



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF WATER AFFAIRS AND FORESTRY
THE REPUBLIC OF SOUTH AFRICA

THE STUDY
ON
THE EXPANSION OF CAPACITY OF
MAGALIES WATER
IN
THE REPUBLIC OF SOUTH AFRICA
(PHASE 1)

FINAL REPORT

EXECUTIVE SUMMARY

DECEMBER 1996

JICA LIBRARY



J 1141065 (1)

SANYU CONSULTANTS INC.

NIHON SUIDO CONSULTANTS CO., LTD.



SSS
JR
96-131

PREFACE

In response to request from the Government of the Republic of South Africa, the Government of Japan decided to conduct a master plan study on the Expansion of Capacity of Magalies Water and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to South Africa a study team headed by Mr. S. Kadowaki, SANYU CONSULTANTS INC., and composed of staff members of SANYU CONSULTANTS INC. and NIHON SUIDO CONSULTANTS Co., LTD., two times between November 1995 and December 1996.

The team held discussions with the officials concerned of the Government of South Africa and conducted field surveys at the study area, and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of South Africa for their close cooperation extended to the team.

December 1996



Kimio Fujita

President

Japan International Cooperation Agency



1141065 [1]

December 2, 1996

Mr, Kimio FUJITA
President,
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit the final report of the Phase 1 on the Study on the Expansion of Capacity of Magalies Water in Republic of South Africa. This report incorporates the views and suggestions of the authorities concerned of the Government of Japan and your Agency. Also included are comments made by the Department of Water Affairs and Forestry, Magalies Water and other stakeholders in the Republic of South Africa during Project Management Committee and Project Steering Committee meetings held in Pretoria where the draft report was discussed.

In terms of South Africa's new water supply and sanitation policy, a specific challenge is to transform and empower institutions in the sector to deliver service so that all communities in the country can have access to water and sanitation in future. The basic elements of this water supply and sanitation policy are presented in the White Paper on Water Supply and Sanitation, which in turn is based on RDP principles. The study has followed these policy and strategy guidelines.

The Study contributes to the above challenge by considering a specific region of South Africa (Magalies Water Board Supply Area) with the following objectives:

To formulate an overall strategic framework/master plan for the appropriately phased, long term, sustainable development of water supply infrastructure and the development of sanitation, including appropriate Second and Third Tier support, in the extended supply area of Magalies Water. By developing a priority programme to the year 2002, and an extended programme to 2015 should be included.

To share technology on planning methods and skills with counterpart personnel of Magalies Water and DWAF, and other participating organisations.

This report contains the findings, conclusions and recommendations and important outputs of this phase have been Policy and Strategy recommendations, Water Supply Infrastructure development plans, Capital Investment plan and Institutional Development proposals.

Feedback from the key stakeholders involved in discussions indicates that the Study is already yielding findings of considerable value. The opportunity to have a team working on this master plan is particularly important in South Africa where there is a shortage of skilled resources.

The report consists of nine volumes being and Executive Summary, Main Report and seven volumes of Supporting Reports.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Welfare of the Government of Japan for their valuable advice and suggestions. We would also like to express our deep appreciation to the relevant officers of the Department of Water Affairs and Forestry, Magalies Water and other related agencies of the Government of the Republic of South Africa for their cooperation and the assistance extended to us during our study.

Very truly yours,



Satoshi KADOWAKI
Team Leader, Phase 1
Study on the Expansion of
Capacity of Magalies Water
In the Republic of South Africa

LOCATION MAP

JICA STUDY ON THE EXPANSION OF CAPACITY OF MAGALIES WATER

KEY MAP

- LEGEND :**
- RIVERS
 - ▭ DAMS
 - ▭ TOWNS & VILLAGES
 - ⊠ WATER TREATMENT WORKS
 - ⊠ SEWAGE TREATMENT WORKS
 - ⋯ JICA STUDY AREA
- SUPPLY ZONES :**
- WESTERN ZONE
 - CENTRAL ZONE
 - EASTERN ZONE
- SUPPLY BLOCKS :**
- ▭

