be supplied to the ESCOM power stations. A separate White Paper had been tabled before parliament in 1976 for the "... appropriation of funds for the first phase of this scheme, which consists of the construction of the Grootdraai Dam on the Vaal River upstream of Standerton and pumping stations and aqueducts to deliver this water on the watershed between the Olifants and Vaal River in a balancing reservoir on the farm Trichardtsfontein". The transfer of water from a third source (Vaal River) for the water requirements of the Mpumalanga power stations resulted in the proposal for a link system between the various sources being considered (RSA, 1976h:3).

In 1981, the DEA requested further funds from parliament for the completion of the link between the Usutu and Incomati water schemes. The amount of the additional funds was R3 million. This increased the cost of the scheme from R24 million to R27 million. The increase in cost of the scheme in 1981 was ascribed to design changes and inflation (RSA, 1982d:3).

The Camben-Lilliput pipeline, by which water from the Usutu River System could be pumped to the Upper Komati River, was commissioned on 1 April 1993. Over the course of the year 19 mcm of water was pumped to the Nootgedacht Dam. This figure represented 24% of the dam's volume (DWAf, 1994:55).

7.4.15. The Driekoppies Dam

In 1986, the DWA proposed the Komati River Basin Development (Driekoppies Dam) scheme. The Driekoppies Dam was the first stage of the first phase of the development of the water resources of the Komati River basin upstream of the confluence of the Komati and Crocodile River at Komatipoort (RSA, 1986c:3).

The first phase of the development was intended to stabilise river flows and to improve the assurance of water supplies to the existing irrigation and urban development in the Komati River basin. This was to provide for expected increases in primary water use and to allow for a moderate increase in irrigation development (RSA, 1986c:3).

The consumers that were to benefit from the first-phase development were situated along the Komati River, downstream of the northern border of Swaziland and along the Komati River downstream of the western border of Swaziland (RSA, 1986c:3).

The first phase of the water resources development of the Komati River Basin was a joint development to the benefit of South Africa, including the national state of KaNgwane, and the Kingdom of Swaziland. In terms of the government's stated policy regarding decentralisation, further development in the Nkomazi Region of KaNgwane was considered to be of vital importance. For this purpose, irrigation development was considered an essential element. This was, however, to adversely affect the water available to existing development in the Onderberg Region downstream of KaNgwane unless new water resources were created by storage. It was also necessary to first stabilise the position of downstream riparian owners before more water was transferred from the Upper Komati River to the Eastern Transvaal coalfields (RSA, 1986c:3).

Several alternative schemes were investigated and the proposed Driekoppies Dam, together with another storage dam at Maguga in Swaziland, was found to be the best choice as a first-phase development (RSA, 1986c:3).

The proposed first stage of the first-phase development consisted of a storage dam on the Komati River. This river is the largest tributary of the Incomati River. This dam was constructed on the farms Schoemansdal and Middelpaats near Driekoppies in the district of Kamhlushwa in Mpumalanga (RSA, 1986c:3).

The proposed Driekoppies Dam was to be constructed to its final capacity of 251 mcm. Besides inundating 2 120 ha in KaNgwane, the dam also inundates about 380 ha of Swaziland territory. For this latter inundation of territory, formal approval had to be given by the government of Swaziland. This approval was given in 1989. Negotiations with Mozambique were also conducted in 1989 on the proposed development of the Komati River's water resources. This was necessary for Mozambique is the downstream riparian in this

international river system, and was therefore to be affected by the development (RSA, 1986c:3-4; DWA, 1989:102).

Construction of the Maguga Dam in Swaziland was expected to commence a year after the commencement of the construction of the Driekoppies Dam. This was to result in simultaneous completion of the two dams comprising the first-phase development (RSA, 1986c:3-4; DWA, 1989:102).

The two dams, when operated as a system to augment downstream run-off, were to permit a net total system draft of 678 mcm/yr for 80% of the time on average, taken over a long period. To avoid failure of the system during the remaining 20% of the time, the net total draft was reduced to 495 mcm/yr (RSA, 1986c:4).

The total cost of the construction of the Driekoppies Dam was estimated at R122 million at March 1986 prices. It was expected that this amount would increase to about R203 million if the prices increased at a rate of 15% per year during the construction period (RSA, 1986c:4).

Because the scheme was an international one, cooperation between South Africa and Swaziland was necessary. Swaziland and South Africa entered into a treaty for the best utilisation of rivers of common interest. Before this agreement, agreements had also been reached regarding the use of some of the water resources of the Incomati River Basin (RSA, 1986c:4).

This cooperation was strengthened by the joint study performed by South Africa and Swaziland, which led to the identification of the Driekoppies and the Maguga Dams as a first-phase development for immediate implementation. This was to be followed in the future by the implementation of up to five dams. The control and administration of the dam was to be a joint venture between South Africa and Swaziland. For this purpose, it was expected that a Joint Technical Commission, with some executive powers, be created (RSA, 1986c:4, 23).

The Incomati River is an international river basin shared by Mozambique, South Africa and Swaziland, but the water resources from the first stage of the first phase of development were only to be shared by South Africa and Swaziland. South Africa was to receive 239.1 mcm/yr and Swaziland 192.1 mcm/yr. Mozambique was to receive no water from the development (RSA, 1986c:17).

The environmental impacts of the dam also received attention by the DWA. The DWA stated in its 1986 report on the proposed Driekoppies Dam that the dam would generally have an insignificant effect on the natural environment. The effect on *fauna*, especially fish, was to be "slightly harmful". In this regard, it was proposed that a small fishing industry be established at the dam. It was also possible to install a fish-way at the dam in the future. Concerning the effect the dam was to have on the human population, the DWA stated that: "Fencing of the reservoir will isolate some of the local population, livestock and game from customary sources of water. The provision of alternative water supplies and the improvement of health education and of treated water and sanitary services, which form part of the general improvement of the infrastructure, may have to be expedited as a result of the construction of the dam" (RSA, 1986c:19-20).

Because of the international implications of the proposal, various actions were necessary before either of the two dams could be constructed. The DWA was instrumental in the establishment of the Komati Basin Water Authority (KOBWA) to oversee the development of the Komati River basin. A treaty was signed between South Africa and Swaziland to create KOBWA, whose first meeting was held in November 1992. The body consists of six members, three each from South Africa and Swaziland, two of whom are DWA officials. The Driekoppies Dam was entirely financed by South Africa and proceedings were initiated for KOBWA to obtain a loan from the Development Bank of Southern Africa (DBSA) for some R488 million. Construction of the dam was to commence in June 1993. The DWA took an active role in the planning for the relocation of the people affected by the dam in collaboration with the government of KaNgwane (DWAF, 1993:85).

7.4.16. The Injaka Dam and Bosbokrand Transfer Pipeline

In 1994, the Department of Water Affairs and Forestry (DWAF) proposed the Sabie River Government Water Scheme. The first phase of the scheme was to consist of the Injaka Dam and the Bosbokrand Transfer Pipeline (RSA, 1994:1).

The proposed first-phase development is a multi-purpose project intended to provide water for the expected increases in primary or domestic water requirements of the mainly rural and semi-urban populations of the Sabie River catchment. Small portions of the populations of the adjoining Crocodile and Olifants River catchments were also to receive water. The development was, in addition, to improve river flows in the Sabi Sand Game Reserve and the Kruger National Park and to stabilise water supplies to some of the existing irrigation and some of the irrigation that had fallen into disuse due to inadequate water supplies. Water was also to be supplied for a small increase in irrigation development (RSA, 1994:1-2).

Besides the benefits to the Sabi Sand Game Reserve and the Kruger National Park, all the other beneficiaries of the proposed development were resident in the Mapulaneng and Mhala districts of Northern Transvaal (now Limpopo province) and the Nsikazi district of Mpumalanga (RSA, 1994:2).

In 1994, DWAF stated in its report on the proposed development that: "Existing development in the Sabie River catchment is already causing serious water shortages in both the Sand River and Sabie River sub-catchments and future development and population growth will aggravate these water shortages. Unless the water supplies are augmented, the basic water requirements of the population in the largely underdeveloped region will not be met. Unless steps are taken to ensure perennality by augmenting low flows in the Sabie and the Sand Rivers, the natural riverine environments of the Sand River in both the Sabi Sand Game Reserve and the Kruger National Park and the Sabie River in the Kruger National Park will be irreparably damaged" (RSA, 1994:1).

Studies of the development possibilities of the Sabie River and its tributaries were carried out by the DWA during the period 1985 to 1991. The studies were directed by a steering committee representing various local interested and affected parties. Several alternative schemes were investigated and the proposed Injaka Dam in the Sabie River sub-catchment and the Bosbokrand Transfer Pipeline to supply water to the Sabie River sub-catchment were found to be the most economical first-phase development (RSA, 1994:2).

The proposed first-phase development of the Government Water Scheme consisted of a storage dam on the Marite River, a major tributary of the Sabie. The dam was to be situated on the farm Injaka in the Mapulaneng district near Bosbokrand in the Northern Transvaal. Water released from the dam was to augment the flow in the Sabie River during periods of low flow. A pumping station at the dam and a rising main will deliver water into a balancing reservoir. From here, a gravity-main was to deliver the water to the watershed of the Sand River sub-catchment on the farm Maviljan in the Mapulaneng district. Some of the water was also to be delivered by means of a gravity-main from the watershed into the Ndlbesuthu River, a minor tributary of the Sand River (RSA, 1994:2).

Preliminary costs of these works were put at R336 million at March 1994 rand values. This amount was to be spent over a period of about 15 years. The proposed Injaka Dam was to be constructed to its final gross storage capacity of 123 mcm. About 910 ha in the Northern Transvaal and 120 ha in the Eastern Transvaal were to be required for the dam, permanent housing, access roads, and reservoir area. The Injaka Dam, when operated, would also augment the low flows in the Sabie River. The dam will increase the net yield of the system by 57.8 mcm/yr. The Bosbokrand Transfer Pipeline, entirely in the Northern Transvaal, is able to transfer up to 25 mcm/yr across the watershed of the Sand River catchment. This pipeline consists of a 2.6 km long rising main to the balancing reservoir and two gravity mains with a total length of 9.1 km. The transfer pipeline was to be constructed in two phases and the pumps in the pumping station would be installed in phases as the water requirements increased (RSA, 1994:2-3).

Construction costs of the proposed Injaka Dam were put at R220.9 million at March 1994 prices, and an additional R13.5 million at March 1994 prices would be required for environmental (social and natural) programmes, land costs and compensation. The construction cost would increase to about R313.9 million if prices increase at a rate of 10% per year during the construction period. The construction cost of the proposed Bosbokrand Transfer Pipeline (pumping station, rising main, balancing reservoir and gravity main) was estimated to be R35.6 million at March 1994 prices. An additional R200 000 at March 1994 prices was to be required for land costs and compensation. The construction cost would increase to about R48.6 million if prices increased at a rate of 10% per year during the construction period (RSA, 1994:4).

It is interesting to note that a number of storage dams had already been in existence in the Sabie River catchment. These are the Da Gama, Casteel, Acornhoek, Orinoco, Edinburgh, and Zoeknag Dams. The Lebowa Government built the Zoeknag Dam. In 1993 it failed and was not repaired. This dam, which had a gross storage capacity of 8.5 mcm, was intended to supply water for irrigation and for some domestic requirements. Mozambique had also, prior to 1994, completed the Corumana Dam to supply water to 36 000 ha of irrigation (RSA, 1994:14-15).

Regarding the impact on the natural environment, DWAF stated in 1994 that: "The proposed Injaka Dam and Bosbokrand Transfer Pipeline will generally have a relatively small effect on the immediate natural environment. No geological or archaeological sites have been found within the reservoir area of the dam" (RSA, 1994:40).

Regarding the impact on the local population it was also stated that: "The populations of the largely underdeveloped Mapulaneng, Mhala and Nsikazi districts who derive their water from the Sabie River catchment will benefit directly from improved water supplies to some of the existing infrastructure for potable water supplies and from the additional water treatment works, reservoirs and pipelines that also have to be provided. This will have major health and social benefits that conform to the objectives of the Reconstruction and Development Programme" (RSA, 1994:41). The fact that the report on the proposed scheme refers to the Reconstruction and Development Programme (RDP) is an indication that the proposal was drafted after the African National Congress (ANC) came to power in May 1994. The RDP was the new government's response to the huge socio-economic inequalities that exist in South Africa.

7.5. The World Commission on Dams Hearings

7.5.1. The Maguga Dam

The construction of the Maguga Dam in Swaziland led to the establishment of the Ekuvinjelweni Resettlement Committee. Jameson Mncina and Ntokozo Ginindza from the Committee stated at the hearings that people are affected by a large dam project right from the beginning – when the rumours of a dam project start circulating. Because of these rumours, people start leaving their homes to settle elsewhere away from the rumoured dam. It was for this reason that the Committee proposed that proper consultations should be initiated between authorities and affected communities right from the beginning – e.g. when the project is being planned. The policies that should be laid down should be of such a nature that governments and private companies involved in the project must always involve communities and the communities must get involved and participate right from the start of the project. Community participation is therefore of the essence, so that these communities can involve themselves and restore their previous livelihoods (Stott, Sack and Greeff, 2000).

7.6. Conclusion

The Incomati River basin's hydropolitical history dates back to the early part of the twentieth century. The reason for this is the control of malaria in the river basin. Before this, farmers, because of the danger of the disease, did not regularly settle the river basin. This is evident from the fact that, by 1920, only two irrigation districts had been established in the Incomati River basin.

After the drought and depression of the 1930s, water resources development projects were starting to appear in increasing numbers on the Incomati River basin. This was followed during the long world economic boom by more and larger projects. These projects were not only implemented to assist the farmer. They were also built as a reaction to South Africa's socio-economic development. The fact that a large proportion of ESCOM's coal-fired power stations are situated in, or near, the river basin, was one of the stimuli that focussed attention on the Incomati River as a source of water for these installations. The Incomati River also supplies water to urban centre, an indication that the river, like the Orange and Limpopo, is an important part of the South African political economy. Further developments in the Sabie and

Sand sub-catchments will mean that, in future, the river will be used at an ever-increasing rate for socio-economic development.

8. THE MAPUTO RIVER BASIN

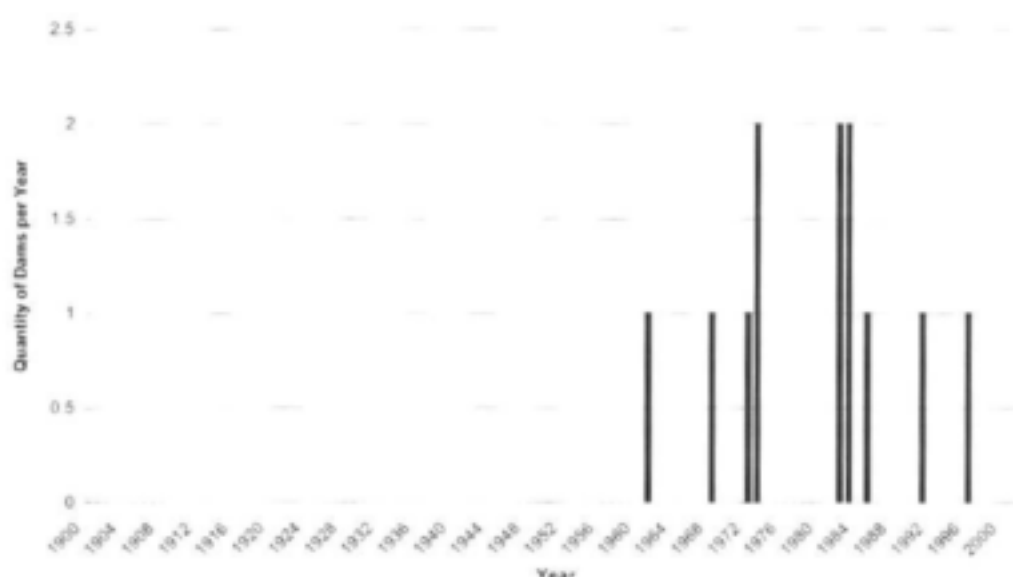
8.1. Introduction²²

The Maputo (known as the Pongola in South Africa) is the least developed of all international river basins to which South Africa is a riparian state (see Figure 9), making it a logical target for future "resource capture". The importance of this river basin is that it is a source for future water transfers to adjacent basins in "water deficit". The Maputo River is a recipient basin for no IBTs; a source basin for two IBTs; with no intra-basin transfers of any magnitude (Vas & Pereira, 1998:114; Vas, 1999:62). The Maputo River is of great importance to Swaziland (Turton, 2003a).

In this chapter the hydropolitical history of the Maputo River is described. In comparison with the Orange and Limpopo Rivers, and like the Incomati the Maputo has a short history. This history dates back to the early part of the twentieth century when the water resources of the river basin were exploited to a small extent only. Whereas political circumstances played a predominant role in the hydropolitical history of the other river basins, the Orange in particular, environmental phenomena were more dominant in the early stages of the Maputo River's hydropolitical history. This chapter starts with a physical description of the river basin and a look at the early developments of the river's water resources. This is then followed by the history of a number of water resources development projects, most notably the Pongola Irrigation Project, the Pongola-Makatini Flats Government Water Scheme and the Bivane Dam.