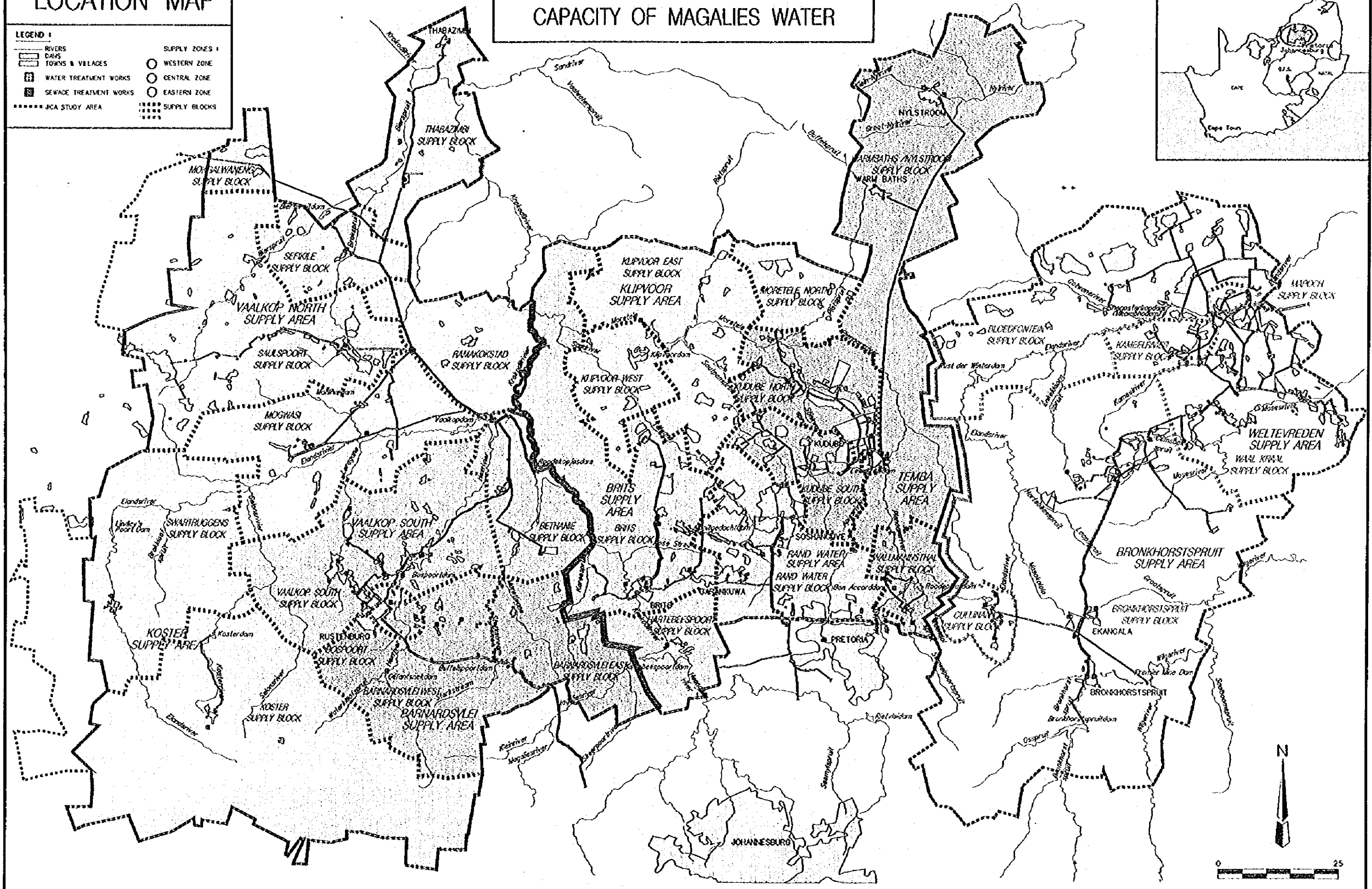
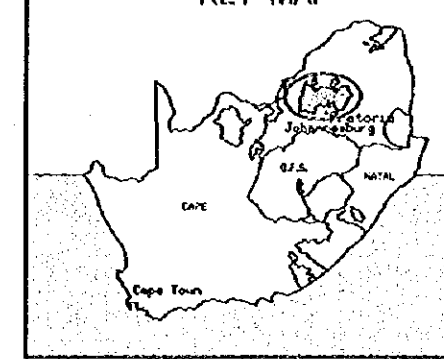


TABLE OF CONTENTS

LOCATION MAP

ABBREVIATIONS AND TERMINOLOGY

1.	INTRODUCTION	1
1.1	Background of the Study	1
1.2	Current Situation of the Water Sector	1
1.3	Objectives of the JICA Study (Phase 1) and Management Structure	2
1.4	Composition of this Report	2
2.	STUDY AREA	3
2.1	Extent of the Study Area and Natural Conditions	3
2.2	Socio-Economic Conditions	3
2.3	Existing Water Supply Infrastructure	4
2.4	Institutional Environment of the Water Sector	5
2.5	Water Tariff and Cost Recovery	6
3.	DEVELOPMENT POLICY AND CONSTRAINTS	7
3.1	Development Objectives	7
3.2	Major Constraints	7
3.3	Policy and Strategy Recommendations	9
4.	WATER DEMAND AND SOURCE OF SUPPLY	12
4.1	Population Projection	12
4.2	Water Demand Projection	12
4.3	Water Source and Availability	13
4.4	Water Quality	14
5.	INFRASTRUCTURE DEVELOPMENT PLANNING	16
5.1	Short and Medium Term Development Plan	16
5.2	Long Term Development Plan	16
5.3	Outline of the Infrastructural Development	16
5.4	Infrastructure Development Cost	17
5.5	Sanitation Improvement	18
5.6	Environmental Impact	18

6.	INSTITUTIONAL DEVELOPMENT PLAN	20
6.1	Basic Concept	20
6.2	Capacity Building for Third Tier Actors	20
6.3	Community Development Plan	21
6.4	Training Programs	22
6.5	Support Structure	22
7.	INITIAL CAPITAL INVESTMENT PLAN	23
7.1	Basic Concept and Framework	23
7.2	Cash Flow Simulation	23
7.3	Preliminary Tariff Calculation (Case Study)	23
7.4	Fund Mobilization	24
7.5	Financial Viability of Stakeholders/Role Players	24
8.	IMPLEMENTING ARRANGEMENT	26
8.1	Implementation Schedule	26
8.2	Management Structures	27
8.3	Budget Arrangement	28
9.	EVALUATION AND PRIORITISATION	29
9.1	Project Evaluation	29
9.2	Prioritisation	31
10.	T.O.R. FOR PHASE 2 AND 3	32
10.1	Major Outstanding Issues in Phase 1	32
10.2	T.O.R. for Phase 2 and Phase 3	32
11.	CONCLUSION AND RECOMMENDATION	34

ABBREVIATIONS AND TERMINOLOGY

The following abbreviations are used in this report:

BODA	British Overseas Development Agency
CBOs	Community Based Organisations
CIP	Capital Investment Plan
CWSS	Community Water Supply and Sanitation
DANIDA	Danish International Development Agency
DBSA	Development Bank of Southern Africa
DC	District Council
DFA	Development Facilitation Act
DWAF	Department of Water Affairs and Forestry
ESA	Extended Supply Area of Magalies Water Board as gazetted in April 1996
ESCOM	Electricity Supply Commission
JICA	Japan International Cooperation Agency (the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan)
LRDC	Local Reconstruction and Development Committee (Local RDP Committee)
LWC	Local Water Committee
MW	Magalies Water Board
NGOs	Non-Governmental Organisations
NWP	North West Province
NWWA	North West Water Supply Authority
O&M	Operation and Maintenance
ODO	Organisation Development Officer
OECF	Overseas Economic Cooperation Fund of Japan
PMC	Project Management Committee of the JICA Study
PSC	Project Steering Committee of the JICA Study
PWG	Project Working Group of the JICA Study
PWV	Pretoria Witwatersrand Vereeniging triangle (geographical area)
RBC	Rotating Biological Contact
RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
RWB	Rand Water Board
S/W	Scope of Works
SR	Service Reservoir
STW	Sewage Treatment Work
SWET	Sanitation and Water Education and Training Program
TDS	Total Dissolved Salts

THM	Trihalomethanes
TLC	Transitional Local Council
TMC	Transitional Metropolitan Council
TOR	Terms of Reference
TRC	Transitional Rural Council
VIDP	Ventilated Improved Double Pit toilet (latrine)
VIP	Ventilated Improved Pit Latrine
WP	White Paper
WRC	Water Research Commission
WRYM	Water Resources Yield Model
WTW	Water Treatment Works

UNITS

c	Cent (100c = R1)
ha	Hectare
kg/c/year	Kilograms per capita per year
kl	Kilolitre
kld	Kilolitres per day
km	Kilometre
km²	Square kilometre
l/c/yr	Litres per capita per year
lcd	Litres per capita per day
m³/c/yr	Cubic metres per capita per year
mem	Million cubic metres
mem/a	Million cubic metres per annum
mg/l	Milligrams per litre
Mld	Megalitres per day
R	Rand (R1 = 100c)

1 Rand = 25 Japanese Yen (as of November 1996)

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Background of the Study

The Governments' main focus is to transform South Africa. The Reconstruction and Development Program (RDP), which is aimed at social and economic development is the central program.

In terms of South Africa's new water supply and sanitation policy, a specific challenge is to transform and empower institutions in the water sector so that all communities in the country have access to water and sanitation services. The provision of support services by the Government and Water Boards is essential to achieving sustainable benefits. The basic elements of the water supply and sanitation policy are presented in the White Paper on Water Supply and Sanitation, which in turn refers to the RDP.

1.2 Current Situation of the Water Sector

The White Paper was published in November 1994 as a policy document with the aim of clearly setting out the position and strategies to be followed by DWAF and other institutions involved in water supply. It covers the historical background, development approach, basic policy principles, institutional framework, standards and guidelines for services delivery, and policy for financing service delivery.

The principles of the White Paper require that: "development should be demand driven and community based"; development pursues "equitable regional allocation of development resources", "water has an economic value and the user must pay for it"; the principles of "integrated development and environmental integrity" are followed.

The White Paper also provides some guidelines for institutional reform in the water sector. This is particularly important because of the Government's emphasis on service delivery but obviously this will require institutional capacity. In terms of the White Paper the phased goals are:

- (1) *In the short term:* To maintain service delivery whilst rationalising DWAF and transforming and democratizing the Second Tier (Water Boards)
- (2) *In the medium term:* To support institutional development at the Third Tier level and to provide financial and technical assistance for water supply and sanitation services. The restructured DWAF and Second Tier institutions will work towards this goal together with the private and NGOS sectors.
- (3) *In the long term:* To ensure that the provision of services to customers is the function of local government supported by provincial government. The Second Tier will provide bulk water supply and wastewater disposal services, and DWAF will manage water

resources and monitor and regulate policy implementation.

1.3 Objectives of the JICA Study (Phase 1) and Management Structure

The objectives of the Study are to formulate an overall and strategic framework/ master plan for the appropriately phased, long term, sustainable development of water supply infrastructure and development of sanitation, including appropriate Second and Third Tier support, in the study Area. A priority program up to the year 2002, and an extended program up to 2015 are required to be included.

The study area covers approximately 28 000 km² and has a population of around 312 million. Within the proclaimed Extended Supply Area of the Magalies Water Board, water is currently supplied by Magalies Water, Rand Water and some local authorities.

Consultation and consensus are recognized to be critical, and this, together with a process-oriented neutral stance, is to be the cornerstone of the JICA Study. A three-tiered project management structure which consists of "Project Steering Committee"(PSC)," Project Management Committee" (PMC) and "Project Working Groups" (PWGs) was established in the initial stage of the Study.

The management structures performed successfully during the study period.

1.4 Composition of this Report

The Final Report is composed of an Executive Summary, Main Report and Supporting Reports. The latter include:

- A: General,
- B: Situational Analysis,
- C: Gap Analysis,
- D: Policy and Strategy Options,
- E: Preliminary Study of Water Supply System,
- F: Institutional Development Plan,
- G: Economic / Financial Analysis

A Data Book (comprising a limited number of hard copies) has also been produced. Much of the data will also be made available on computer disc for further use by the stakeholders, if required.

2. STUDY AREA

2.1 Extent of the Study Area and Natural Conditions

The Study Area is shown on the Location Map. It falls within part of four Provinces; Gauteng, North West, Mpumalanga and a small part of the Northern Province and is primarily drained by two main natural drainage catchments; parts of the Crocodile and the Olifants river basins, which are both of common interest to neighbouring states in the north and east.

The climate is semi-arid to arid and mean annual rainfall in the Study Area ranges from 500 to 800 mm, and takes place mostly between November and February. Average temperatures range from 8 to 28°C in the west and from 11 to 27°C in the east. Evaporation (A-Pán) decreases from the west (2,040 mm/year) to the east (1,700 mm/year) and is higher in summer. Runoff is highly seasonal and very variable from place to place. Average wind speeds are low and the prevailing wind direction varies across the Study Area.

Within the Study Area, the Crocodile River system comprises the Upper Crocodile, Pienaars, Elands and Lower Crocodile sub-systems. The former two also include the urban metropolitan areas of northern Johannesburg and Greater Pretoria which heavily influence the prevailing water quality in the Study Area and will have a significant impact on water resources availability in the years to come. Surface water impoundments have been developed on most tributaries within the Study Area and the estimated naturalised mean annual runoff of 883 mcm/a is close to the total storage volume of large dams which totals 840 mcm. Irrigation is a major water use sector and much of the infrastructure was developed to meet this demand. Bulk potable water supply schemes in the Study Area rely almost entirely on surface water.

Groundwater is widely used within the Study Area and there are many boreholes for private use for which no information is available. In many instances, however, the yield or quality is unsatisfactory and the potential for further significant development is low.

2.2 Socio-Economic Conditions

Since 1990 South Africa has seen unprecedented demographic shifts in the population arising from migration away from rural areas and rapid migration into the urban centres and surrounding peri-urban areas. The Study Area, located immediately adjacent to the PWV area (which is the economic heartland of the country) has been directly impacted by these changes. Some studies indicate that population growth rates in recent years have been as high as 26% per annum in some peri-urban settlements.

In the Urban Development Strategy and the Rural Development Strategy published in 1995 it was forecast that 75% of the national population will be urbanised by the year 2020 (compared to the present level of 38%).

Household size has a direct bearing on the Study as it affects both the level of consumption of water and the ability of households to pay for services.

In general it is noted that formal urban areas have the smallest households and that a significant

proportion these are white and Asian households of 3.2 to 4.0 persons and 3.5 to 5.0 persons respectively. By contrast rural and peri-urban villages have the largest household size with 6.0 to 7.8 persons and these are largely black households.

It is noted that there is a high disparity of incomes in the Study Area. As with household size average income figures are therefore of little use. The income distribution is characterised by: a high proportion of predominantly white population in the higher income categories, particularly in urban areas (e.g. Wonderboom); the subsistence rural population (predominantly black) with nobody in the higher income categories (e.g. Mankwe); areas with a high proportion of commuters having a high proportion in the middle income categories (e.g. Moutse); a relatively high income in the formal townships (e.g. Soshanguve).

Following the provisions of The Local Government Transition Act 209 of 1993, some 700 transitional metropolitan, local, and rural councils have been established throughout South Africa. There are approximately 15 transitional local councils (TLC's) and 25 transitional rural councils (TRC's) in the Study Area. Their major task is to maintain services, collect revenues and assume the functions of municipalities, but many of the TRC's are small in terms of the number of councilors and they lack critical resources. Residents in many communities are in no position to pay for services because the rural areas are underdeveloped with few employment opportunities. TRC's are therefore strongly dependent on proceeds from district councils and on Central Government grants.

District Councils are an evolution of the old Regional Services Councils. They are able to utilise levies paid by businesses in their areas of jurisdiction to support TRCs and other priority activities. They are also major actors in regional development planning. Some 6 DCs have been established in the Study Area, under the jurisdiction of various provincial local Government departments.

2.3 Existing Water Supply Infrastructure

The entire western region falls within the Crocodile River Basin, although substantial quantities of primary water (maximum capacity 140 Mld) are supplied to the Rustenburg area by Rand Water from the Vaal River system, via Randfontein and Barnardsvlei. Besides imported water, water for primary purposes is obtained largely from the Vaalkop Dam on the Elands River, which in turn is augmented from the Crocodile River system (Hartbeespoort and Roodekopjes Dams) via a transfer channel between Roodekopjes and Vaalkop. Primary water is also obtained from the Hex River for Rustenburg and its environs (Bospoort Dam), from the Koster River for Koster and its environs, and for Swartruggens from the Upper Elands River. Thabazimbi obtains a substantial portion of its primary water from underground sources. Vaalkop WTW has a current capacity of 120 Mld and is owned and operated by Magalies Water. Bospoort WTW has a capacity of 13.7 Mld (greater than the firm yield of the Bospoort Dam), and is jointly owned and operated by the Rustenburg TLC and by Rustenburg Platinum Mines.

All raw water sources for the central region form part of the Crocodile River catchment, with potable water being supplied into the Study Area from the Vaal River System by Rand Water. Raw water is abstracted for primary purposes from the Roodeplaat Dam (Pienaars River), the

Leeukraal Dam (Apies River) and the Hartbeespoort Dam (Crocodile River). At present water is purified by Magalies Water at Wallmannsthal WTW (14 Mld from the Roodeplaas Dam), Temba WTW (18 Mld, also from the Roodeplaas Dam), Kudube WTW (20 Mld, from the Leeukraal Dam - further extensions to 30 Mld are planned), and at two small local plants at Bosplaas and Makapaanstad (soon to be redundant). Brits TLC purifies Hartbeespoort Dam water within its own area of jurisdiction (60 Mld). Nylstroom TLC has a plant with a capacity of 4.0 Mld (Nyl River), and groundwater sources of an equivalent capacity. Warmbaths TLC operates a plant of 1.2 Mld capacity (local river). Generally the plants are in good to excellent condition and recent upgrades have enhanced both the capacity and operational efficiency. A large volume of potable water (capacity recently increased from 140 Mld to 300 Mld) is supplied into the central region by Rand Water, for consumption in the urban and peri-urban areas of Rosslyn, Ga-Rankuwa, Soshanguve, Mabopane, Winterveld and the surrounding villages.