²² Part of the introduction to this chapter was taken, *verbatim*, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

Figure 9
Number of Large Dams Built in the Maputo River Basin between 1900 and 2002



8.2. Physical Description of the Maputo River Basin²³

The Maputo River has a total basin area of 35 000 km² with an MAR of 3 900 mcm. There are three riparians, with 56% of the basin area lying in South Africa (upstream riparian), 34% lying in Swaziland, and 10% in Mozambique (downstream riparian). Contribution to MAR by each riparian is not disputed, with 56% coming from South Africa, 38% from Swaziland and 6% from Mozambique (Turton, 2003a).

There are six dams with a storage capacity in excess of 12 mcm, with the largest being Pongolapoort Dam in South Africa that inundates part of Swaziland. Ironically, the water that this dam stores has never been used for the purpose for which it was overtly intended originally, but it serves to stake a claim over the resource for future development as a manifestation of the realist hydropolitics during the "total national strategy" era in South Africa. Plans are currently under consideration in South Africa to divert this water to other inland basins in "water deficit", but no final decision has yet been taken. There is a significant IBT from the Usuthu catchment for industrial use and the cooling of ESCOM power stations in the Limpopo and Orange River Basins (Heyns, 1995:8; Turton, 2003a).

²³ Part of the physical description of the Maputo River basin was taken, *verbatim*, from A.R. Turton's (2003a) D.Phil Thesis: *The Political Aspects of Institutional Developments in the Water Sector: South Africa and its International River Basins*. Pretoria: University of Pretoria.

Given the overall importance of stable energy generation to the effective functioning and long-term growth of the national economy in South Africa, the Maputo River is considered a strategic resource by South African planners. The Maputo River can therefore be regarded as having been captured by South Africa for transfer elsewhere as the strategic need dictates (Turton, 2003a).

8.3. Early Developments

The early history (from 1836 to about 1920) of the development of the Maputo²⁴ River's water resources is closely tied to the prevalence of malaria in the eastern lowveld areas of South Africa. Development, and especially agricultural development, in the Maputo River basin was minimal because of the malaria factor. It was only in the period 1915 to 1920 that whites started to settle the basin, and commenced with agricultural activities. And it was only in 1930-31, when Professor Swellengrebel's report stated that malaria could be controlled, that there was a more positive outlook on South Africa's lowveld as an area of socio-economic development (Union of South Africa, 1944:3). This was also, to a certain extent, the case in parts of the Incomati River.

During the 1930s, the cases of malaria in Natal dropped remarkably, due to controlling measures. For instance, during the 1932 malaria epidemic, the two main hospitals in Durban treated 13 578 cases, of which 2 252 cases were malaria cases. In 1938, these hospitals treated 26 009 cases, of which only 64 cases were malaria cases. The Commission of Inquiry into the History of the Pongola Settlement concluded by saying that "the control methods in operation in this Province [Natal] have succeeded in reducing the incidents of malaria from a very grave economic and public health menace to relatively insignificant proportions" (Union of South Africa, 1944:3).

Thus, while the other river basins under consideration were already well developed, from a water management perspective, the Maputo River was still lagging behind due to the prevalence of malaria. It was only in the mid-1920s that plans for an irrigation project on the Maputo River were put forward.

8.4. Water Resources Development Projects

8.4.1. The Pongola Irrigation Project

Possibilities for irrigation development along the Maputo River in its upper reaches are limited. This is due to the fact that the valley within which the river flows is too narrow. However, it is only when the area in which the Pongola Irrigation Scheme is reached that extensive irrigation becomes a possibility (Union of South Africa, 1961e:5).

In 1925, at the request of R.A. Rouillard, a local farmer, and E.G. Jansen, then MP for Vryheid, the Department of Irrigation initiated a survey of the construction of an irrigation scheme on the Pongola (now Maputo) River. The purpose of this scheme was to serve both sides of the river down to Lebomboport (Union of South Africa, 1944:1).

²⁴ Formerly known as the Pongola River.

In 1931, the Irrigation Commission recommended that the Pongola Irrigation Project be included in the "building programme" for the year 1930-1931. In the same year, a report from the Irrigation Commission was submitted to the Minister regarding this project. This report was tabled in parliament during the 1932 session and considered by the Select Committee on Irrigation Matters. On 13 May 1932, the Committee recommended that the project should be implemented as a Government Irrigation Scheme (Union of South Africa, 1944:1).

One of the possible obstacles regarding the implementation of irrigation projects in this part of South Africa, during the 1930s, was, as mentioned, the occurrence of malaria. However, the Committee was convinced that the risk of malaria fever was at that time minimal due to the control of the disease. A large area of land was purchased by the Department of Lands, at a low price from the Candover Estate Company, Ltd. The farm Uitkyk, belonging to the Company, was also bought. While Uitkyk was still in the hands of the Company, an experimental station was established on it. The purpose of the project was to improve the living standards of the settlers living in the Pongola Valley. In particular, the settlers would grow cash crops such as Tung Nuts, coffee and citrus fruit. The Commission also considered that full use should be made of the pumping station at Uitkyk. If this could be done, large plots of land could be given to former employees of the Company. The Commission regarded these people to have considerable knowledge of soil types and other agricultural conditions within the Pongola valley (Union of South Africa, 1932b:28).

In February 1931, the Commission obtained a preliminary report from the Irrigation Department on possible irrigation projects along the Pongola divide. These irrigation projects were as follows:

- West of Rooirand;
- West of Lebombo; and
- East of Lebombo.

The first two schemes would depend on the flow of the Pongola River without storage. The scheme to the east of Lebombo would require storage in the Lebomboport. The third scheme would have submerged a considerable area that could have been irrigated under the second possible scheme. Although the Lebomboport was a good sight for a storage reservoir, the area to the west of Rooirand had better soil types than the one east of Lebombo. The Irrigation Commission considered the west of Rooirand to be a better proposition than the east of Lebombo option. It recommended that investigations into the west of Rooirand option be carried out so that further recommendations could be made (Union of South Africa, 1932b:28).

Construction of the works started on 16 June 1932, after the Union parliament approved the scheme. The project was situated in the Piet Retief (Transvaal) and Ngotshe (Natal) districts. The works consisted of a diversion weir and about 65 km of canal. The irrigable area that was served by the project was near 6 000 morgen. Initially labour was to be supplied by Bantu-speaking people from the area, with white supervisors overseeing the work. However, the Irrigation Department received instructions that up to 250 white labourers should be taken on. This was a measure to relieve the districts of Vryheid and Piet Retief, where there was "acute

distress" due to drought and unemployment (Union of South Africa, 1934c:22; Union of South Africa, 1961e:5).

The average labour force on the project was 124 whites and 1 080 blacks. White labourers were paid five shillings per day, and were charged one shilling for their food. Accommodation in wood and iron bunkhouses was free. The black labourers were, on the other hand, paid one shilling 3d per day, but received their food free of charge (Union of South Africa, 1935a:26). The reason for using more "native" labourers than whites was the high cost of accommodation for whites in a malaria area. Construction work on the project was completed by the end of 1934. Before this, at the end of July 1934, the white labourers were paid off and only black labourers were retained (Union of South Africa, 1936:36-37). Work on the project was completed in early 1935, and the project was handed over to the Department of Lands from the Irrigation Department. Malaria did not restrict the construction of the works, because the Senior Malaria Officer of the Department of Public Health's advice on the prevention of the disease was strictly adhered to (Union of South Africa, 1944:2; Union of South Africa, 1961e:5).

Because of the depression, the government decided that it would also allow single white men who had graduated from agricultural schools to settle on the scheme. They were, however, not permitted to marry, until such time as they had completed their "probationary period and received the allotment of the holdings" on the scheme (Union of South Africa, 1944:2).

In 1937, the Irrigation Commission reported that there were about 20 people on the settlement working in groups on a share basis. Large areas of land were planted with maize and potatoes and "good crops were anticipated". An experiment with cassava, for stock feed, was even conducted (Union of South Africa, 1937d:12). In 1939 a new government came to power and a new policy regarding the disposal of Crown land was adopted. This policy can be summarised as follows: "that for the duration of the war [Second World War] no holdings should be made available for allotment in order to give soldiers, as well as other applicants, an equal opportunity, after the cessation of hostilities, of applying for holdings". The result was that no further holdings on this settlement were advertised (Union of South Africa, 1944:2).

In November 1941, the Minister of Lands decided to close the settlement. The remaining lessees were given the option of either moving to the Loskop settlement, or receiving the balance of their trust accounts as their final claim to their holdings. This decision was based on the following criteria: the climatic conditions at the settlement (it rained a lot); the high administrative cost of running the settlement; and additional costs to the lining of canals that were starting to leak. Evidence suggests that malaria was also a factor that was considered in the closing down of the Pongola Irrigation Settlement. The Commission that looked into the history of the Pongola Settlement stated in 1944 that full malaria control should be initiated, in not only the Pongola Settlement, but also the Loskop Settlement. If this were done, malaria would no longer be a prohibitive factor in irrigation development – not only in the lowveld area of South Africa, but other parts of the country as well (Union of South Africa, 1944:2; Union of South Africa, 1961e:5).

Three out of the 28 lessees asked for the payment of the amounts due to them and left the settlement. Twenty-two requested to be moved to the Loskop settlement, three were discharged, and the other 15 were still in active military service. These 15 soldiers' claims would have received consideration after they had been discharged from the military. Some of

the holdings were also used by government to grow food, because of a food shortage the Union experienced due to the war (Union of South Africa, 1944:2).

In 1943, a Commission of Inquiry was launched to investigate the Pongola Settlement and to come up with policy recommendations regarding the resuscitation thereof. This was after the Settlement had been closed in 1941. The conclusions of the Commission of Inquiry can be summarised as follows:

1. That the Pongola Settlement can be made a successful closer settlement scheme;
2. That malaria can be thoroughly controlled;
3. That healthy families can be raised under the prevailing climatic conditions, particularly if the children are given a change of climate during the latter period of their education;
4. That while the settlement might be a success under present transport facilities, it would be more of a success if the transport facilities were improved;
5. That sugar farming is the most successful form of agriculture as a main crop to be carried out in this area, but that this be held in abeyance for the time being until the sugar position with regard to the Union had been more clarified (Union of South Africa, 1944:5).

From this the Commission of Inquiry made a number of recommendations. They were as follows:

1. That the Pongola Irrigation Scheme should be fully utilised for closer settlement purposes;
2. That the scheme be divided into allotments containing at least 30 morgen of irrigable land;
3. That prior to the allotment of the land houses of a type and position approved of by the Health Department be built on all lots;
4. That the health of the settlement should be under control, as recommended by Dr Annecke's (senior malaria officer from the Department of Public Health) recommendations. These recommendations are as follows:
 - That the construction of dwelling houses, for both whites and blacks, shall not be altered without consultations with the Department of Public Health. The construction of these dwellings shall be done in the following manner:
 - a) Screening of white and black sleeping quarters;
 - b) Porch and double doors on front and back doors of house; and
 - c) Due regard for ventilation of roof and floor.
 - Intelligent use of a reliable insecticide in screened European and particularly in screened Native sleeping quarters;
 - Use of bednets if deemed necessary by the Department of Public Health;
 - Use of repellent smears if necessary only recommended by the Department of Public Health;
 - Institution of anti-larval work, i.e. -
 - 1) Permanent destruction of dangerous mosquito breeding grounds;
 - 2) Where (1) is impracticable the treatment of these breeding grounds by oils recommended by the Department of Public Health. The extent of this work is dependent on size of the settlement and in any case shall only be undertaken by trained staff passed for the purpose by the Department of Public Health.
 - Sanitation arrangements and potable water supply shall be subject to conditions required by the Department of Public Health;

- Necessity may arise in an area to institute measures for prevention of bilharzia requiring greater care for drinking and ablution water supplies;
 - Staff requirements will vary with the size of the scheme envisaged. These may entail –
 - a) A resident doctor
 - b) A resident certified health inspector
 - c) Suitable trained sub-ordinate native personnel, and finally
 - d) Labour gangs.
 - If necessary anti-larval and anti-adult measures to extend beyond boundaries of the settlement, bearing in mind effective (nocuous) range of vector flight is 2.4 km;
 - Native labour should be recruited from locality if elsewhere in consultation with Department of Public Health;
 - Any other reasonable measures to maintain health.
5. That in the selection of superintendents it should be borne in mind that the superintendent should remain on the settlement long enough to carry out any programme of development for which he is qualified;
 6. That the form of farming for the present should be mixed farming, with winter potatoes, wheat, and maize as the main crops. That these should be farmed in close conjunction with cattle, both for beef and, on a smaller scale, dairy products;
 7. That pig farming should be encouraged extensively;
 8. That the growing of cash crops, such as fruit and vegetables, be encouraged; always bearing in mind that the first objective is to provide the settler and his family with an adequate supply of fruit and vegetables;
 9. That the question of accessibility to markets is one of the controlling factors in making the settlement a success. Therefore, it is recommended that all-weather roads be constructed to both railheads, i.e. Golliel and Piet Retief. Further that as soon as circumstances permit the question of the building of the link railway line from Golliel to the Piet Retief line be considered;
 10. That as soon as an opportunity arises the settlement should be converted to a sugar-growing proposition, complete with its own mill, etc. This recommendation will not interfere with the recommendations regarding cattle and pigs;
 11. The Commission does not recommend the immediate complete lining of the main canals and subsidiaries, but does recommend that gauges be immediately instituted and consistent records kept. Some portions of the canals will have to be lined, but the Commission recommends that this work shall be left over for the present until further information is available as to its necessity;
 12. "Superimposed on all the previous recommendations is the question of fixation of prices. The Commission, therefore, recommends that some practical scheme of price fixation be investigated as without fixation of reasonable prices, both to the producer and consumer, closer settlement cannot be successful over a period" (Union of South Africa, 1944:5-6).

The decision to resuscitate the Pongola Irrigation Scheme for the production of sugar-cane necessitated considerable improvements to the distribution system to increase its delivery capacity. Betterment works in this regard started in 1950 and were completed in 1955. These works cost an estimated £1.1 million, of which £192 416 represented the cost of the original works. Some five years after the rehabilitation of the scheme the DWA decided to enlarge the scheme, this after the scheme proved "an outstanding success", according to the Department (Union of South Africa, 1961e:5).

This success was due to the tonnage of sugar-cane and the revenue it produced for the settlers on the scheme. In the early 1960s, 5 386 morgen was irrigated. The tonnage of sugar-cane produced by the farmers had increased considerably since production started in the mid-1950s. The sucrose content of the cane was also high as a result of the favourable climatic conditions. Each morgen of land produced no less than 8 tonnes of sugar-cane. The average income per morgen was about £160 per year gross, or £80 net at least. The average net income per farmer amounted to no less than £2 400 per annum for a scheduled area of 30 morgen (Union of South Africa, 1961e:5).

The success in the growing of sugar-cane at the Pongola Irrigation Settlement led to the rapid development under sugar-cane of the privately owned areas along the river downstream, between the Rooirand and Lebombo Mountains. The basin of the Maputo River was proclaimed a Government Water Control Area, under the Water Act, No. 54 of 1956 (Union of South Africa, 1961e:5-6). Therefore, sugar-cane production dominated agricultural activities on the Pongola Irrigation Scheme. However, it was also in light of South Africa's national sugar demand that the scheme was proposed.

8.4.2. The Pongola-Makatini Flats Government Water Scheme

In 1960, the sugar requirements of South Africa, to cover domestic consumption and a total export quota of 269 000 tonnes, were estimated at 1 066 000 tonnes. Analyses at the time showed that domestic consumption was to increase at a rate of 3.5% per year. The total sugar requirement for South Africa for 1980 was estimated, in 1960, at 1 836 000 tonnes in 1960, or 812 000 tonnes more than the total production for 1960. According to the DWA, in 1960 "The Pongolapoort-Makatini Flats project is the only irrigation scheme in the Union [of South Africa] which can provide, at reasonable cost, the additional sugar production capacity required" (Union of South Africa, 1961e:6).

With this in mind, and to irrigate 64 000 morgen of land, for sugar-cane production, the DWA came up with a plan to further utilise the water resources of the Maputo River in 1960. The proposed plan included the irrigation of sugar-cane in Zululand in the area east of the Lebombo Mountains. It was also envisaged that the water resources would be supplemented for this purpose with a portion of the Assegai River. The motive behind the irrigation of sugar-cane was to meet the anticipated demand for sugar in South Africa up to the year 1978 (Union of South Africa, 1961e:2, 13).

The proposed plan envisaged the construction of a major storage dam on the Maputo River at the lower end of the Pongolapoort through the Lebombo Mountains, about 20 km south-east of Gollel. The plan also proposed the construction of concrete-lined canals to distribute the stored water to the areas to be irrigated. The final phase of the project intended to divert part of the Assegai River into the Maputo catchment, above the new dam. This was done by means of a canal and tunnel, to increase the available water supplies (Union of South Africa, 1961e:2).

The area intended for development lies along the Maputo and M'kuzi Rivers. It was planned to bring about 65 000 morgen of land under irrigation. In the early 1960s, it was envisaged that the scheme would provide substantial quantities of water (about 270 million litres per

day) to meet the needs of future townships, industries, and other non-agricultural users with water. The estimated cost of the project was £18 million (Union of South Africa, 1961e:2).

Also of interest was that the DWA stated in its 1961 report on the proposed scheme that negotiations with Swaziland had to be entered into as regards three aspects. The first pertained to the diversion of the Assegai River, a tributary of the Usutu River, which flows from South Africa into Swaziland. In the report it was stated that: "In conformity [sic] with accepted international usages where the utilization of the flow of a river of common interest to more than one state is concerned, it will be necessary to consult with the Swaziland Government in order to determine the conditions in this connection, if any, which may require to be observed". The second aspect concerned the inundation of a portion of Swaziland territory by the reservoir of the Pongolapoort Dam. The size of the territory was about 2 200 morgen. The report stated in this regard that negotiations with Swaziland should be initiated, "in order to obtain agreement and decide upon the method of compensation for this encroachment". The third element regarding negotiations with Swaziland concerned "the possible future utilization by the Union of portions of the flows of the Usutu and Ngwavuma rivers in the lower Pongola valley" (Union of South Africa, 1961e:15).

8.4.3. The Bivane Dam

During the period 1989-90, the DWA planned a scheme according to which a dam was to be built in the upper reaches of the Pongola River. This proposed dam was to eliminate the water shortages that occurred regularly at the Pongola Government Water Scheme. Dam sites at Jagtdrift and Paris were being investigated along with the impact on long-established communities and the environment. The economy of the entire scheme, which included the canal betterments and possible extensions at Pongola, was also investigated (DWA, 1990:85).

In January 1996 the former Minister of Water Affairs and Forestry, Prof. Kader Asmal, approved a subsidy estimated at R35 million (one third of the total cost) for the implementation of the Paris Dam (now Bivane Dam) Water Supply Scheme to be built in the Bivane River, a major tributary of the Maputo River. The Bivane Dam has a storage capacity of about 118 mcm (DWAf, 1996c).

The dam was constructed on behalf of the Impala and Pongola River Irrigation Boards to supplement water from the Pongola River for the provision of sugar-cane irrigation requirements as well as to supply approximately 220 000 rural inhabitants with potable water. These irrigation boards sourced the bulk of the capital costs of the dam through loans. The dam was also constructed in line with Reconstruction and Development Programme (RDP) principles, to link economic growth, development, and equity. The growth would emanate from the stabilisation and expansion of the successful irrigation agriculture and the development element from the supply of water to the rural communities in the surrounding areas within convenient walking distance. The dam supplies water for domestic use to nearly 260 000 people. Equity is promoted by the provision of water to develop 700 ha of irrigation for about 70 small farmers from black communities at Pongola. Improved road works and compensation land to the communities directly affected by the construction of the dam were also provided (DWAf, 1996c).

The subsidy of R35 million was subjected to RDP requirements. These requirements are as follows:

1. Capacity-building through the involvement of rural communities;
2. The establishment of a representative steering committee consisting of all interested and affected parties;
3. The assurance that the provision of domestic water will enjoy priority during drier seasons; and
4. The implementation of environmental impact recommendations before the construction of the dam (DWAF, 1996c).

Before the construction of the dam started, the provincial government of KwaZulu-Natal had to agree to the scheme. Because the Maputo River is a shared river basin between Mozambique, South Africa, and Swaziland, formal consent from the neighbouring countries was obtained (DWAF, 1996c).

With the approval of the subsidy, the Minister said that: "This scheme represents an important partnership between the white farmers who benefited under previous governments and the black communities who were formerly excluded" (DWAF, 1996c).

Construction began in 1997 as a joint effort between the Pongola cane growers, the DWAF and Illovo Sugar. The dam was completed in December 1999 and provided supplementary water to the Pongola Irrigation Scheme for the first time in the winter of 2000 (Illovo Sugar, (2003). *Bivane Dam Proves Its Worth*. <http://www.illovosugar.com>, 2 March 2002.)

"For the past two seasons the Pongola growers have had the full benefit of water from the Bivane Dam. The dam provides up to 60% of the Pongola Irrigation Scheme's water requirement during winter. During 2002, 34.59 million cubic metres of water was released into the Pongola River at an average rate of 12 960 cubic metres per hour (12.96 million litres of water every hour)" (Internet: Illovo Sugar, 2003).

The water supply from the dam provides a substantial boost to sugar-cane production in the area. According to Illovo Sugar, "Given the water to irrigate throughout the year over the past two seasons, Pongola's growers have been able to increase their yields from an average of 87 tons/ha to 96 tons/ha with some growers now harvesting up to 135t/ha. The 2001/02 season produced a record crop from Pongola growers of 1 263 939 tons of cane and the 2002/03 crop is likely to exceed this" (Internet: Illovo Sugar, 2003).

Not even the dry spell South Africa experienced at the end of 2002 and the beginning of 2003 had a major impact on cane production. "In spite of a relatively dry 2002/03 season, growers in the Pongola area who benefit from the scheme were able to irrigate their young cane throughout the winter. This ensured that the drop-off in yield usually experienced on fields harvested in the late summer was considerably reduced. The ability to irrigate the ratoon cane during winter also made it possible for the cane to ratoon more quickly and this bodes well for the 2003/04 crop" (Internet: Illovo Sugar, 2003).

As stated earlier, the rural communities in the area are also benefiting from the scheme. In January 2003 Illovo Sugar reported that: "An important part of the Bivane Dam scheme is the benefit it has for local rural communities. The scheme is designed to provide high-quality

potable water to the Mthethwa Tribal area where as many as 4 000 homes have been provided with clean water 'on tap'. In addition to the potable water scheme, about 500 ha of first-class cane land has been developed and occupied by 54 emerging farmers. These new small-scale growers from the Ntshangase, Simelane, and the Nxotshane communities each farm approximately 10 ha of cane. The growers have become landowners and each holds title deeds for his/her own plot. In the 2001/02 season the Phumulela farmers, as they have become known, harvested 25 235 tons of cane off 301 ha at 85 t/ha. The low yield was mainly because the cane was harvested very young in order to get the crop into cycle. In the 2002/03 season, it is estimated the Phumulela growers will have produced at least 55 000 tons off 535 ha at about 103t/ha, with some growers harvesting as much as 127 t/ha. The eventual area to be developed is 738 ha and feasibility studies are in progress in various areas to find suitable land for the remaining 203 ha of the scheme. Once complete, the scheme will provide land for some 73 emerging farmers and will deliver 65 000 tons of cane to the Pongola mill" (Internet: Illovo Sugar, 2003).

Thus, whereas the first irrigation settlement on the Maputo River provided employment to white settler farmers only, the Bivane Dam Water Supply Scheme has led to the socio-economic improvement of all racial groupings in the area where the dam is situated.

8.5. The World Commission on Dams' Hearings

8.5.1. The Pongolapoort Dam

The impacts of the Pongolapoort Dam on the communities near the dam, especially those living downstream of it, were communicated to the WCD hearings by The Combined Phongolo River Floodplain Committee Programme. The environmental impact and the subsequent socio-economic impact on communities downstream of the dam was one of the complaints. The Committee stated that: "With the construction of the dam you had the natural flood regime altered completely – the water would be released either at the wrong time or for too long a duration. This had an immediate impact on the socio-economy of the people that lived immediately below the dam. Indigenous rights were encroached on by this development" (Stott, Sack and Greeff, 2000).

The Committee also said that the dam was a "white elephant", because no one ever settled as a farmer on the scheme. In the 1970s and early 1980s, a state cotton scheme was established. This resulted in the removal of about "5000 people from their place of origin". During the same period a game reserve was proclaimed. This was for the protection of a herd of elephant in the area. This also resulted in the removal of the people outside of the proclaimed area (Stott, Sack and Greeff, 2000).

The Committee also stated that the dam has a huge problem: water has to be released from the reservoir regularly so that the pressure of the water behind the dam does not cause any cracks in the dam wall. The release of the water by the DWA was done without any prior consultation with the communities. The response from the communities to this state of affairs was to establish the Pongola Water Committee in 1987. There are presently 14 water committees, each comprising of five user-groups from the dam to the Mozambican border. These committees were formed to negotiate the release of water from the dam. The committees also look into matters such as health and agriculture, with The Combined

Phongolo River Floodplain Committee Programme coordinating these different committees. The programme succeeded in negotiating the release of water from the dam. These releases worked well for a couple of years, until a number of cotton farmers got together and "held the entire programme to ransom". According to the Committee present at the hearings, the water releases from the dam, as negotiated by the Committee, do not comply with the cotton-growing cycle of the cotton farmers (Stott, Sack and Greeff, 2000). It is not clear whether these cotton farmers negotiated a new water release regime from the dam. However, the cotton farmers and the Committee are not seeing eye-to-eye on the management of the river system from the Pongolapoort Dam to the Mozambican border.

The Committee therefore suggested that the WCD establish a kind of unit akin to the Security Council of the UN, which would look into the planning, monitoring and decommissioning of dams. With the setting up of such an institution, problems regarding large dams would not be as frequent as in the past (Stott, Sack and Greeff, 2000).

8.6. Conclusion

The hydropolitical history of the Maputo River, as with that of the Incomati River, dates back to the early part of the twentieth century. Malaria also played a role in the slow development of the river, as a source for surface water. Therefore, this chapter has shown that the Maputo River has a relatively short hydropolitical history, compared to that of the Orange and Limpopo Rivers.

The development of water resources development projects started after the drought and depression of the 1930s. These occurrences in the history of South Africa were therefore the main stimuli for the initial development of the river basin. Throughout the twentieth century, the river basin was, like the other international river basins, the target for grandiose schemes, like the Pongolopoort Dam. This scheme was not without controversy. This is evident in the World Commission on Dams Hearing held in 1999. The development of the Maputo River basin culminated in the construction of the Bivane Dam. Capacity-building of previously disadvantaged farming communities was one of the main stimuli for the project, supplying water to small-scale sugarcane farmers along the Maputo River.

9. LEGISLATION AND INSTITUTIONAL CAPACITY PERTAINING TO THE WATER RESOURCES OF SOUTH AFRICA

9.1. Introduction

In this chapter the legislative and institutional developments relating to water in South Africa and the river basins respectively are discussed. The history of the legislative aspects concerned with water dates back to the settlement of Europeans in 1652. Nonetheless, there is scant evidence, if anything at all, regarding the traditional "legislation" surrounding water resources in South Africa. The authors were unable to retrieve any written documentation about the traditional laws concerning the management of water resources. It is believed that the information does exist, but in oral form, and that the time and financial resources at the researcher's disposal were too limited to give any detailed attention to this matter.

Even so, the history of written water legislation dates back to the mid-seventeenth century. This first part of this chapter traces the history of South Africa's water law. In this part of the chapter reference is also made to the successive Departments of Water Affairs. The second part of the chapter looks at the South Africa-Namibian border issue. This is an important matter to consider as future water resources development projects on the lower reaches of the Orange River might be subjected to the border issue. The third part of the chapter summarises the international treaties and agreements that had been reached within the four international river basins between South Africa and its neighbours. This part shows that South Africa's international river basins are not at risk of "political stress" or "conflicting interests" as argued by Wolf, Yoffe and Giordano (2003). Lastly a conclusion is drawn.

9.2. The Origin of South African Water Law

South African water law is the product of different law systems. The rules of English, Roman, Roman-Dutch Law and even American Law have to a lesser or greater extent assisted in the establishment of the South African water law. The rules of these systems sometimes clashed and led to great misunderstanding for both implementers and beneficiaries of the law (Gildenhuys, 1970:4).

Under Roman law, a distinction was drawn between a river (*flumen*) and a stream (*rivus*). A stream that did not have much water in it, or that did not flow that often, was a *rivus*. The more permanent and larger streams were called *flumines* (Gildenhuys, 1970:4).

The water in a *rivus* could be used privately and was linked to private property. The owner of such property was allowed to use the water. The water in a *flumen*, on the other hand, was seen as *res communis*. This meant that the water, under certain limitations, was there to serve the joint needs of the riparian owners. This joint utilisation meant that the river could be navigated, that the owners had a right to use the river's water for domestic purposes and to command the water for irrigation purposes. This, if the utilisation did not injure another riparian owner (Gildenhuys, 1970:4).

The joint utilisation of *flumines*, which all citizens could use, was controlled by the state. The Caesar of the Senate had the right to block the utilisation of a river's water. He could also stipulate rules regarding the utilisation of a river's water for a specific purpose. The state was

not the absolute owner of public waters, but commanded absolute control regarding the allocation of public waters (Gildenhuys, 1970:4).

Even so, in The Netherlands, the philosophy of *state property rights* over water resources in public rivers started to take shape from the seventeenth century onwards. By the eighteenth century it was widely accepted. All rights concerning the water resources in public rivers belonged to the state. It was the state's property and was not (as was the case under Roman Law) under state control. As in English Law, every owner of riparian land had the right to use the water resources of a river. This right was in accordance with the property rights the owner had over the land. The owner could use the water resources of a river to such an extent that it did not cause appreciable harm to the other riparian owners. The basic principle was that the right, regarding the use of waters in natural rivers, was there for the riparian owners' use and that such a use did not belong to the state (Gildenhuys, 1970:6).

9.2.1. Early Developments of the Water Law in South Africa

Shortly after the arrival of Jan van Riebeeck at the Cape of Good Hope, in 1652, problems concerning the allocation of water surfaced. The first exercise of state control over the public streams of South Africa is to be found in the *Placaat* (Placard) of van Riebeeck, which was published on 10 April 1655. This *Placaat* was issued in response to sailors becoming ill because of polluted water obtained from the streams of Table Valley. In the *Placaat*, van Riebeeck prohibited "*aancomende opperhoofden en minder gequalificeerde persoonen*" from washing themselves and their clothes in those streams. There was also a stream that originated on the slopes of Table Mountain, which flowed into Table Bay. This stream gave rise to clashing interests between gardeners and the manager of the Dutch East India Company's water mill. On 16 December 1661, Van Riebeeck issued a *Placaat* which forbade the use of the water for irrigation to the prejudice of the Company's mill and other activities (Hall, 1937:160, 161; Hall & Burger, 1957:1; Gildenhuys, 1970:6).

It was in 1761 that a resolution of the Council of Policy of the Dutch East India Company actually authorised the use of water of the Table Valley streams for irrigating gardens for four hours every day. This authorisation was published in the form of an interdict against any use of the water by landowners except during these four hours. After this authorisation, the Council of Policy referred the matter of the division of water, during the hours of water-leading, to the *Burgherraad* of Cape Town. This body then fixed hours of water-leading for all the proprietors of the gardens. Notwithstanding this fixture, there was constant friction between the garden owners and the Company's miller and between the gardeners themselves (Hall, 1937:162; Hall & Burger, 1957:1).

Lewis (1934:2) states that the first farms around the Cape where the Dutch settled were generally not along the upper reaches of the rivers and their tributaries. In this regard he says that: "What a simple affair water law would be if settlement and development of a new country proceeded from the tops of the streams downwards so that priority of time would fall in with priority of position and establish an easy rule".

Subsequently, as the town grew and the gardeners became more extensive new claimants to water appeared. At the same time, the town demanded the whole of the undiminished flow

once a week for the flushing of its open drains. The reason for this flushing was the stench that originated from the drains (Hall & Burger, 1957:1).

In 1787, the Council of Policy appointed a committee to hold an inquiry into the entire position of the use of the Table Valley streams. This committee consisted of two members of the Council and two commissioners of the Court of Justice. The committee recommended an extension of the hours of water-leading to eight, and a new system of distribution by turns. The Council adopted these recommendations. It laid down a series of regulations for the control of the water and provided severe penalties for any contravention of them. After 1787, according to Hall and Burger (1957:2), there do not appear to have been any further dealings by the Council of Policy with the streams of the Table Valley.

Later there were clashes between farmers and the people of Stellenbosch over the allocation of the Eerste River. Placaats and the announcements of the courts and Heemraden solved these clashes.²⁵ These announcements confirmed that the state was *dominus fluminis*. Regarding *dominus fluminis* the state had the absolute right to grant that water to whomsoever it chose. "It was always at pains to impress upon those persons to whom it granted water rights that those rights were granted as a privilege which could be withdrawn at any time if it appeared to the Council that the conditions under which the grant had been made had not been observed" (Hall, 1937:165-167; Hall & Burger, 1957:2; Gildenhuys, 1970:6).

After the occupation of the Cape by the British, in 1795, the same principle was upheld. The principle of state ownership was removed and replaced by the principle that the owner of land is also the owner of all water resources that originated on his land. With the final occupation of the Cape by the British in 1806, an entire change in the policy of land tenure occurred (Lewis, 1934:8; Hall & Burger, 1957:2; Gildenhuys, 1970:6).

This was in contrast to Dutch policy. "The [Dutch East India] Company had, it is true, granted land in freehold to certain favoured persons, but its general policy had been to grant leases for limited periods and to retain the ownership of the soil for the Government. Although the leases were generally renewed upon expiration, the tenure was in law a precarious one and the British Administration decided to adopt a policy, which had as its object security of tenure. It proceeded to give every lessee full ownership of the land on the basis of a perpetual quitrent grant and to make further grants to crown land on the same basis" (Hall & Burger, 1957:2).