In the eastern region, raw water is abstracted from the Bronkhorstspuit and Premier Mine Dams, (the former is to be augmented from the Grootdraai Dam (Vaal River System) under an OECF project in the short to medium term future), from the Mkombo (Renosterkop) Dam on the Elands River, and from the Loskop Dam, (by way of a transfer channel to the Weltevreden Works). At present water is purified at Bronkhorstspuit WTW (41 Mld from the Bronkhorstspuit Dam), Cullinan WTW (16 Mld from the Premier Mine Dam) and Weltevreden WTW (60 Mld from the Mkombo Dam). Magalies Water operates the Cullinan plant, DWAF the plant at Weltevreden and Bronkhorstspuit TLC the plant at Bronkhorstspuit.

2.4 Institutional Environment of the Water Sector

A new Department of Water Affairs and Forestry (DWAF) was established in July 1994 to replace the old Department of Water Affairs and to assume responsibility for water resources management, water supply, sanitation, and forestry functions and to better meet and manage the water related objectives of the RDP.

First Tier: DWAF has the national responsibility for ensuring that the water supply and sanitation needs of the people, and of the economy which sustains them, are met effectively. As part of the reform process within DWAF, a new *Chief Directorate of Community Water Supply and Sanitation* was established to promote water supply and sanitation. The responsibilities of the Chief Directorate are to:

- (1) assure effective on-going operation of potable water supply systems for which DWAF is responsible;
- (2) to plan and promote the expansion of services in collaboration with provincial governments;
- (3) to develop organisations at the local and regional level to achieve the goals of the RDP; and
- (4) to monitor and regulate water supply and sanitation activities in accordance with the constitution.

Second Tier: Water Boards will continue to function as autonomous, not-for-profit utilities, but will assume expanded responsibilities. They will continue to supply water to organized communities and individual consumers which may also include the provision of sanitation services. And they will assist in the development of the Third Tier.

Third Tier: Third Tier institutions are constitutionally responsible for the provision of water and sanitation services. Both statutory and non-statutory institutions are included in the Third Tier, and its capacity is highly varied. Roles and responsibilities have not been fully identified, understood or accepted. Currently some TLCs supply water using their own infrastructure. LWCs and LRDCs have water sector responsibilities at community level. The range of Third Tier institutions in the Study Area includes Local Authorities (DCs, TLCs, TRCs), Tribal Authorities, RDP structures, LWCs, NGOs and CBOs.

2.5 Water Tariff and Cost Recovery

In the Study Area, key role players for the delivery of water supply and sanitation services are DWAF (Mpumalanga Regional Office), Magalies Water Board, Rand Water, Brits TLC and Bronkhorstspruit TLC. In accordance of DWAF policy, some parts of areas formerly under North West Water Supply Authority (NWWA), namely, Bafokeng, Mankwe, Odi 2 and Moretele have been transferred to MW.

Since MW is a not-for-profit autonomous body and operates and manages its four water purification schemes largely for the wholesale of bulk water, it does not face serious risk of bad debts and has achieved full cost recovery until now. In 1995/96, water tariffs applicable in MW varied from 64.5c/kl in Temba to 110c/kl in Vaalkop.

NWWA is basically performing both the Second and Third Tier functions inherited from the former Bophuthatswana Water Supply Authority, and at time of data collection applied sliding tariffs in the Mabopane, Ga-Rankuwa and Temba areas with 100c/kl for the first 10kl/month, 225c/kl for over 45kl/month and 165c/kl in between. Tariffs for other service areas vary from 33c/kl in Kudube to 139c/kl in La Patrie/Doorhoek. NWWA employs the electric company to collect payments on their behalf, however, cost recovery has not been good historically and remains at 40 to 50 percent.

In Kwandebile, DWAF provides water supply and sanitation services, but only the Moutse area was being billed. While the prevailing tariff rose from 90 to 113c/kl in 1994, cost recovery was below 10 percent. It is reported that there is some overstaffing and a low level of efficiency in the current workforce.

TLCs which provide these services each apply their own tariff scale ranging from 94c/kl to 104c/kl. They are performing their duties in a satisfactory manner, but are facing problems with an increasingly substantial amount of bad debts.

3. DEVELOPMENT POLICY AND CONSTRAINTS

3.1 Development Objectives

Targets for water sector development in South Africa are based on the White Paper for Water Supply and Sanitation. In the broadest sense the policy objective is to redress the imbalances of the past. The key challenge in this context is to provide water supply and sanitation services to people and communities that have not had access to them in the past. Several more specific development objectives flow from the underlying policy vision:

- (1) All South Africans should enjoy at least the RDP minimum level of water supply and sanitation service (25 litres per person per day, to be transported over a distance not exceeding 200 m), and the opportunity to pursue higher levels if they are able to pay for them.
- (2) For service delivery in the water sector to be effective, actors across all three tiers should work in a mutually supportive way. Roles and responsibilities should be clearly assigned and accepted.
- (3) The economic value of water has to be recognised and accepted by all users. Appropriate payment for water is a foundation for further water sector development.
- (4) Water supply and sanitation services should be demand driven. Participation is thus a fundamental development objective.

3.2 Major Constraints

(1) Peripheral Area Issue

During the Study, problems of resolving boundaries were identified. However due to the sensitive nature of these issues the Study cannot resolve them during this phase. Instead these issues were discussed in order to facilitate an ongoing process of dialogue between the affected stakeholders. It is proposed that the Study should continue to provide similar input during Phase 2 to achieve final consensus.