Even so, the records of the Court of Landdrost and Heemraden at Stellenbosch show that up to the year 1826 that body continued to adjudicate in water disputes. In fact, the first case before the Court of Landdrost and Heemraden, which was taken to the Privy Council, was in 1819 when they settled the water rights between two farms La Cotte and Cabriere. They allotted the water of certain tributaries of the French Hoek River to the latter and the water of other tributaries to the former. Its commissioners also framed regulations for the use of the water of various rivers in the large area, which was then the district of Stellenbosch. In one instance, the governor sent these regulations for confirmation so that they might obtain legislative sanction. Without these sanctions, they were apparently not considered by the Court of Justice to be binding upon the parties. This practice continued right up to 1826. In

²⁵ In The Netherlands matters relating to dikes and water were entrusted to Heemraden (Lewis, 1934:10).

1827, the Courts of Landdrost and Heemraden were removed and magistrates took their place (Lewis, 1934:10, 11; Hall & Burger, 1957:2-3).

Cases regarding disputes between landowners about which streams and rivers flowed were judged upon the principle that the landowner was the absolute owner of all water *crumpens in suo*. This doctrine was abolished in 1869, when the Privy Council rejected it and suggested that the correct principle was that "when water had flowed beyond the boundaries of the land on which it rose in a known and defined channel, the lower owners became entitled to it" (Hall & Burger, 1957:3-4).

9.2.2. The Foundations of South African Water Law

The case of *Louw v. Retief*, heard in 1856, laid the basis of the Common Law of water rights in South Africa. The foundation of South African water law was further strengthened by Judge J.H. de Villiers (Hall, 1947: 483; Hall & Burger, 1957:4). In his delivery of *Hough v. Van der Merwe* (1874), he stated his position as follows:

"According to our law the owner of land, by or through which a public stream flows, is entitled to divert a portion of the water for the purposes of irrigation, provided – firstly, that he does not deprive the lower proprietors of sufficient water for their cattle and domestic purposes; secondly, that he uses no more than just and reasonable proportion of the water consistently with similar rights of irrigation in the lower proprietors; and thirdly that he returns it to the public stream with no other loss than that which irrigation causes" (Gildenhuys, 1970:6).

The principle here is as follows:

- a) Only riparian owners qualify for the use of public water;
- b) The water must be used for domestic purposes, stock watering and irrigation; and
- c) Every riparian owner is entitled to a reasonable share of the water (Blaine, 1885:2; Gildenhuys, 1970:60).

These principles were most certainly derived from Angell on *Watercourses* and the decisions quoted in paragraphs 95, 120, 121, and 128 of that work. It also showed a similarity to the judgement of Justice Bell in *Retief v. Louw*, delivered in 1856 (Hall & Burger, 1957:4). However, before and during the same year of De Villiers's judgement, bills dealing with irrigation came before Parliament in 1861, 1863, 1866, 1874 and 1875 (Bell, 1891:18; Lewis, 1934:35; Hall, 1939:61).

If the owner of the land refused to accept the amount awarded, the dominant owner could pay the amount into a bank to the credit of the servient owner and take and use the land for the laying of the furrow. Provision was also made, under the law, for compensation for damage caused by the owner who constructed the furrow. This safeguarded the rights of the servient owners to passage over the furrow. A further provision was made which gave the government the right to expropriate any land or the bed of any river for the construction of irrigation works and for the purposes of irrigation, upon paying compensation (Hall, 1939:61-62).

The parliament of the Cape Colony debated the implementation of an Irrigation Bill, in 1866. This Bill was advanced under the assumption that if land should be irrigated it would increase in value. This increase, it was argued, would be directly proportional to the type of crops to be planted. For instance, if land was brought under irrigation for £100 000, it could return £40 000. If the land under irrigation would be planted with tobacco, the return was assumed to be more than £1 000 000. What was also interesting about the debate regarding the 1866 Irrigation Bill was that it was promoted by Pilkington, the Attorney General at that time. He was also an engineer by profession and an MP. He encountered resistance from other MPs because they felt that there was an ulterior motive involved. Pilkington wanted to lay out an irrigation scheme on the Zwartkops River in the Cape Colony. He also proposed to declare the wastewater of springs "common property", and said that the Irrigation Bill would facilitate irrigation projects. Pilkington also stated that the Irrigation Bill would herald an "irrigation millennium". This would see the cultivation of high-value crops in the Cape Colony (The Argus, 6 October 1866:3).

In 1874, a Select Committee sat on a Bill to encourage irrigation in the Cape Colony. Very little evidence was taken and the Bill, produced by the Committee, had 18 sections. These were not implemented and nothing came of it (Lewis, 1934:34).

In 1875, an Irrigation Bill was again debated in the Cape Colony's parliament. This Bill had two objectives. In the first place it was to enable farmers who wanted to get land for irrigation purposes to do so. Machinery of the divisional councils of the Colony was also to be put to their disposal. Secondly, the Bill would also have enabled farmers to make use of another farmer's land, under certain restrictions. For instance, if a farmer who had a farm some distance from a river and his neighbour between him and the river denied him access to the water, the Bill would enable him to build a furrow across his neighbour's land. He would then have access and could make use of the river's water. Yet he must do it in such a way not to deprive his neighbours of their legitimate share of the water (Legislative Council Debates, 1875: Page Unknown). This was the same principle contained in the 1876 Right of Passage of Water Act.

The Bill dealt mainly with wasted or flood water. However, both were not clearly defined. It was considered the water that came down during a flood over and above the ordinary flow of a river (Legislative Council Debates, 1875: Page Unknown).

The 1875 Irrigation Bill was developed for it was believed that it would lay a solid foundation for the implementation of irrigation work in the Cape Colony. To build on this foundation, it was proposed that a hydraulic engineer should be appointed to support the implementation of irrigation projects under the auspices of the Bill (Legislative Council Debates, 1875: Page Unknown).

Members of parliament had a number of objections to the Bill and subsequently did not support it. This does not imply that they were opposed to irrigation projects. The objections were as follows:

- The Bill did not fit the purpose of implementing practical solutions to start with irrigation projects;

- The divisional councils were not reliable and not much power should be placed in their hands to interfere with vested interests proposed by the Bill;
- Individuals would have large expenses before they could introduce projects under the Bill;
- The Bill could pave the way for a great deal of litigation;
- A hydraulic engineer should first be appointed;
- It would be too expensive for the country and there would be no benefits from irrigation projects;
- There was not enough water for irrigation projects, and the aridity allowed for too much water to evaporate from dams; and
- The servitudes for canals across neighbouring farms would not disappear (Legislative Council Debates, 1875: Page Unknown).

In spite of these objections, many MPs supported the Bill. Their main motivation was that irrigated land was worth much more than land that was not under irrigation (Legislative Council Debates, 1875: Page Unknown). Also noteworthy from the discussion of the 1875 Irrigation Bill was that a hydraulic engineer was to be employed in assisting farmers with irrigation projects.

However, the deliberations of the Cape parliament and the work of a number of select committees on these bills bore fruit, and, in 1876, The Right of Passage of Water Act (Act 24 of 1876) was passed. This Act did not deal with water rights as such, only with servitudes. Its aim was to facilitate the use of water when the right to water use was undisputed. It provided that persons having a right to the water of "springs, dams, reservoirs, or any other sources should be entitled to take that water through the property of others to enable them to use it for irrigation or for the use of hydraulic works". Under the Act, a "right of aqueduct" could be claimed from the owner over whose property passage was sought upon payment of reasonable compensation. This compensation could be fixed by arbitration if necessary (Bell, 1891:18; Lewis, 1934:35; Hall, 1939:61).

In 1879, Act 8 of 1877 for the promotion of irrigation had been passed by the Cape parliament. This Act did not aim at regulating and defining water rights as between the proprietors of riparian land. It also did not in any way impact on the development of a water law. Its purpose was only administrative, in that it provided for the constitution of irrigation districts controlled by irrigation boards. A board could only be established at the request of owners of irrigable land after inquiry by the government and proclamation in the *Gazette*. "Once it had been constituted, the board was given charge of every natural river and watercourse and of every dam, reservoir, vlei, and embankment which was common to two or more owners situated in the irrigation district; and it had the absolute control and regulation of the supply of water throughout the course of every river, stream, and watercourse in its limits". One of the major limitations of the Act was that: "Any effort was made to stimulate individual effort by authorizing the making of irrigation loans to farmers desirous of constructing storage dams. The conditions were, however, difficult and the terms of repayment onerous" (Bell, 1891:18; Lewis, 1934:35-36; Hall, 1939:62-63).

Furthermore, under the Act associations of landowners would be established for the purpose of irrigation works. The reason for this was that much of the land in the Cape Colony was private property. Government would therefore have had great difficulty in implementing irrigation projects for the betterment of private land. The Act provided for joint cooperation

between individuals who felt it necessary to construct a dam or diversion. If another farmer would object to such endeavours, the Act provided for the establishment of an association of proprietors. This association would have the power to override the objections of a minority (Cape of Good Hope, 1879:1, i)

These associations were to be formed in the following manner: "Where any number of adjacent landowners think that a tract of country can be improved either by the construction of a large reservoir or by the damming-up and leading-out of any river and three of them who are owners of not less than one-tenth of the whole extent of the proposed district may apply to the Government, in writing, to have the district ... proclaimed an irrigation district. Due notice of this application will be given to all interested, and after such notice the Government will send an officer to report who will ascertain whether proprietors of not less than two-thirds of the land affected consent to such application; and if such be the case, and there are no reasons to the contrary, the district will be proclaimed, and a Board for the management of all matters relating to irrigation within the district will be elected". Owners of land within the district would be eligible to be members. The members of the Board would have voting rights, even by proxy. The number of their votes would be directly proportional to the value of their land. "The Resident Magistrate will be the returning officer". The Board would have the power to implement all works for the storage and distribution of water within the district. They would also have the power to borrow money in order to make improvements and levying taxes for maintenance purposes. Money can be borrowed either from private sources or government. Money was to be advanced at eight per cent per annum for 24 years. At the end of this time, all payment would cease (Cape of Good Hope, 1879:i-ii, iii-iv).

The purpose of this Bill was therefore to facilitate the formation of irrigation associations or Boards, and to promote the establishment of irrigation in the Cape Colony. The Bill would give irrigation boards power to enter upon certain lands, to levy rates, and to advance loans upon certain conditions, for the construction of reservoirs to facilitate the impounding of water. The Bill also provided that, in places where there was no such board, persons might obtain loans for irrigation works. These loans could be secured in a manner similar to that adopted in England with loans for drainage purposes. The works were "watched over by Government inspectors" (*Standard & Mail*, 31 May 1877:3; Kanthack, 1909:26).

According to the Act two or three farmers, provided they owned one-tenth of the irrigable area, could petition government to have their district proclaimed an irrigation area (Cape of Good Hope, 1896:469). The reading of this Bill received considerable support from MPs. The Commissioner of Crown Lands and Public Works, John Laing, said that the Bill would be of great value to the colony. He stated that in 1874 a certain amount of money had been advanced by parliament to look into the possibility of constructing irrigation works on the Orange River. However, it was decided at that time that it "was very unwise to go into large irrigation works without appointing a hydraulic engineer . . ." On the matter of the 1866 Irrigation Bill, Laing said that it was not approved by parliament (*Standard & Mail*, 8 June 1877: Page Unknown).

As regards loans to irrigation works, Laing said that no money would be advanced under the Bill except for the improvement of the land. On this matter, he said that: "Wherever water was put on the ground the effect was magical". The object of the Bill was to improve land, and the grant of government would be rent charge on that land. The interest rate for advanced money would be eight per cent, and should encourage associations and individuals to start

with irrigation projects. He also said that the Irrigation Bill would be the only one needed to carry out irrigation works in the Cape Colony with any degree of success. Irrigation associations would be the most efficient way for irrigation to succeed. Watermeyer, MP, said that government should have first started with irrigation before it commenced with the construction of a railway system in the Colony. More money should have been spent on irrigation, he believed. Ayliff, MP, said that if irrigation works should be started they would assist in job creation and that these works would be of great value to the country. There was also a motion that government should start pilot projects in the district of Oudtshoorn to test the success of irrigation projects (Standard & Mail, 8 June 1877: Page Unknown).

With respect to the 1877 Irrigation Act, it was stated in parliament by a number of MPs in 1882 that the farmers had problems in getting their applications for loans from government to be processed. This had compelled a number of farmers to borrow money from private institutions, at a much higher interest rate than they would have received from government. This made the construction of irrigation works undesirable. Merriman, MP, mentioned that in 1878 government received an application and that nothing had been done to process it (Cape Argus, 11 May 1882: 117).

From this it can be deduced that the parliamentarians had taken notice of the recommendations contained in the 1877 Gamble Report and that more were in favour of the Irrigation Bill than was the case in 1866. The Irrigation Act of 1877 was not a success, however. Only one Irrigation Board had been established, at Warrenton, on the Vaal River (Cape of Good Hope, 1896:469). The failure of the Act, and those following it, was not because of the content of the Acts, but due to the defective administration overseeing the implementation of these Acts (Kanthack, 1909:26).

Nonetheless, in 1879, an Appeal Court of the Cape of Cape Hope was established. In the same year, Act 28 of 1879 was passed which extended the facilities for irrigation loans to municipalities. Act 7 of 1880 was passed and this act simplified the provision of irrigation loans. In 1880, De Villiers, as judge of appeal, got the chance to stipulate the entire legal position regarding water resources in his judgement of *Van Heerden v. Wiese*. Firstly, De Villiers classified all streams as either public or private streams. Public streams were permanent streams, i.e. they flowed throughout the year, and were therefore suitable for use by the riparian owners. All other streams were private streams. All the different riparian owners must share the water resources of all public streams. Every riparian owner of a private stream could do with the water what he liked, and such water was not subject to the claims of other riparian owners. The principle of state ownership is mentioned nowhere in the judgement. The right of utilisation of water resources is therefore the right of the riparian owners alone. This principle later formed the basis of the codification of South African Water Law (Bell, 1891:18; Lewis, 1934:36; Gildenhuys, 1970:6-7).

In 1882, Act 26 of 1882 was passed by the Cape parliament. This Act repealed Act 24 of 1876. The preamble of the Act stated that the previous Act (24 of 1876) was insufficient for its purpose and had led to considerable litigation. However, Hall (1939:62) states that there is evidence of only one incident of litigation – that of *Hiscock v. de Wet* in 1880. Hall found no other litigation proceedings in any of the courts of the Cape. Notwithstanding this, the Act repealed the former one and was more comprehensive. "It included in the source of supply any river or stream, and it made provision for the passage of water for irrigation, hydraulic works, or any other useful purpose, thus including the watering of animals or the driving of

machinery within its compass". This Act also remained "unrepealed" until the codification of the irrigation law of the Cape Colony in 1906. The majority of the provisions of Act 26 of 1882 were then incorporated into the statute and formed the basis of that law (Bell, 1891:18; Lewis, 1934:35; Hall, 1939:62).

The Irrigation Law of the Cape Colony came under scrutiny again in 1896. It was suggested that an inquiry should be launched into the workings of the present Irrigation Acts. The reason for this was to make amendments to the Act in order to encourage landowners to take advantage of the provision contained in the Acts, and to establish private irrigation works for the development of their property. The opinion was also raised that the government of the Cape Colony did less for farmers, regarding irrigation, than other countries. Government claimed that it was doing all it could do to establish irrigation works. Yet it was suggested that there might be flaws in the Irrigation Acts, and that this prevented the widespread establishment of irrigation projects by farmers. The issue of interest rates was also considered. In 1892, the Select Committee on irrigation recommended that the interest rate for loans by farmers should be reduced from eight to seven per cent. Some MPs also expressed the view that the future development of the country depended on agriculture. Because of this, the matter of starting irrigation works should be the government's responsibility. Yet it seemed that farmers were not taking advantage of government loans. On the other hand, it was said that one of the gravest problems was that much of the land was "bonded" and that government did not provide security for loans taken by farmers (Cape of Good Hope, 1896:224). Thus, it seems as if irrigation was still a tough issue for the government in 1896. The main problem stemmed from the fact that financial considerations, especially the issue of loans, on the part of farmers and government alike, prohibited the widespread establishment of irrigation in the Colony.

Yet the matter of irrigation was not abandoned in 1896. An Irrigation Works Bill was introduced to parliament in that year. Irrigation was deemed just as important as the establishment of railways in the Cape Colony. The reason why the Irrigation Works Bill was introduced was the failure of the 1877 Irrigation Act. Other subsequent Acts did not do much either for the widespread establishment of irrigation in the Cape Colony. These Acts were as follows: the Act of 1879; the Act of 1880 that showed that government wanted to promote irrigation (this Act removed the difficulty caused by people being unable to get any money until the works were completed); and the Act of 1882. The 1882 Act tackled the issue of passage of water across adjoining property, and gave government the power to expropriate land or water. Little came of the efforts. Two reasons for this were given. Firstly, much of the land was under mortgage and the moneys for irrigation were to be the first mortgage on the land. Secondly, individuals could get money from private financial institutions at a better rate than the money advanced by government. For these reasons, between 1886 and 1896 there were no applications for loans to start irrigation projects. In 1896 there was between £60 000 and £70 000 lying unused (Cape of Good Hope, 1896:469-470).