The three most significant peripheral area issues are those of the Eastern Supply Zone, the Rand Water / Magalies Water interfaces and the question of TLC's acting as water boards:

- The issue concerning the Eastern Zone relates to the question of whether this area should form part of the MW extended supply area or not. An ongoing consultation process involving the stakeholders, DWAF and British ODA concerning the future of this area is taking place. Provisionally the stakeholders have expressed a desire for an independent water board. From a water resources management perspective, it would be desirable for a water board to operate on a catchment-wide basis and therefore incorporate Bronkhorstspuit WTW (Bronkhorstspuit TLC), and Cullinan WTW (Magalies Water).

- Rand Water currently supplies two areas within the Study Area. Both schemes comprise very significant inter-basin bulk water imports: The first area is Barnardsvllei where the long term role of Rand Water and the boundaries to the east and west are the major matters to be resolved; The second area comprises Soshanguve, Winterveld, Ga-Rankuwa and Mabopane and important issues relate to whether the capacity of the existing infrastructure should be further increased.
- The role of TLC's in water supply is becoming a pressing issue. Brits and Bronkhorstspuit TLC's currently supply water outside their area of jurisdiction and are fulfilling the role of a water board.

Further less pressing peripheral areas issues include those of Naboomspruit (north of Nylstroom) and the western boundary between Magalies Water and NWWA.

(2) Major Gaps

A participatory gap analysis identified a number of key gaps between prevailing conditions and development objectives. Among these were the following:

- The White Paper and other policy instruments are, in many cases, ill matched to existing legislative and regulatory frameworks (e.g. the Water Act of 1956).
- Roles and responsibilities among water sector institutions are often not clearly defined, assigned or understood.
- Many water sector institutions (especially in the Third Tier) lack organisational, financial and technical capacity. Capacity requirements are not well understood.
- Community involvement is widely promoted and encouraged, but its practice is variable and outcomes are of differing value to the communities concerned.
- Despite a proliferation of forums and similar communication vehicles within and across tiers, coordination and communication is still limited.
- Development targets assume a level of cost recovery that remains distant from reality. Recovery levels are highly variable across water suppliers, but the reasons are not always fully understood.
- Policy stresses the economic value of safe and reliable water supply. This perspective is not always shared by users, for reasons relating to limited water knowledge, local payment history, poor service, poverty and opportunism.
- There is a gap between the basic level of service set by the RDP and the expectations of communities. The gap is also evident among water sector actors, where divergent perspectives are often articulated.

(3) Third Tier Capacity

Limited and unequally distributed capacity among Third Tier water actors is perhaps the biggest institutional challenge in the transformation of the water sector. The Third Tier is complex and diverse, so institutional development has as much to do with mechanisms for interaction as it has to do with organisational change.

(4) Community Expectation

The government and its departments have to deal with high levels of community expectation. In the water sector, community expectations regarding levels of service sometimes diverge from the guidelines of policy, and from the pace of delivery that is feasible.

3.3 Policy and Strategy Recommendations

A number of policy and strategy responses to the identified gaps are proposed:

Proposal 1: Overall Policy Review	
Strategy Proposal	It is recommended that the JICA Study and Magalies Water make inputs to relevant policy review processes.
Lead Actors	DWAF is leading the process. MW and JICA to present relevant material.
Proposal 2: Clarification and Interpretation of Specific Policy and Guidelines	
Strategy Proposal	Several aspects of existing policy require clarification and the development of a common understanding among affected water sector actors. Some of the areas where clarity is necessary are: the role and impact of the Development Facilitation Act in the promotion of local planning and service delivery; updated views on transitional roles and functions originally outlined in the White Paper; clear definitions of "bulk" and "bulk customers".
Lead Actors	It is suggested that the following lead actors take responsibility for processes leading to the clarification of the issues listed above: <ul style="list-style-type: none"> - DFA, District Councils and DWAF. MW and DC to consider jointly the implication of the DFA for the development of bulk services. - Transitional roles. DWAF and District Councils, through regional and area planning forums. - Definition of Bulk: MW and District Councils.
Proposal 3: Integration and Partnership	
Strategy Proposal	It is proposed that a framework and an active plan for sharing information and the integration of activities are established. This plan will examine existing communication instruments and networks, and their effectiveness, and will implement actions to deal with shortcomings.
Lead Actors	DWAF should continue to lead the development of water sector institutional arrangements, and the provinces and District Councils local government functions. A forum or forums for integrated planning should be developed. The emerging area forums may serve this purpose, but attention must be given to areas where institutional capacity is not present.

Proposal 4: Coordination of Training and Training Resources	
Strategy Proposal	Design and implementation of an integrated approach to training and the sharing of training resources. This might include issues such as the formation of a training cooperative, the implementation of training needs audits, forums to discuss the deployment of human resources, and the effective use of local support structures such as NGOs, LWCs and RDP committees.
Lead Actors	Training needs are so diverse that it is not possible to identify a single lead actor. Area planning forums, with inputs from District Councils and DWAF, may serve an initial "brokerage" function.
Proposal 5: Water Supply and Local Economic and Resource Development.	
Strategy Proposal	The development and implementation of a strategy to link water supply to both local economic development and community institutional capacity building.
Lead Actors	The primary responsibility for local development planning should rest with the provinces and the District Councils. DWAF and MW might play a catalytic role.
Proposal 6: Sharing "Best Practice".	
Strategy Proposal	The development of an approach and vehicles for the sharing of best practices (and information).
Lead Actors	The most effective forums to discuss and explore best practice are those where both water delivery and local government administration are on the agenda (eg area planning forums). Lead actors might be District Councils and DWAF. MW should contribute wherever possible.
Proposal 7: Development of New Markets/Bulk Customers.	
Strategy Proposal	The development of new bulk markets is a long-term activity that will include aspects of Third Tier capacity building. Issues requiring attention in the context of the development of bulk markets are: determining the nature of Third Tier support required to empower effective future bulk customers; the development of a classification of emerging bulk customers, with the type of support required for each category; the preparation of cost recovery forecasts and targets, and the development of appropriate capacity to interact with emerging bulk customers.
Lead Actors	MW is the lead actor in this context, but the proposed strategy will require discussion with DWAF and elements of the Third Tier.
Proposal 8: Perceptions of Water Boards	
Strategy Proposal	Develop a strategy to build a constructive perception of water boards (and especially MW) in the Study Area.
Lead Actors	MW is the lead actor in this context, but will have to work within the framework of Third Tier institutions and protocols. ODA will be a useful source of technical advice.
Proposal 9: Systems and Key Processes	
Strategy Proposal	Investigate and develop key processes and systems (eg. prepaid metering, role of the private sector financing for higher levels of service) that will assist in the effective supply and management of water at local level. This strategy might be carried out in conjunction with the "best practice" strategy discussed above.

Proposal 9: Systems and Key Processes	
Lead Actors	The discussion of "best practice" might take place in the forums discussed above.
Proposal 10: Appropriate Structuring of MW.	
Strategy Proposal	Develop a structure proposal for MW in the Extended Supply Area which addresses short, medium and long term needs, and MW's role vis-a-vis other players in the water and local government sectors.
Lead Actors	Magalies Water.
Proposal 11: Redeployment of Resources to Create Capacity	
Strategy Proposal	Of the 350 NWWA staff absorbed by MW, to some 50 might be trained for strategic deployment to the Third Tier.
Lead Actors	MW to lead the process in consultation with the Third Tier.

4. WATER DEMAND AND SOURCE OF SUPPLY

4.1 Population Projection

The JICA Study envisages that whilst movement of the rural population from outside the Study Area to Soshanguve, Wonderboom, Brits, Moretele 1 and Odi 1 will continue, less significant numbers of the rural population living within the Study Area will move out to the PWV and to other urban areas. The overall growth rate of the population in the Study Area is therefore estimated to remain at about 2.7 % during the next two decades, slightly higher than the current national natural growth rate of population which is 2.3 %. The Study forecasts that the primary growth will take place in the Pretoria, Ga-Rankuwa, Mabopane and Tembisa areas in the central region, and that a secondary growth area is that of Rustenburg in the western region with a growth axis extending up to Monakato - Mogwase - Northam - Thabazimbi. The Study Area population estimated for the years 1995 and 2015 is summarised in the table below.

Study Area Population

Year	Western Zone	Central zone	Eastern Zone	Study Area
1995	676000	1668000	771000	3115000
2015	1033000	3243000	1007000	5283000

4.2 Water Demand Projection

Water demand was estimated separately for its two major components, viz primary water demand and non-primary water demand. Primary water demand has been estimated for each of its elements, viz domestic, industrial, commercial, institutional and mining water demand. Non-primary water demand has also been estimated for each of its elements, viz agricultural, stock-watering, environmental and international river flow requirements. For the purpose of estimating domestic water demand, communities in the Study Area were categorized into one of five different settlement types which have been developed from the socio-economic study of the Study Area, and a mix of levels of service was assumed for each specific type of settlement. Demands for large consumers, such as mines and special industrial and commercial centres were confirmed with the current suppliers of those demands, viz Magalies Water and Rand Water. The table below shows a summary of the estimated primary water demand in the Study Area.

Primary Water Demand (mcm/a)

Year	Western Zone	Central zone	Eastern Zone	Study Area
1995	86.6	87.6	24.1	198.3
2015	123.4	171.2	37.4	332

The water demand for irrigation was evaluated by sub-catchment and in respect of Government

Water Schemes, Irrigation Board schemes and private irrigation schemes. It is assumed in this Study that the future irrigation demand will remain at the current level. Stock-watering demand was estimated from the total population of equivalent large stock units in the Study Area with an average daily water requirement of 50 litres per unit. It was also assumed that the stock-watering demand will remain at the current estimated level of supply. Since environmental water requirements are generally non-consumptive, and a significant portion of irrigation water requirements are abstracted directly from the river, the water balance simulation did not include specific provision for these purposes. For this reason, the Study did not take account of environmental water requirements. A simplified assumption was made in the Study that the residual flow in rivers would satisfy inter-state obligations and that new development proposals would be discussed with neighbouring states before implementation. The table below presents a summary of the estimated non-primary water demand in the Study Area.

Non-Primary Water Demand (mcm/a)

Year	Crocodile River Basin	Olifants River Basin	Study Area
1995	431.8	9.8	441.6
2015	431.8	9.8	441.6

4.3 Water Source and Availability

In order to assess the adequacy of the limited water resources in the Study Area against the estimated water demand, a water balance simulation was conducted. The model used for this purpose was the Water Resources Yield Model (WRYM) developed for DWAF over a long period of time. The model can accommodate a wide range of operating policies using a complex penalty structure to govern the allocation of water between sources. The same user group divisions and associated level of supply assurance as used in a previous study, "Crocodile River, Western Transvaal Catchment Study, March 1993" were applied for the JICA Study. The following water balance simulations were carried out to compare water availability with the estimated water demand.

- (1) Case 1: To simulate the water balance between existing available water resources and the water demand in 1995.
- (2) Case 2: To simulate the water balance between existing available water resources and water requirements in 2015.

The Case 2 simulation indicated that the water demand in the target year can just be met using the existing available water resources infrastructure, including the primary water supply from Rand Water at the maximum existing infrastructure capacity of 126.2 mcm/a. Assessment of the results of this simulation result indicated that increasing return flows from the PWV area predicted in the future (222.2 mcm/a in 1995 to 410.9 mcm/a in 2015) and a large volume of

water imported from Rand Water, are the two major reasons which lead to this conclusion. Based on the assessment, the JICA Study conducted the following two additional water balance simulations under Case 3.