In the Transvaal Republic Law 11 of 1894 was passed in that year. This was the first enactment that laid down substantive rules for the use of public waters. In the Law, a public stream is defined as water flowing in a defined channel; the channel may contain water throughout the year or may be dry for any period. Private water, on the other hand, consists in a spring or stream, which is not of a permanent nature, not capable of subdivision, or having no defined course extending to a property adjoining that on which it originates. The distinction between a private and public stream was not clear. The reason for this was that a

stream whose channel was dry during a considerable part of every year would not seem to comply with the requirements of permanency (Hall, 1939:65).

The Law contains the following provisions:

- A riparian owner is declared to be entitled to the reasonable use of the water of a public stream for household and agricultural purposes;
- He may lead the water out of the stream by means of furrows, and he may construct a weir in the channel to divert it;
- Where two persons want to use the same water and cannot agree the matter must go to arbitration, but if they both consent, they can have recourse to the courts;
- Water taken from a public stream must not be led beyond the boundaries of riparian land, and all furrows must be kept in proper order;
- The liability of a riparian proprietor for damages occasioned to lower riparian owners through his taking water from a public stream for domestic or agricultural purposes is limited to cases where (a) he takes more than half the flow when the stream forms the boundary between two or more farms, (b) he makes unreasonable use of the water he has taken out, or c) he wastes the water or uses it wrongfully (Hall, 1939:65).

The principles laid down are a departure from those the Cape courts had laid down as those of common law, i.e. exhaustive use for animal and domestic purposes and proportionate sharing for irrigation. This Law was the first enactment in which priority of position is recognised as giving preference. It was also the first measure in which the ordinary legal tribunals were excluded from jurisdiction in any disputes regarding water rights (Hall, 1939:66).

In 1887 Law 17 of 1887 was passed. This law dealt with the water supply of Ventersdorp and Klerksdorp. It bore resemblance to the Water Regulations, which were promulgated from time to time by the Council of Policy under the Dutch East India Company. "It purports to regulate the use of water by the owners of farms situated on the Schoonspruit and to give powers and directions to a water-bailiff for the control of the water of this stream. From the terms of the law it would appear as if Government was regarded *dominus fluminis* and exercised its powers as such for the benefit of the urban areas which were dependent for their water upon the Schoonspruit". The law prohibited any obstruction of the stream by farmers, and the wastage of water. The water bailiff had, under the law, the powers to inflict fines for contravention of the regulations. This Law did not lay down any principle. However, it is interesting to note that the old idea of the state as *dominus fluminis* had not entirely disappeared. The method for dealing with the position was that of the Dutch Administration of a century earlier (Hall, 1939:64-65).

The next step in the codification was Act 40 of 1899 in the Cape Colony. This Act, passed on 20 October 1899, created water courts with jurisdiction to decide all disputes and claims to water rights. These courts were also given powers to grant servitudes required for irrigation and to adjudicate in apportionment suits. "The act effected the codification of the substantive law in so far as it gave validity to regulations which laid down the principles and considerations which should guide a water court in defining the reasonable use of the water of a public stream. These regulations embodied many of the decisions of the courts during the proceeding twenty-five years". According to Lewis, the Act dealt with perennial rivers only.

However, in Section 13 of the Act provision was made by a Water Court "in respect of unused water" in making an apportionment (Lewis, 1934:40, 58; Hall & Burger, 1957:5).

Before the constitution of the Union of South Africa, it was found impossible to frame a law approximating even remotely to an ideal water law for the Union. This was because of the large stakes which had accrued throughout the Union during previous generations. All that could be done was to make the most of old common law principles, based on Roman-Dutch law, which had controlled the situation previously. Moreover, it was found that no water law could be framed which would work with precision and provide a clear and ready solution for every case that might arise. Owing to the conditions of South Africa (aridity), water legislation must be flexible to a full degree and its practical value necessarily depends on the efficiency of the administrative capability created by legislation (Union of South Africa, 1917b:377; 1918:409; Davidson, 1909:16-24; Hurley, 1909:91).

The Cape Colony was therefore the first to pass legislation regarding irrigation works and various other matters pertaining to irrigation. It was only in 1894 that the ZAR passed legislation regarding the construction of dams on rivers. In the OFS and Natal no legislation regarding water resources utilisation, irrigation works, or the construction of dams was passed (Gildenhuys, 1970:7).

The reason for this was that in the OFS farmers were still farming extensively as the frontier was closing towards the end of the nineteenth century. Under these circumstances intensive use of rivers and streams *via* irrigation projects was not possible. Moreover, most of the farms in OFS were utilised for stock-farming purposes, and no irrigation was necessary for this type of farming. The same can be said of the ZAR. In the Cape Colony, on the other hand, farming that is more intensive was practised as the frontier started to close and farms became smaller. Intensive use of rivers and streams was therefore necessary to accommodate intensive farming practices. Yet in the early years of the twentieth century Roman-Dutch law still played a prominent role in the Cape Colony's irrigation act.

The Irrigation Act of 1906, passed in the Cape Colony, was mostly concerned with issues of administration, and the law of irrigation and water rights was mainly controlled by the common law based upon Roman-Dutch law. This was the first comprehensive codification of the water law and applied only to the Cape Colony. This complicated matters and created many vested rights, so that any drastic departure from common law was impossible. The principle of water conservation was totally ignored. According to the 1919 Yearbook of the Union of South Africa, the conservation of water in a semi-arid and arid country like South Africa was one of the most important factors of a water law. With this Act came the complete codification of existing law. It was derived from the decisions of the courts and from previous legislation. It affected a far-reaching change in the attributes that had hitherto determined the character of a public stream (Union of South Africa, 1919:481; Hall & Burger, 1957:5; Gildenhuys, 1970:7).

The Transvaal, now a self-governing colony, followed the lead given by the Cape Colony as regards the codification of a water law. It adopted the general framework of the Cape Act. However, it made provision for central control of public water by an Irrigation Department (Hall & Burger, 1957:6).

9.2.3. From Irrigation Law to Water Law and Departmental Responsibilities

The period before and after the establishment of the Union of South Africa was, according to Lewis (1934:67), "very disturbing to the framing of irrigation laws on account of the Act of Union on May 31st 1910, which was preceded by meetings of the National Convention in 1908 and 1909 and the South African Act, 1909, and followed by the changes that had to take place after Union".

Shortly after the establishment of the Union, Kanthack, Director of Irrigation, was instructed to draft a Bill to consolidate and amend the irrigation laws. The Bill was drafted and referred to a Select Committee in 1911. Kanthack in giving evidence before the Committee stated that the main objective was to see that as much flood water as possible was utilised in South Africa's rivers in some form or other. "If certain individuals along the stream are not prepared to use it we should allow others to use it who are prepared to do so" (Lewis, 1934:71).

The Bill was discussed in parliament and at an Irrigation Congress in Bloemfontein in 1911. In 1912, the Union Irrigation and Conservation of Water Act No. 8 passed successfully through parliament. This Act provided, in the first place, for a national law regulating the use of water in public streams and effected a compromise between the water law in the north (Transvaal) and that of the south (Cape). It kept the general framework of the Cape Act No. 32 of 1906. Yet its provisions were modified to embrace northern conditions. "The characteristics of a public stream were again changed, through substituting for the characteristic of general common use that of common use *for irrigation*, while the creation of a distinction between normal flow and surplus water was an innovation of a far-reaching character" (Lewis, 1934:72; Hall & Burger, 1957:6).

The 1912 Act, furthermore, provided special judicial machinery for dealing with the definition of water rights along public streams, the settlement of disputes, the granting of servitudes and permits and other matters. It also contained a number of provisions designed to promote the development of irrigation in the Union. The Act contained a complete codification of the South African Water Law. This law did not provide for any government control over public water resources. The allocation of water between riparian owners was the responsibility of Water Courts. The Department of Irrigation was also established with the Director of Irrigation as its chief executive under this Act (Union of South Africa, 1917b:377; 1918: 409; Gildenhuys, 1970:7; DWA, 1988:1).

A summary of the chapters of the Act will give an indication of the scope of the law:

Chapter I. General control, including provision for hydrographic surveys, preparation of schemes, engineering services, water boring.

Chapter II. Use of public and private water.

Chapter III. Use of subterranean water.

Chapter IV. Constitution of *Water Courts* and their jurisdiction, powers, and authorities.

Chapter V. Constitution of *River Districts* and *Boards*.

Chapter VI. Constitution of *Irrigation Districts* and *Boards*.

Chapter VII. Expropriation of land and acquisition of servitudes.

Chapter VIII. Irrigation loans to private persons and to *Irrigation Boards*.

Chapter IX. General and miscellaneous matters relating to right of entry upon land for irrigation purposes, services of notices and documents, exemption of irrigation lands from rates, offences and penalties, etc. (Union of South Africa, 1917b:377; Union of South Africa, 1918:409).

Regarding the Water Courts, the allocation of water resources by the Courts was expensive and the machinery of the Courts were lacking in this respect. These Courts were not able to allocate water resources, especially regarding those of large rivers, like the Orange, Limpopo, Incomati and Maputo. The Courts, furthermore, did not have the necessary knowledge and information to deal with water disputes between citizens. The citizens could also not supply the Courts with the necessary knowledge and information. There was therefore a greater appeal that the responsibility of the allocation of public waters should be vested with the state. This was based on practical considerations and not on the interpretation of Roman and Roman-Dutch Law (Gildenhuys, 1970:7).

Even so, the administration of the Irrigation Act was placed in a special department, known as the Irrigation Department. This Department stood under a Director of Irrigation with a staff of engineers and other administrative officers. Irrigation projects and settlements were considered by the Irrigation Department, as part of its activities, together with the application for loans. The services of government engineers in connection with irrigation projects were available and water boring for agricultural and stock farming was carried out by the Department (Union of South Africa, 1917b:377-378; Union of South Africa, 1918:409-410).

By the end of the 1920s, the activities of the Irrigation Department were expanded. These activities included the following:

- The collection and compilation of hydrographic data throughout the Union. The results of this were used to determine the absolute MAR of surface water resources from a number of clearly defined catchment areas; the relationship between the MAR and rainfall over the catchment; the determination of the maximum intensity of MAR during storms, and the gauging of permanent springs;
- The hydrographic surveys were closely allied with the meteorological services of the Union;
- Systematic reconnaissance surveys, together with hydrographic statistics indicating where and how irrigation development can take place. From these surveys irrigation projects were proposed;
- The maintenance and administration of irrigation works;
- Professional assistance is given to *bona fide* farmers, irrigation boards, and river boards, at a prescribed fee.
- The drilling of water for farmers, for the purpose of settling vacant crown land, schools, hospitals, prisons, and other public institutions;
- The Department also acted as the adviser of Provincial Administrations on all matters regarding water supply, drainage, sewerage, or irrigation within the areas controlled by municipalities and public institutions;
- It also advised and more or less controlled irrigation and river boards (Union of South Africa, 1929b:359-360).

In July 1931, Dr Kanthack published a memorandum in which he stated that:

"[T]he 1912 Act was a big advance in the direction of freeing a large portion of the water from the restriction of the old Common Law provisions. The next obvious step is the divorcement of all surplus water from riparian restrictions and to *nationalise* it. This is, I am afraid, not practical policy at the present time. This being the case, I am, at this stage, merely endeavouring to make the best of a bad system" (emphasis added) (Gildenhuys, 1970:7).

The "Common Law provisions" Kanthack was referring to, was the rules judge De Villiers developed and not the Roman and Roman-Dutch law principles. The consequence of this was the new water act of 1956 (Gildenhuys, 1970:7).

Before the passing of this water act, parliament passed an Act (Act 46 of 1934) amending the Irrigation Act of 1912. The introduction of protection of water in any area was left to the discretion of government. The Act also stated that the construction of large storage works within a protected area could only be carried out after permission from the Minister of Irrigation had been obtained. This granting of permission was entirely in the discretion of the Minister. Only diversion and storage works of a very small capacity in water protection areas did not need the permission of the Minister to be constructed. The Act also gave the government greater powers of expropriation for facilitating the construction of government irrigation schemes that it previously possessed. The Act, furthermore, allowed landowners in South West Africa (now Namibia) to use the water resources of the Orange River (Hall, 1939:137-138). It was only 22 years later that the Union government would introduce a new Water Act.

On 13 July 1956, the Water Act No. 54 was passed and came into operation. It was no longer the Irrigation Act but the Water Act. The purpose of this Act was to consolidate and amend the laws pertaining to the control, conservation, and use of water for domestic, agricultural, urban, and industrial purposes. This increased the scope of water law in South Africa to such an extent that riparian owners could still use the water resources on their private property, but that the state could also allocate water to industries and non-riparian users. This Law classified water resources into two categories: private and public water. Public water was further divided into two categories: normal streaming and surplus water (Hall & Burger, 1957:6; Union of South Africa, 1957:515; Vos, 1967:7; Gildenhuys, 1970:7).

The principles of South African Water Law originated at a stage when industrial development in the country was of a limited extent. Water allocations for industrial development therefore did not pose a great problem. The drafters of the 1956 Water Act wanted to make it easier for the industrialist to get water for industrial development. Their intention was also to make provision for greater state control over the allocation of water and for the allocation of responsibilities to government to make water available to users, other than agriculture and domestic, and for the allocation to non-riparian users. These principles for greater state control over water were strengthened further by a number of amendments to the Water Act (Act 57 of 1957, Act 56 of 1961, Act 63 of 1963, Act 71 of 1956, Act 11 of 1966, Act 79 of 1967 and Act 7 of 1969) (Vos, 1967: 7; Gildenhuys, 1970:8).

A listing of the chapters of the Act will give an indication of its scope:

Chapter I. Central control.

Chapter II. Control and use of private and public water.

- Chapter III. Control and use of subterranean water and water found underground.
- Chapter IV. Water courts.
- Chapter V. Government works.
- Chapter VI. Irrigation boards.
- Chapter VII. Water boards.
- Chapter VIII. Servitudes.
- Chapter IX. Irrigation loans, liabilities and subsidies.
- Chapter X. General and miscellaneous (Union of South Africa, 1957:515).

Of significance regarding the Water Act of 1956 was that: "The State President may declare any area within which the use of water should be controlled in the public interest to be a Government water control area; and may equally declare any portion of a stream or adjoining land to be a catchment control area. In such control areas the State may upon compensation, expropriate any land or right in respect of land or any existing right. In the Government water control areas all water rights are placed under the control of the State and no one may abstract or impound any water save upon the terms authorised by the State. The State is however, bound to appropriate the water amongst the riparian owners who may, if aggrieved by the apportionment to seek redress from the Water Court. The water court has no power to affect an apportionment itself. In the catchment control area the State may suspend certain rights in or over land ..." (Vos, 1967:45-46). Thus, the state gained effective control over the country's water resources.

The DWA administered the Water Act of 1956. This Department was headed by a Director of Water Affairs with a staff of engineers and other professional, administrative, and clerical officials (Union of South Africa, 1957:515). Thus, the DWA succeeded the Irrigation Department in 1956 (RSA, 1988/89:354). The focus of the new Department was no longer on irrigation alone, but had a wider scope in that it managed the water resources of South Africa for a wider user group.

The primary function of the DWA was to promote the most beneficial use of the available water resources of South Africa. This primary concept was the principal reason why the Water Act No. 54 of 1956 provides for a much greater degree of state control over the country's water resources than was the case before 1956, for both surface and undergroundwater supplies (RSA, 1976i:586).

Although much of the water resources were placed under state control (except groundwater which was effectively private water until 1998) the 1956 Water Act did not inhibit the development of private water supply projects. However, the abstraction of water from any public stream was subject to Ministerial approval on conditions recommended to the minister by his department. The rationale behind this thinking contained in the 1956 Water Act was because of the high capital costs involved and the increasing need for regional and multi-purpose projects. These projects were necessitated by the need to ensure the best use of the available supplies, in that they favour national development at the expense of private projects (RSA, 1976i:586; B. Rowlston, personal communication, 20 January 2004).

In 1956, when the Department of Irrigation became the DWA, it had the following functions:

- The Research Branch of the Planning and Research Division undertook preliminary investigations into the water resources of South Africa and their possible utilisation for

agricultural, urban, and industrial development. If a scheme appeared feasible, the Planning Branch, assisted by its Reconnaissance Section, made detailed field investigations. If the outcome was favourable, the Planning Branch prepared detailed designs for construction purposes and drew up estimates of cost for parliamentary approval.

- The Construction Division organised and carried out construction work.
- On completion of the scheme it was either handed over to an irrigation board elected from among the owners of land within the proclaimed irrigation district concerned or its administration was taken over by the Superintending Division. This Division also scrutinised plans and advised local authorities on proposed water supply schemes.
- The Mechanical Division solved all mechanical and electrical problems. The above-mentioned divisions drew on the resources of this Division in case of mechanical and electrical problems. The Mechanical Division consisted of the following three branches:
 - The Mechanical Branch
 - The Mechanical Workshops
 - The Boring Branch.

The main purpose of the Boring Branch was to develop water supplies from underground resources for farmers in areas where surface supplies were inadequate. The state met part of the cost. This Branch also undertook exploratory drilling to test the suitability of dam sites.

- The Hydrographic Branch undertook the gauging of rivers, taking of silt samples *etc.*, and the correlation of the data primarily for the benefit of the Research Branch.
- In 1956, the DWA established the Hydrological Division, which incorporated the Hydrographic Branch. This Division collected and correlated data on rainfall, river flow, evaporation, transpiration, underground water, the water requirement of crops, and spring flow and return seepage. The objective behind this was to promote the most efficient utilisation of South Africa's water resources.
- The Circle Organisations were a decentralised section of the Superintending Division. The Union was in 1956 divided into eight areas or "circles", with separate headquarters in each. Circle work included regional investigation of water resources, advice to farmers (and at a nominal fee, actual investigation and planning) regarding the construction of water schemes, and advice to irrigation boards.
- The General Administration Division dealt with legal and administrative matters. The matters arose out of the Water Act, Workmen's Compensation Act, transport matters, *etc.* They also included applications from farmers, irrigation boards, local authorities, *etc.*, for irrigation loans and subsidies (in collaboration with the Superintending Division). Also included under General Administration were permits to build works on or abstract water from rivers in government water control areas, permits for the abstraction of river water for industrial purposes, initiation of prosecution of offenders under the Act, especially pollution of water, registration of private water-boring contractors, supervision of irrigation boards and water boards.
- The Servitudes Branch attended to the acquisition of servitudes of storage, abutment, aqueduct, and drainage in connection with government water schemes.
- In varying degrees, the above divisions and branches were dependent on the remaining branches of the Department, such as Accounts, Stores, Staff Branch, Registry, Drawing Offices, and Plan Reproduction Section (Union of South Africa, 1957:515-516).

Because of the government's rationalisation programme for the Public Service, the Department amalgamated with the then Department of Forestry and Environmental Conservation on 1 April 1980. This formed the DEA. The union was, however, short-lived and on 1 September 1984, the Department of Water Affairs was reinstated as an independent department (DWA, 1988:1).

From an organisational point of view, a significant degree of decentralisation in the form of eight circles, based on run-off areas, existed from 1912. The headquarters of these circles were situated at Cape Town, Cradock, Upington, Bloemfontein, Kroonstad, Durban, and Pretoria (two headquarters, one of which was later moved to Nelspruit). These circles continued to exist until the establishment of regional organisations came into operation in 1987/1988 and the circles were incorporated into them. Also of importance is the fact that when the homelands existed, South Africa effectively had 11 water acts, and most of the rivers in the country were, according to the NP controlled government, international rivers. This led inter alia to a number of proposals, which were never implemented, to create hydroelectric generating capacity for each homeland where it was feasible. On 14 November 1990, the DWA became the Department of Water Affairs and Forestry (DWAF) with the incorporation of the Forestry branch of the Department of Environmental Affairs (DWA, 1988:1-2; DWA, 1991:13; B. Rowston, personal communication, 20 January 2004).

In 1989, the DWA had the following main functions:

- Collection and collation of hydrological data necessary to determine the quality and quantity of the surface water resources available. This work included construction, operation and maintenance of river flow gauging stations and the recording and analysis of the data obtained.
- The Division of Geo-hydrology (created in 1978) is concerned with the quantitative assessment of groundwater supplies and their development.
- Planning the optimal utilisation of all water resources is an important function of the DWA. This planning requires intensive evaluations of probable future water demands and the most economical means of meeting those demands, field investigations to find suitable dam sites, and the environmental implications of water projects. Parliamentary approval was needed for all projects costing R10 million or more and White Papers were prepared for such approval.
- After parliamentary approval had been granted for a project and the funds voted, the Design Directorate prepared detailed designs, plans, specifications, and contract documents for the construction of the project. An increasing proportion of design and construction work was, by 1989, done by private contractors under the supervision and direction of the DWA.
- The department cooperated closely with local and statutory authorities, like ESCOM and the RWB, in the design and construction by private enterprise of projects needed to meet the water demands of these authorities.
- The department manages, operates, and maintains irrigation and regional water supply projects. The state encouraged the establishment of water boards wherever feasible to take over multi-purpose projects providing water for a number of independent authorities.
- In 1986, the department established a dam safety office. The purpose of this office was to control the design, construction, operation, maintenance or abandonment of structures

classified as dams with a safety risk, to prevent loss of human life or damage through the failure of dams.

- The department had a scientific services directorate whose physicists, geologists, chemists, geologists and biologists assisted the engineers, hydrologists and administrative staff in developing water resources and preventing pollution.
- The department undertook research drilling for water projects and drilling operations for other government departments (RSA, 1988/89:354-355).

9.2.4. The National Water Act (Act 36 of 1998)

In 1998 the South African government under the ruling ANC party adopted yet another new Water Act (Act 36 of 1998). The foundation of the New Water Act, the third in South Africa in only 86 years, occurred in August 1994. A conference regarding water provision and sanitation issues was convened in Kempton Park. Government officials and representatives attended this conference from a broad range of interest groups. The result of this was not only larger public participation in the policy process, but the White Paper was also summarised into legislation (Van Wyk, 2001:48).

By adopting this act, South Africa was the first country in the world to adopt a national water law in which water is seen as a tool in the transformation of society towards social and environmental justice (Schreiner, van Koppen & Khumbane, 2002:127).

On World Water Day (22 March) in 1995, a discussion document, *You and your water rights*, was published. In this the reasons why South Africa should amend the Water Act of 1956 were stipulated. The reasons were as follows:

- i) Because the existing water law was contained in the Water Act of 1956, associated laws are contained in 33 other Acts, it was reasoned that a single, integrated Act was necessary;
- ii) The needs of rural people was not adequately protected in the 1956 Water Act;
- iii) Water rights are allocated on an unfair and skewed playing field. These rights were coupled with existing landowner rights. Most of this property was in the hands of white South Africans;
- iv) The current Act (the Water Act of 1956) was based on European principles where there is a different climate, culture and hydrology;
- v) The Water Act of 1956 did not contain any structured pricing system for water resources; and
- vi) The Water Act of 1956 also did not reflect interdependence between water resources and water catchment areas (SAIRR, 1996:402-403; Van Wyk, 2001:48).

In November 1997, President Nelson Mandela signed the Water Services Act of 1997. This Act provided for the following:

- The right to basic water provision and the right to basic sanitation;
- The monitoring of water services by the Minister of Water Affairs and Forestry;
- That the Minister has the authority to prescribe norms regarding tariffs and standards. The norms are differentiated on an equal basis between the different users of water services,

different types of water services, and different geographic areas (RSA, 1997a; Van Wyk, 2001:48-49).

The National Water Act (Act 36 of 1998) was signed in August 1998. This forms the basis of the government's new water policy. The preamble of this Act emphasises the scarcity of water in South Africa and stresses that the water resources of the country belong to all South Africans. It also indicates the government's responsibility regarding the country's water resources and the utilisation thereof. The Act also stipulates that the end purpose of water resources management in South Africa is the sustainable use of water to the benefit of all users. To attain these goals, the Act furthermore provides for the integrated management of water resources and the delegation of management responsibilities to the regional or catchment level (Van Wyk, 2001:49).

Chapter 1 of the Act contains the fundamental principles of the Act of which sustainability and equity are the most important. The needs of the current generation of South Africans and the future ones are also mentioned. The final responsibility of this lies with the national government based on the principles contained in the constitution of the Republic of South Africa (Van Wyk, 2001:49).

Chapter 2 of the Act contains the purpose of the Act. That is to ensure that South Africa's water resources are protected, used, developed, conserved, managed, and controlled by ways taking into account the following factors:

- The supply of basic human needs to the current and future generations;
- The promotion of the equitable accessibility to water;
- The correction of the consequences of racial and gender discrimination from the past;
- The promotion of the effective, sustainable and beneficial use of water in the public's interest;
- The streamlining of social-economic development;
- Supplying water to an ever-greater demand;
- The protection of water and related ecosystems and their biological diversity;
- The reduction and prevention of pollution and deterioration of water resources;
- The fulfilment of international obligations;
- The promotion of dam safety;
- The management of droughts and floods (RSA, 1998).

The National Water Act contains, furthermore, the following regulations:

- Water management strategies at national and catchment level (part 1 and 2 of Chapter 2 of the Act);
- The protection of water resources by way of a classification system for water resources and the purposes of resource quality (part 1 and 2 of Chapter 3 of the Act);
- Part 3 of Chapter 3 contains aspects regarding the determination of the water reserve;
- The prevention of pollution (part 4 of Chapter 3 of the Act);
- Chapter 4 of the Act contains the general principles for the utilisation of water (part 1), the conditions by which licenses are awarded (part 2), current lawful water uses (part 3), stream flow reduction activities (part 4), controlled activities and powers (part 5 and 6), the procedures to handle the application of individual licenses (part 7), the compiled

application of license for the use of water regarding specific resources (part 8), the review of license (part 9), and the regulation of offences (part 10);

- Financial regulations (Chapter 5);
- The general authority of the minister and of his/her director-general (Chapter 6);
- The establishment and operation of catchment management agencies (Chapter 7);
- Water user associations (Chapter 8);
- Advisory committees (Chapter 9);
- International water management (Chapter 10);
- Government waterworks (Chapter 11);
- Dam safety (Chapter 12);
- Entrance and rights to land and servitudes (Chapter 13);
- Chapter 14 contains aspects regarding national monitoring systems;
- Appeals and dispute resolution (Chapter 15);
- Offences regarding water resources (Chapter 16); and
- Transitional stipulations concerning accountability, competence, and mandates (Chapter 17) (RSA, 1998).

Whereas the Water Act of 1956 originated from the need to supply water to an ever-growing economy due to industrial development, the National Water Act of 1998 was born from the inequalities of the past. These inequalities were a direct outflow of the apartheid policy of the previous government. This break from the past is evident in the emphasis the New Water Act places on equality and its linkage with the Constitution. In 1994, the water policy of South Africa was characterised by inequitable access to water resources and the poor delivery of services for the largest part of South African society (Van Wyk, 2001:51).

The Water Act is also a break from the past in that it places heavy emphasis on the sustainable use of the country's water resources. Where this was not even mentioned in the 1956 Water Act, the New Water Act has it as one of its central tenets. This is a direct consequence of the rise of the global environmental movement in the 1960s and 1970s. This movement took sustainable development as its central philosophy and promoted it on the global stage. Thus, it was both internal (national) considerations and external (international) factors that drove the South African government to adopt a new water Act.

In March 1995, the Minister of Water Affairs and Forestry published his first annual report. In this he states what the transitional mission of the Department of Water Affairs and Forestry (DWAF) will be: "To ensure that basic water and sanitation services are provided to meet social, economic and environmental needs of all South Africans on an *equitable basis* to ensure growth and well being, through the *sustainable development*, utilisation and allocation of scarce water and forestry resources as custodians of these resources" (emphasis added) (RSA, 1995). Thus, DWAF's function from then onwards would still be entrenched in the custodianship of South Africa's scarce water resources. It was still to ensure that socio-economic development took place by managing these scarce water resources. However, the basis on which this new function rests is equality and the way this function will be performed is through sustainable development.

9.2.5. Rural Water Supply

In March 1999, Mvula Trust reported on a number of water projects at a DWAF conference in East London. The survey conducted by the Trust was done under the auspices of the then Minister of Water Affairs and Forestry, Prof. Kader Asmal. The purpose of the survey was to investigate 21 water projects where the supply of water to people had failed. The Trust also investigated 56 of the water projects it implemented. The Trust found that, although the government was able to silence its critics by stating that 3 million people had received water, it placed too much emphasis (during the communication process) on the physical infrastructure of these projects, i.e. taps and pipelines. Enough emphasis was not placed on the sustainability of these projects. Criticism of Minister Asmal came from SAMWU, when it stated that more than 50% of water projects in the rural areas had failed. The Minister responded by stating that there had been some problems with some of the projects, but that the problems were being looked at. He also stated that his Department was very successful in its endeavours to supply water to rural populations (Van Wyk, 2001:60).

Thus, the rural population which in the past had no access to water was receiving the attention of government in this regard. Regarding the criticism levelled against DWAF, it shows that it is a daunting task to correct the inequalities of the past concerning water and sanitation services to a large part of the South African population (nearly 50%). The levelling of the playing field with respect to water supply and sanitation will be the main focus of government in the near to distant future. In this regard, South Africa's international rivers will play a pivotal role concerning this issue, for they carry most of the surface water supplies of the country.

9.3. The South African/Namibian Border Disagreement²⁶

This section of the chapter briefly looks at the issue of the border between South Africa and Namibia, as defined by the Orange River. It is included in this chapter because the border between the two countries is mainly an international legal matter. The legality of the border is much influenced by other legal principles, like sovereignty and territorial integrity. However, other international and national factors also play their part of which national interest is one of the most important.

The Orange River border disagreement has been on the cards now between South Africa and Namibia since 1990. During the run-up to Namibia's independence, it was agreed that the border between the two countries should be changed from the northern bank to the middle of the river. Nonetheless, for the past 11 years this change has not yet been incorporated, although Namibia's constitution states emphatically that the border should be in the middle of the river. This stance is contained in Article 1 (4) of Namibia's constitution, which states that:

"The national territory of Namibia shall consist of the whole territory recognised by the international community through the organs of the United Nations as Namibia, including the enclave, harbour and port of Walvis Bay, as

²⁶ Parts of the history of the South Africa/Namibia border disagreement were taken, *verbatim*, from R. Meissner's (2001) article: *Drawing the line*, Conflict Trends, 2/2001, Durban: ACCORD.

well as the off-shore islands of Namibia, and its southern boundary shall extent to the middle of the Orange River." (Constitution of Namibia, 1990).

This is the view and legal institution stipulating Namibia's border with South Africa, and the rest of the international community. After 1994, when the African National Congress (ANC) took power in South Africa, there was a sort of "gentleman's agreement" that the border would be respected as being in the middle of the river. However, no formal agreement has been reached between the two states regarding the matter.

Yet South Africa takes the position that the border has already been established. This is contained in an agreement signed between Britain and Germany on 1 July 1890 in Berlin (Erasmus & Hamman, 1987/1988:49). This agreement states that:

"In South-west Africa the sphere in which the exercise of influence is reserved to Germany is bounded – To the south by a line commencing at the mouth of the Orange river and ascending the north bank of that river to the point of its intersection by twentieth degree of east longitude" (Agreement, 1890).

This is another legal principle, although more than 110 years old, that defines the border between the two countries, and which is also upheld by South Africa as the most legal principle defining the frontier. For instance, during the first round of negotiations between the former National Party government of South Africa and Namibia on 14 March 1991, South Africa took the stance of the 1 July 1890 agreement between Britain and Germany with respect to the Orange River border. Nonetheless, during the second round of negotiations the two countries agreed that the middle of the river, or the *thalweg*, should define the border between the two countries. A Joint Technical Commission (JTC) was appointed to investigate the stipulation of the border. The JTC brought forth a concept agreement and presented it to the two states. The only outstanding matter was the stipulation of the border, which was in effect a technical matter to be resolved. Both states agreed to the concept of the agreement. In effect, a gentleman's agreement existed between the two states with respect to the border, although Namibia has not yet indicated its stance on the agreement at that time. It seems therefore that the previous government of South Africa and Namibia has laid down the specifications of the border (Meissner, 2001).

In early 2001, the South African government informed Namibia that the colonial borders of Africa should not be tampered with. This stance is in line with the obligations set forth by the Organisation of African Unity (OAU). According to South Africa, the boundary is set and cannot be changed. It upholds the principle of *uti possidetis* with respect to African pre-colonial borders, as set out by the OAU in a resolution adopted in July 1964. This resolution states that existing borders are so to speak "set in stone" and cannot be changed. In the preamble of the resolution, the view was that the borders of African states on the day of their independence "constituted a tangible reality", and that border problems "constituted a grave and permanent factor of dissension". Also, South Africa stated that, if the border between the two countries should be changed, it could create a dangerous precedent with respect to land claims from other neighbouring states, most notably Lesotho (Andemichael, 1976).

The announcement by South Africa came as a big surprise to Namibia. In fact, according to the Namibian Foreign Affairs Minister, Theo Ben Guirrab, a number of formal agreements

had been reached with South Africa and negotiating teams, from both sides, had held discussions in the past on the Orange River border issue (Internet: The Namibian, April 26, 1999).

A difference of opinion between South Africa and Namibia is driving the border issue. For South Africa, the OAU Charter is the policy instrument by which the matter should be resolved, and for Namibia, the national constitution is the way to go about negotiating a resolution. This gives a clear indication of how countries are influenced by national as well as international principles and obligations with respect to their conduct of foreign affairs between each other. Both states are arguing from the national interest stance, with the one trying to gain territorial integrity and the other wanting to protect its integrity.

Namibia has a number of interests with respect to the waters of the Orange River. It is at present looking at the feasibility for a new dam in the lower part of the Orange River to ensure a more sustainable and stable water supply for irrigation needs. One of the most promising and lucrative prospects for harnessing the waters of the river is the production of dates. Plans are underway to start the development and production of dates, not only in the Orange River vicinity, but also in other places in Southern Namibia. A new dam on the Orange River, for this purpose, could have a positive impact on the production of this cash crop. Namibia is particularly targeting the export market with destinations as far as Europe and the Middle East. On the European market a kilogram of dates can fetch between R30 to R60 with 10 000 tonnes expected to be exported to this region alone. It is therefore imperative for Namibia to resolve the border issue, for if an agreement is not reached the foreign date markets may dry up. Yet according to the South African government, the border issue will not negatively affect Namibia's utilisation of the river's waters, for South Africa will not complain against such use (Internet: The Namibian, March 11, 1999; The Namibian, June 8, 2000).

For South Africa the Orange River mouth holds lucrative mineral prospects, especially diamonds. The offshore diamond concessions are directly involved in the disagreement. The reason for this is that if the border between South Africa and Namibia cannot be secured, the 200 nautical mile sea boundary is also not defined. This has an impact on the exploitation of marine resources by the two states. Both states therefore not only have incompatible national and international principles to uphold, but the interests in the resources directly and indirectly proportional to the Orange River are also playing a role (Internet: The Namibian, 12 May 1999).

9.4. International Agreements and Treaties

A number of international treaties and agreements had been reached between South Africa and its neighbours since the 1890s. The vast majority of these treaties and/or agreements had been signed in the last part of the twentieth century. In Table 9.1, these treaties and agreements are summarised. Nearly half of the earth's land surface lies within international river basins. The complexity of the management of international river basins is derived from the social, economic, and physical disparities between riparian states sharing international river systems. In this regard, international treaties, and agreements are important instruments, in that they provide structure to allow states to address these disparities within a legal framework. Joint management and monitoring of the shared water resources, including the

management of water flow, water quality, and infrastructural development may be provided by these structures (UNEP, 2002:vii).

Nonetheless, Wolf, Yoffe and Giordano (2003:29, 46-47) identify the international river basins in the world with the potential of "political stress" or "conflicting interests" in the next five to ten years. These international river basins are as follows: the Ganges-Brahmaputra, Han, *Incomati*, Kunene, Kura-Araks, Lake Chad, La Plata, Lempa, *Limpopo*, Mekong, Ob (Ertis), Okavango, *Orange*, Salween, Senegal, Tumen and Zambezi. These basins at risk are characterised by a hostile political setting and/or institution-less setting within the basin itself.

Interestingly enough, Wolf, Yoffe and Giordano (2003) state that three of South Africa's international river basins are basins that are at risk of political stress. Table 9.1 indicates the contrary, showing that none of the international rivers discussed in this study are institution-less.

UNEP's (2002) *Atlas of International Freshwater Agreements* also shows the apparent lack or small number of international treaties and agreements that had been reached within the four international river basins. Table 9.1 also shows whether the *Atlas* recorded these treaties and/or agreements.

Table 9.1 International Agreements and Treaties Signed between South Africa and Neighbouring Countries Regarding the Four International River Basins.

Signatories	Date	River Basin(s)	Recorded in UNEP <i>Atlas of International Freshwater Agreements</i> (Yes/No)	Purpose of Agreement or Treaty
1. Germany and Great Britain	1890	Orange	No	Establishing of the Border between the two Colonial Powers on the Northern Bank of the Orange River.
2. Portugal and South Africa	1926	Limpopo Incomati, Maputo	No	Joint Utilisation of rivers of mutual interests and the Kunene River.
3. Portugal and South Africa	1964	Limpopo and Incomati	No	Rivers of Mutual Interest and the Kunene River Scheme.
4. Portugal and South Africa	1971	Limpopo and Incomati	No	Rivers of Mutual Interest and the Massingir Dam.
5. Rhodesia and South Africa	1974	Limpopo	No	A <i>conditional</i> agreement at technical level between the DWA and the Rhodesian Ministry of Water Development for the joint construction of the proposed Thor Dam.
6. Botswana and South Africa	1983	Limpopo	No	Establishment of a Joint Technical Committee to make recommendations on matters regarding rivers of mutual interest.
7. Mozambique, South Africa and Swaziland	1983	Incomati, Limpopo and	Yes	Establishment of a Tripartite Permanent Technical Committee (TPTC).

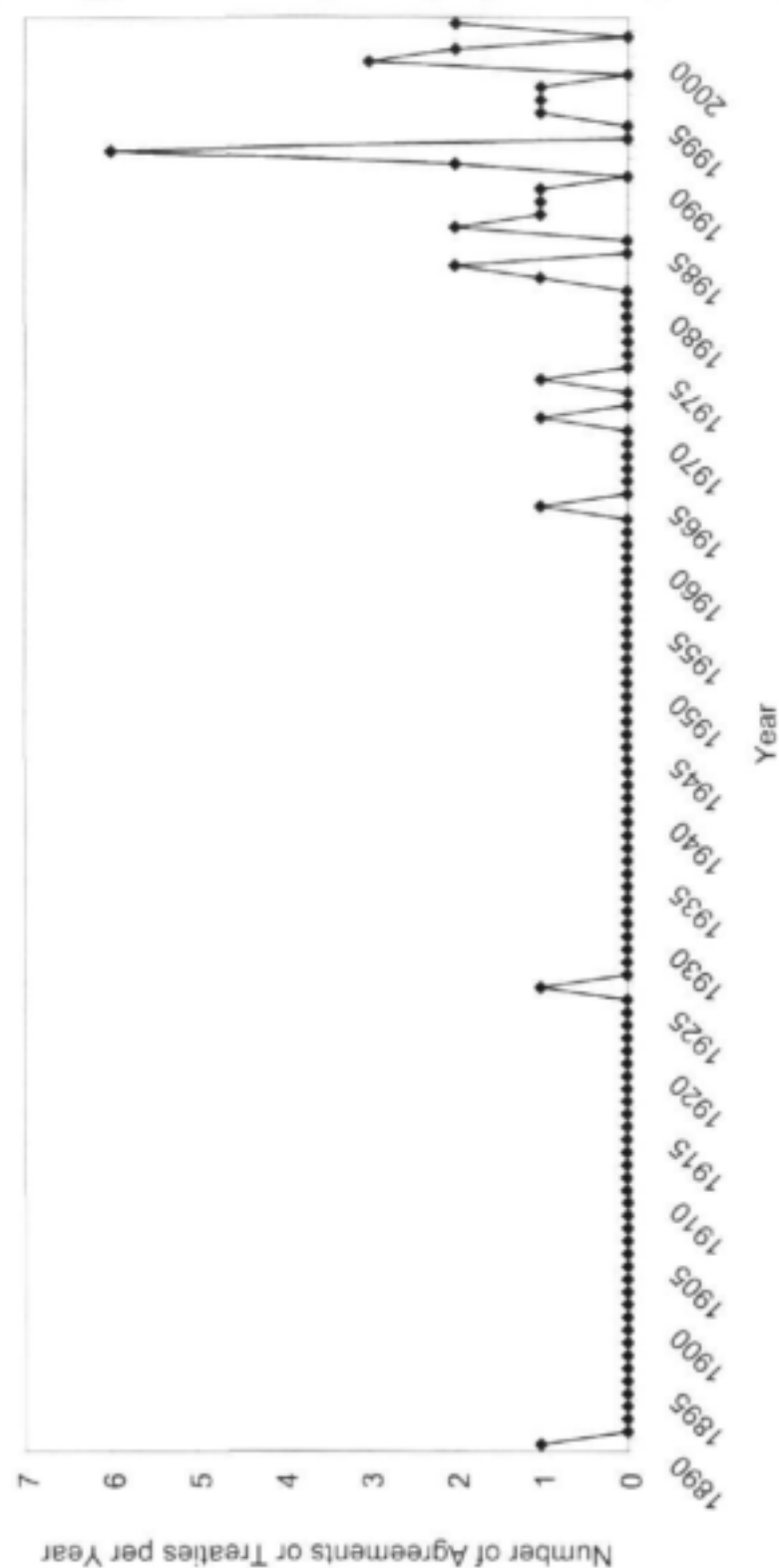
		Maputo		
8. Botswana, Mozambique, South Africa and Zimbabwe	1986	Limpopo	No	Establishment of the Limpopo Basin Permanent Technical Committee (LBPTC).
9. Lesotho and South Africa	1986	Orange/Senqu	Yes	Implementation of the Lesotho Highlands Water Project (LHWP).
10. Namibia and South Africa	1987	Orange	No	Control, Development and Utilisation of the Water Resources of the Orange River.
11. Bophuthatswana, Botswana and South Africa	1988	Limpopo (Marico River)	No	The supply of water from the Molatedi Dam on the Marico River.
12. Botswana and South Africa	1989	Limpopo	No	Replacing the Joint Permanent Technical Committee with a Joint Permanent Technical Commission. The Joint Upper Limpopo Basin Study (JULBS) under the auspices of the JPTC established in 1983.
13. Mozambique, South Africa Swaziland	1991	Incomati	Yes	TPTC ministerial meeting of ministers responsible for water affairs.
14. Lesotho and South Africa	1991	Orange	Yes	Protocol IV to the LHWP Treaty: Supplementary Arrangements regarding Phase 1A.
15. Lesotho and South Africa	1992	Orange	Yes	Ancillary agreement to the deed of undertaking and relevant agreements entered into between the LHDA and South Africa.
16. South Africa and Swaziland	1992	Incomati	Yes	Establishment and Functioning of the Joint Water Commission (JWC).
17. South Africa and Swaziland	1992	Incomati	Yes	Development and Utilisation of the Water Resources of the Incomati River.
18. KaNgwane and South Africa	1992	Incomati	Yes	Development and Utilisation of the Water Resources of the Incomati River.
19. Namibia and South Africa	1993	Orange	Yes	Establishment of a Permanent Water Commission (PWC).
20. Namibia and South Africa	1993	Orange	No	Vooldsdrift and Noordoewer Joint Irrigation Scheme.
21. SADC Member States	1995	All International River Basins in the SADC Region.	No	SADC Protocol on Shared Watercourse Systems.
22. Mozambique and South Africa	1996	Limpopo and Incomati	No	Establishment and Functioning of a JWC.
23. Botswana and South Africa	1997	Limpopo	No	Establishment of a Joint Water Commission (JWC).
24. Lesotho and South Africa	1999	Orange/Senqu	Yes	Protocol VI to the LHWP Treaty.

25. Lesotho and South Africa	1999	Orange S enqu	No	Joint Permanent Technical Commission (JPTC) of the LHWP.
26. LHDA and Lesotho NGOs	1999	Senqu	No	Memorandum of Understanding regarding cooperation between the LHDA and NGOs on the LHWP.
27. SADC Member States	2000	All International River Basins within the SADC Region.	No	Revised SADC Protocol on Shared Watercourses.
28. Botswana, Lesotho, Namibia, and South Africa.	2000	Orange S enqu	No	Establishment of the Orange-Senqu River Commission.
29. Mozambique, South Africa and Swaziland	2002	Incomati and Maputo	No	Cooperation on the Protection and Sustainable Utilisation of the Water Resources of the Incomati and Maputo Rivers.
30. Mozambique, South Africa and Swaziland	2002	Incomati and Maputo	No	Resolution of the Tripartite Permanent Technical Committee of Exchange of Information and Water Quality.

Sources: Agreement (1890); Agreement (1964); Agreement (1971); Agreement (1983); Agreement (1986a); Agreement (1986b); Treaty (1986); Agreement (1987); Agreement (1988); Tripartite Ministerial Meeting (1991); Agreement (1992); Treaty (1992a); Treaty (1992b); Agreement (1993a); Agreement (1993b); SADC (1995); Agreement (1996); Agreement (1997); Treaty (1999); Agreement (2000); Agreement (2002a) and Agreement (2002b).

Many of the agreements or treaties entered into between South Africa and its neighbours took place during periods of great political tension that sometimes involved cross-border raids by elements of the South African Defence Force (SADF) (see Figure 10). This attests to the positive value of cooperation in the water sector (Turton, 2003b:147-148) between states regarding the four international river basins.

Figure 10
Number of Agreements or Treaties regarding the Four River Basins from 1890 to 2002



9.5. Conclusion

The institutional and legal developments regarding the country's water resources date back to the arrival of white settlers in South Africa in the seventeenth century. As early as the late 1650s a number of Placaats appeared that dealt with the safeguarding of the streams that flowed from Table Mountain. These regulations mainly dealt with the pollution of these streams and laid down certain requirements regarding the matter. It was in the nineteenth century that laws regarding the allocation of water resources among different users started to develop. However, it was only in 1912 that the first water law was codified. This was two years after the establishment of the Union of South Africa. It can therefore be concluded that South Africa's water law was the outflow of a centralised government, which took water resources development to heart. Before the 1912 Water Act, the government of the Cape Colony also passed numerous laws. Most, if not all, were failures.

The 1956 Water Act was a response to South Africa's increasing urbanisation and industrialisation. It not only focused on irrigation, like the 1912 Act, but more on water resources for urban and industrial users. The 1998 National Water Act superseded this Act. This Act responded to the skewed allocation of water resources to different population groups. No longer were white farmers the privileged recipients of water, but rural communities and the urban poor were given preferential treatment in this regard.

The institutional development regarding South Africa's water resources has another face. It is not only domestic laws and regulations that have developed over time. International agreements and treaties also increasingly became part of the hydropolitical landscape of South Africa's international river basins. However, these were much later additions to the institutional arrangements of the international river basins.

The type and frequency of the signing of the agreements and treaties is an indication of the trajectory of the development of the river basins. Starting in 1890, a border treaty was signed between Germany and Great Britain. This is an indication that the frontier was nearing closure and that the colonial powers were fixing the borders between their territories.

Starting in 1926, a number of agreements and treaties relating to the water resources development of the international rivers were entered into. Between 1926 and 1963 only one agreement had been signed between Portugal and South Africa. Because this agreement was concerned with rivers of mutual interest between the two countries, they were legally bound by this agreement regarding any future development of the Incomati, Maputo, and Limpopo. However, joint projects were now implemented between the two countries except for the Kunene River Project between South West Africa and the Portugal colony of Angola. It was only in 1971 that the Massinger Dam was constructed, but this dam is situated entirely in Mozambique. Portugal relinquished its colonies in 1974 and no further mutual developments took place regarding the Incomati, Maputo, and Limpopo.

From the mid-1980s to the present agreements and treaties were entered into at an ever-increasing frequency regarding the joint utilisation of the international rivers. This was after and during South Africa's implementation of large-scale inter-basin transfers and other water resources development projects within its borders. This is an indication that, as the river basins became increasingly over-exploited, international institutional arrangements were necessary to manage them in an increasingly complex interdependent system. This system

not only included the network of dams and IBTs in South Africa, but also those that transferred water to South Africa's neighbours and took water from them. Thus, South Africa and its neighbours were becoming increasingly part, both infrastructurally and institutionally, of a region-wide water resources development complex.

A large number of agreements were signed between 1990 and 1995. This is a sign that South Africa was entering into relationships with its neighbours that were more cordial following political reforms in the early 1990s, and that the country was re-entering the international arena after years of isolation. Furthermore, the four international river basins in combination also show an advanced degree of institutional development.

10. DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

10.1. Discussion

The study had the following objectives:

- To document the hydropolitical history of the major international river systems in South Africa in one coherent document;
- To discover what the past experience of water management in these river systems was;
- To establish a backdrop which project planners, water service utilities, government departments and catchment management agencies (CMAs) can use for the effective management of the international rivers' water resources;
- To contribute to a multi-disciplinary understanding of the dynamics of South Africa's major international river basins; and
- To build capacity by incorporating research assistants from previously disadvantaged communities into the research team.

These objectives were reached in the following manner:

Objective 1: To document the hydropolitical history of the major international river systems in South Africa in one coherent document. This objective has been successfully completed. The hydropolitical history of South Africa's major international river basins has been documented in one coherent document entitled: *A Hydropolitical History of South Africa's Major International River Basins*.

Objective 2: To discover what the past experience of water management in these river systems was. This objective was successfully completed in that major discoveries were made regarding the past experience of water resources management in South Africa's major international river basins. For instance, the development of the legal and institutional arrangements from the mid-seventeenth century to the present is an indication of the manner in which the decision-makers in South Africa managed the country's water resources over time. The past experience of these management practices is contained in these developments.

Objective 3: To establish a backdrop which project planners, water service utilities, government departments and catchment management agencies (CMAs) can use for the effective management of the international rivers' water resources. This objective was unfortunately not successfully completed. The reason for this was the overwhelming volume of information to be incorporated to reach objective 1 and 2. Nonetheless, the research can be used to develop objective 3 further.

Objective 4: To contribute to a multi-disciplinary understanding of the dynamics of South Africa's major international river basins. This objective was successfully reached. The research included not only disciplines like politics and international relations, but also anthropology, common law, history, international law and sociology.

Objective 5: To build capacity by incorporating research assistants from previously disadvantaged communities into the research team. This objective was successfully reached by the incorporation of two research assistants from previously disadvantaged communities,

Oteng Seremo and Patrick Mampane. Both students gained valuable research experience and are thinking of furthering their studies in the disciplines of geography and international relations respectively. Patrick Mampane has indicated that he would like to do a D.Phil. in international relations on a subject relating to water politics.

10.1.1. State-of-the-art

The research contributed to the state-of-the-art of water resources management in South Africa in that it looks at the history of the management of South Africa's international water resources. Where information was previously fragmented and widely dispersed in numerous publications, it is now compiled into one coherent document. In this way, the research takes us a step closer towards understanding water resources developments in the international rivers. It also indicates the phenomena, events, and individuals that played a role in the development of these water resources and the institutional arrangements accompanying it.

10.2. Recommendations

A number of recommendations are made:

- That further research is conducted on the traditional (Bantu, Khoi-Khoi and San) legal arrangements (before European settlement) regarding water resources management in South Africa. It is recommended that such a study be conducted with the current developments regarding the South African water law, to indicate the complementarity or disparity between Western and traditional water resources management practices.
- That further research is conducted on the issue of the Incomati, Limpopo and Orange River basins being at risk of political stress. In other words, further research on the international treaties and agreements (institutional development) that will either prove or refute Wolf, Yoffe and Giordano's (2003) assumptions about the three international river basins.
- Related to this, further research should be conducted on the direct or indirect role of the governments of South Africa's neighbours regarding the entering into agreements with either South Africa or the former TBVC states.
- That further research is conducted on the history of the occurrence, frequency and severity of extreme weather events (droughts and floods) in comparison with the contemporary climate change discourse.
- It is recommended that the Department of Water Affairs and Forestry (DWAF) set up a water museum. Such an endeavour had been attempted in the past but was abandoned because of a lack of funding. Such a museum could become a valuable learning centre regarding the water resources of the country.
- That this study should be produced as a geographic information service (GIS) product. Such a tool will be a valuable source of information, not only for decision-makers, but also for students and NGOs wanting to learn more about South Africa's international river basins. A second version of such a GIS product can also be produced for learners at secondary school level.
- It is also recommended that the study be followed up by another outlining the trajectory (history) of water resources development to supply water to some of South Africa's major

cities. This will give an indication of the drivers behind urban and industrial water use and the pattern of distribution between different users.

- This study, it is recommended, should be followed up by one that describes the hydropolitical history of some of South Africa's coastal (national) rivers, like the Thukela and the Berg Rivers.
- There are still a number of historical gaps in the research. These could not be filled due to time and financial constraints. It is suggested that the gaps be identified and further researched.

10.3. Conclusion

The hydropolitical histories of South Africa's international river basins are linked closely and interdependently to the general history of the country. Humans, and the events they are responsible for, shape history, just as they shape the course of the water resources management of a river and ultimately a country. This can be discerned in the connection between the opening and closing of the frontier and water resources development of the international river basins.

With the opening of the pre-colonial frontier, the river basins were settled by traditional pastoralists and hunter-gatherers. They used the rivers as a source of drinking water, and in the case where cattle were owned, for stock-watering purposes. The rivers were also a source of food. The Bushmen used to dig large pits in which hippo and other game were caught. However, no evidence of irrigation by the San, Khoi-Khoi, and Bantu peoples was found during the research. Therefore, it can be assumed that dry-land farming was practised in the case of the Khoi-Khoi and Bantu peoples. They were the peoples who were most likely to plant maize and other indigenous foodstuffs, like millet. The San were hunters and gatherers, and were therefore unlikely to plant foodstuffs. This is not to say that they did not make physical or spiritual use of the international rivers, however.

The development of South Africa's international river basins is therefore closely linked with the settlement of the land over the centuries. The San, Khoi-Khoi and Bantu used the international rivers in much the same way. The rivers were seen as valuable sources of the natural resources, water and food included, and were used accordingly. The settlement of Europeans changed this. The white settler attached more economic value to the water resources of the international rivers than the other population groups of South Africa. This is evident in the development of the legal and institutional development of water resources management since the late 1650s. The early laws, contained in Placaats, forbade the pollution of the streams flowing from Table Mountain. The reason for this was that the Dutch East India Company (VOC) placed an economic value on the water resources, because it was at that time "exporting" water *via* its trading vessels to other parts of the world. The sailors of its ships needed a clean water supply to last them on their long journeys to the East.

These laws later developed into more sophisticated regulations, especially regarding the riparian use of rivers and streams. The state later took control of these rivers and streams to stimulate the socio-economic development of the country. This was especially the case in the late nineteenth and twentieth centuries.

The first international river to be exploited, in a Western manner, was the Orange. This was followed by the Limpopo and lastly the Incomati and Maputo Rivers. The last two rivers' late development was due to the prevalence of malaria in their basins. It was no coincidence that these rivers' hydropolitical histories conform to this chronological sequence. The Orange and Limpopo Rivers were first exploited because of their geographical location from Cape Town, the place where whites first settled the country. The Orange was the first large river to be encountered when whites started to move north into the interior of South Africa and the Limpopo the second. The Voortrekkers also saw the Orange River as a natural divide between themselves and the British when they embarked on their epic journey in the 1830s. Therefore, the Orange was, over the centuries, not only a river of economic importance, it also contained psychological value to the white emigrants, for it was beyond the Orange River that freedom from Britain was to be obtained.

The Great Trek (as the harbinger of the third phase of the frontier) and the proceeding Difaqane / Mfecane were other occurrences in the history of South Africa that had an impact on the country's international river basins. The Difaqane / Mfecane depopulated the interior of the country and led to the settlement of Bantu tribes in areas of the country other than the south-eastern coastal belt. Those who lived in the interior moved further north, or, in the case of the Basotho and the Tswana, to mountain regions and the fringes of the Kalahari Desert, respectively. After the Great Trek, whites were settled across the entire territory of South Africa. The Trek also led to the establishment of two new states in the South African interior – the OFS and ZAR. These two entities had to establish the border between themselves and between themselves and the British in the Cape Colony. Only after a border dispute between the OFS and ZAR was the Vaal River set as the border between the two states. The Orange River was also established as the border between the OFS and the Cape Colony. Thus, after 1854 (when the OFS gained its sovereignty), the Orange, Limpopo, Incomati, and Maputo Rivers were shared by no fewer than four state entities – the Cape Colony, the Colony of Port Natal, the OFS, and the ZAR.

Development plans of some of the international rivers also date back to this period. Plans to develop the Orange and Caledon Rivers date back to 1850 and 1846, respectively. These were some of the most important discoveries made during the research. Material on Sir George Gray's plans (c. 1850s) to use water from the Orange River to irrigate land in the Eastern Cape indicates that the Orange River Project (ORP) dates back much further than the 1960s. The discovery of Thomas Bain's map and sketches, proposing a canal from the Orange River near Aliwal North to the Eastern Cape in 1886, is also important regarding these earlier plans. This is another indication that the ORP had been in the minds of engineers and decision-makers long before the National Party Government under Hendrik Verwoerd started with construction on it in the 1960s. It was Arbousset, the French missionary, who suggested that the Caledon River be used for irrigation. Arbousset's 1846 book also describes the upper reaches of the Orange, Vaal and Tugela Rivers and whether these rivers can be exploited. Thus, by 1846, the Orange River was known from source to mouth: its exploration was started by a number of individuals from a variety of backgrounds, from Col. Robert Jacob Gordon, garrison commander at the Cape in 1777 and 1779, to thieves and cut-throats and missionaries like David Livingstone. The journeys of these people were important to the contribution of the knowledge of the river basin. From this knowledge came some of the plans for the exploitation of the Orange.

Thus, during the pre-colonial, first, second, and third phases of the frontier of South Africa, the international river basins of the country saw very limited developments. It was during the fourth (final) phase of the frontier that water resources development projects were discussed in earnest among the decision-makers of the Cape Colonial government. Yet shortly before this phase individuals, other than government officials, propagated the hydraulic mission.

Brown's 1875 and 1877 books on the water supply and hydrology of South Africa were valuable in gaining insight into water resources development during the late nineteenth century. He also used some of the knowledge of the earlier explorers in his study, suggesting that their knowledge was indispensable at that time for any plans to develop irrigation along the Orange River. In this, he argued that the rivers of the country should be used to make the desert bloom. He also criticised the laziness of trekboers who did not practise any irrigation methods. In other words, Brown can be seen as the father of the hydraulic mission in South Africa. However, his recommendations concerning the establishment of irrigation in South Africa were not implemented by the decision-makers of his time.

Many Members of Parliament were either for or against irrigation in the Cape Colony. Reasons that were stated were, amongst others, that the financial situation of the Colony did not permit irrigation projects. It was also argued that irrigation projects should be implemented across the entire Colony and not only on the Orange River. Because of these debates, irrigation in the Orange River developed in fits and starts.

This was also the case regarding irrigation in the OFS and ZAR. In these states factors similar to those in the Cape Colony also played a role. The farmers of these states either farmed extensively, requiring large tracts of land, or were trekboers, moving from one piece of land to the other, according to the season and availability of grazing. These methods of farming did not require irrigation. Livestock was also the predominant agricultural commodity. Dams were necessary for stock-watering purposes, but were not always vital. If a farmer had access to a natural surface water body, he would have had a supply of water and did not need to construct a dam. Where grains or vegetables were planted, this occurred to a limited extent and relied on rainfall for water.

This changed with the discovery of minerals in the interior of South Africa, especially gold and diamonds. These discoveries led to infrastructural developments like railways and roads. Because of these infrastructural developments, markets were opened and the farmer could sell his surplus produce to this market. The growth of towns and cities were a further stimulus. This was during the final phase of the South African frontier. When the frontier closed in 1900, a number of irrigation projects had already been implemented on the Orange and Limpopo Rivers.

The discovery of diamonds and gold, in 1867 and 1886, respectively, led to the establishment of urban centres that had to be supplied with water. At first Johannesburg and Kimberley were supplied with water by private companies. Later the state, or in the case of Kimberley, local government, took over this role. In the case of Johannesburg water was supplied from sources situated long distances from the centre of demand. This was also the case with the area supplied by Sedibeng Water. The discovery of gold in the Free State after the Second World War led to the establishment and growth of urban centres that needed to be supplied with water. Later this regional water supply had to be expanded to serve other human settlements. The same happened with the Kalahari East and West water supply projects.

where the growth in mining concerns heralded the establishment or expansion of water supply projects. Thus, where the discovery and exploitation of minerals occur, as in the case of Johannesburg, Kimberley, and Phalaborwa, water resources development projects will follow. The only case where this did not happen was in the Ellisras district. In this case, the discovery and exploitation of minerals followed water resources development, after the sinking of boreholes for stock-watering purposes unearthed coal deposits.

Nonetheless, international cooperation dates back much further than 1926, when South Africa signed an agreement with Portugal regarding rivers of mutual interest (the Limpopo being one). In 1899, the Aliwal North Water Supply Scheme and the Odendaal Stroom Scheme were discussed between the Cape Colony and the Orange Free State (OFS). Notwithstanding a joint conference between the two governments, the outbreak of the Anglo-Boer War later that year put a stop to the implementation of the project. Today, a number of international agreements and treaties have been signed between South Africa and its neighbours regarding the international rivers. These agreements and treaties are positive aspects that bode well for future cooperation within the international river systems.

After the end of the Anglo-Boer War, the reconstruction of South Africa began. In this, water resources development projects played an important part. For example, the White River Estates, in the Incomati River basin, were established as a means to settle Afrikaner farmers who had no income. Thus, water resources development project form an integral part of the socio-economic development of a society after a traumatic political event like a war.

Eight years after the end of hostilities, in 1910, the Union of South Africa was established. Before this, in 1909, the first Irrigation Congress was held in Robertson in the Cape.

During this congress the seriousness of irrigation and its benefits to the country as well as a development of South African water law before 1909 were discussed. It was the consensus of the congress that irrigation works should be implemented on a larger scale across the entire country. In this regard, water resources planners and decision-makers played an important part in the strengthening of irrigation development in the country.

After 1910, increasing numbers of irrigation districts and projects were implemented. The consolidation of the South African state was therefore an important landmark and stimulus for the construction of irrigation projects. However, it was after 1930 that large-scale water resources development projects were starting to be implemented on the international rivers, especially the Orange and Limpopo. Before this, the Incomati and Maputo Rivers also attracted attention after malaria in these basins was controlled.

Lewis's arguments in the 1930s that no large irrigation project should be constructed on the Orange River did not deter the government from constructing such large schemes as the Vaal Dam. The severe drought and depression impelled the government to do this. Therefore, the drought and the depression of the 1930s can be seen as the main stimuli of the hydraulic mission of the twentieth century in South Africa.

Some of the most important results are that many irrigation projects were implemented during the twentieth century to assist the South African agricultural sector. This was especially the case after the depression and drought of the 1930s, because this sector was hardest hit by these events and therefore had to be helped.

Many projects, dams included, were constructed by using white labour to perform skilled tasks and black and coloured labour to do the menial tasks. Whites were also paid more than the other racial groups working on these projects. In one case, the Orange River was even used as a natural divide to separate the white workers' camp from that of the coloured workers. Thus, water resources development projects were a means of alleviating the poor white problem that had been haunting South Africa since the 1890s.

Related to this, water played an important part in the establishment of the black homelands. Water was to be the backbone of agricultural development in these areas. Subsequently, agricultural development was to be the mainstay of these areas' socio-economic development. Without irrigation, agriculture was not possible, and without any agriculture, there would be no development. A number of schemes, like the one on the Njelele River, were implemented for this reason. Thus, successive National Party governments' apartheid policy was another stimulus of the hydraulic mission. It can therefore be stated that social policies, along with economic and other policy initiatives, will have an impact on the manner in which water resources management is conducted.

Furthermore, as South Africa's population increased over time, increasing numbers of water resources development projects were implemented. This indicates that population growth and socio-economic development of the population are some of the most important drivers behind the implementation of such projects. Most of the projects were implemented during the time of the world economic boom (from about 1930 to the mid-1970s). It is no coincidence that construction of the ORP was planned and started during this period. South Africa had the financial resources for such projects and the level of socio-economic development, although these favoured a small minority of the country. The ORP was also the first inter-basin transfer (IBT) scheme to be constructed in South Africa. It was not the last. Others followed in its wake, like the Tugela-Vaal Project, the Vaal-Gamagara Scheme, the Usutu-Vaal Scheme, the LHWP, and many others. These IBTs fulfill an important function in the South African political economy, in that they transfer water from where it is in abundance to where it is in dire need. Therefore, they can be seen as means to an end and not as ends in themselves (to serve as a political instrument for the political entrenchment of a small portion of the country's population).

It was during the 1970s that inflation and associated increasing costs started to become an important consideration for the implementation of such projects. This factor is still today an important consideration regarding the construction of large water resources development schemes. However, other aspects also started to become important in this regard.

The HIV/Aids pandemic is one such variable. With this pandemic raging across Southern Africa it will be interesting to note what impact this disease will have on the implementation of water resources development projects. Population growth and the associated socio-economic development of South African society were among the main reasons for the hydraulic mission being implemented during the twentieth and the early parts of the twenty-first centuries. Some of the projects were not without controversy. The impact on the natural environment and on communities affected by large projects is yet another factor that will in future have an impact on the construction of large schemes. The WCD hearings attested to this.

The WCD hearings, held in November 1999, gave a different perspective on the planning, implementation and operation of water development projects, particularly large dams. Whereas these projects were implemented in the past in the best interest of the nation, the planners did not foresee or ignored completely the problems that these projects would create. The most serious problem was the negative impact on the people living in the area where dams were built, for the good of a minority group that ruled South Africa from 1652 to 1994. The controversy surrounding large water resources development projects is not a thing of the past and will continue into the future. This is the case with the LHWP and will most likely be the case with any future water project on South Africa's other international river basins.

Therefore, what seem to be new developments in South Africa's international river basins (i.e. international cooperation, plans for large-scale water resources development projects, conflict over water and other natural resources, the role of non-governmental organisations and individuals, new developments in water laws, and the propagation of water demand management) have already occurred to some extent in the past.

In summary, the following events in South Africa's history had an impact on the development of the country's international river basins:

- The pre-colonial settlement of the country.
- The arrival of white settlers.
- The miscellaneous expeditions into the interior of the country.
- The Difaqane / Mfecane.
- The Great Trek.
- The establishment of sovereign independent states.
- The discovery of minerals.
- The Anglo-Boer War.
- The First Irrigation Congress.
- The establishment of the Union of South Africa.
- The codification of South African Water Law.
- The establishment of the Department of Irrigation.
- The depression and severe drought of the 1930s.
- The Second World War.
- The rise of the Afrikaner as the ruler of South Africa.
- The introduction and implementation of apartheid.
- The world economic boom.
- The policy of apartheid.
- The 1970s oil crisis.
- The total onslaught and total national strategy.
- F.W. de Klerk's 2 February 1990 speech.
- The ANC's electoral victory in 1994.
- The National Water Act (Act No. 36) of 1998.

These events had an impact on South Africa's international river basins not because they took place, but because individuals made them happen. In some cases, like in the case of the depression and the numerous droughts and floods, individuals either propagated or

implemented the hydraulic mission as a reaction to these natural events. Thus, the hydraulic mission is stimulated by political and environmental factors as well as human activities.

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