- (1) Alternative 1: In the case of water imported from Rand Water remaining at the 1995 level of 81.4 mcm/a.
- (2) Alternative 2: In the case that return flow in the year 2015 is decreased to 80% of the predicted volume.

Both of these alternatives also indicated that the availability of water resources for the supply of primary and irrigation water in the Study Area is at a sufficiently high level when the return flows from treated effluent of urban users reaches a certain level, and operation of each storage dam is properly managed.

Concerning the amount of water to be supplied from Rand Water in the future (the existing system capacity is 126.2 mcm/a), it will be necessary to carry out a further study including an assessment of alternatives to extending the existing systems. Such an assessment would be carried out mainly from an economic view-point and would consider the marginal cost of the Rand Water supply in order to determine the most preferable option from a national perspective. As the existing capacity is in place, there is clearly no justification in curtailing the supply at a level lower than the existing capacity. However, in the long term, when planning is begun to consider replacing the infrastructure, the issue should be revisited. At that stage, the study would also take into account trends in the water resources development program of the Vaal River basin.

4.4 Water Quality

4.4.1 Groundwater Quality

Groundwater is widely used within the Study Area for primary water supply, particularly in the northern rural areas. However, the quality is generally poor and in many cases the yield is inadequate. Poor sanitation, agriculture and geological conditions are the prime causes of the poor water quality. The potential for developing significant groundwater facilities in most parts of the Study Area is therefore low. Little monitoring of groundwater quality is carried out at present. It is proposed that those communities which currently rely on groundwater of Class 3 and 4 (unacceptable quality for domestic use), will be prioritized to receive a surface water supply by 2002 and those using Class 2 groundwater (safe for short term use only), will be programmed to receive a surface water supply by 2015.

4.4.2 Surface Water Quality

As a result of indirect water reuse, water quality in the Study Area is deteriorating. Parameters of particular concern include phosphates, (which control eutrophication); TDS (which will be critical to certain sensitive industries and could have a major impact on the profitability of some

mining operations); nitrates (which are of concern due to health considerations as well as being a factor in eutrophication); and bacteriological contamination (which has adverse health implications).

Return flows and urban runoff, much of which originates outside the Study Area, have a beneficial effect on water availability but an adverse effect on quality and cause salination, pollution and eutrophication. From the water balance study, the urban runoff and return flows are expected to increase significantly by 2015 therefore effective water quality management will be of vital importance. An in-depth study of water quality within the catchments modelled during the water balance study would be a major undertaking and if required, should be the subject of a separate study.

4.4.3 Recommendations Concerning Treatment Works Management

The South African Water Quality Guidelines (1993) published by DWAF govern water quality. One of the eight volumes concerns water for domestic use but is currently under revision. The 1993 edition was based on SABS 241 - Specification for Water for Domestic Supplies. Samples taken to investigate the quality of treated water within the Study Area found the quality to be safe; in most cases either conforming with or only marginally exceeding the domestic water quality guidelines.

Except for the treatment works operated by MW, Brits TLC and Rustenburg TLC, the level of routine sampling and analysis carried out is poor. Little routine monitoring other than for absolutely the most basic parameters is carried out on site. Daily sampling should be carried out on site and should include easily measurable but important parameters. Where necessary, emergency plans should be prepared for dealing with events which may lead to interruptions of supply or possible harmful health effects; trigger points should be established so that operators know when to advise their superiors of operational difficulties.

Proper management systems should be established to ensure that necessary adjustment and optimization of the treatment process takes place according to the information obtained from the analysis of samples. The cause of any failure to meet water quality guidelines should be established and a strategy for addressing such failures prepared. Where responsibility for the water supply infrastructure is split between Second and Third Tier organizations, a coordinated approach is required to ensure that water reaches the consumer with an adequate residual chlorine level.

Ideally an independent third party should play a monitoring and auditing role in the interests of protecting public health.

5. INFRASTRUCTURE DEVELOPMENT PLANNING

5.1 Short and Medium Term Development Plan

Due to the very large total cost estimated to provide infrastructure to meet the water demands in the target year, it is necessary to prioritise the work for implementation. Based on the principle in the White Paper of some for all rather than all for some, those areas which are totally unserved by surface water schemes at present and in most cases rely on inadequate groundwater supplies were selected for priority implementation. Such communities are mostly located in the northern parts of the Study Area and three priority regional water supply schemes have been identified. These are Northern Mankwe, the Klipvoor area in northern Moretele 1 and Odi 1 districts, and the entire Moretele 2 District. It is proposed that a Feasibility Study be conducted for these three areas during 1997 to lead on to possible detailed design, securing of finance, construction and implementation by 2002.

5.2 Long Term Development Plan

The balance of the capital works proposed comprises of some schemes to serve individual communities which are in a similar situation to those selected for the priority projects, and other upgrading work to strengthen existing infrastructure to meet the projected demand. While the former should also be considered for implementation in the near future, the latter type of project cannot practically be prioritised as implementation will be subject to the actual priorities of local and regional development and to political pressures. It has therefore been assumed that these upgrading and extension projects will constitute a Continuous Investment Programme which will be established by each of the role players. The period over which these projects be executed should be considered on a case by case basis by the management of the role player concerned and will be dependent on the availability of finance, management capacity, other infrastructural priorities (such as electricity, housing etc), and other factors.

5.3 Outline of the Infrastructural Development

The infrastructure development proposed is almost exclusively based on the use of surface water to meet primary water demand due to considerations of quality and availability. It is assumed that conjunctive groundwater use in Thabazimbi will continue and that the dolomitic aquifer will be used to supplement the surface water source in Koster towards the end of the planning horizon. The following table shows the principal water treatment works in each Supply Area, the existing capacity, and that required to meet the projected demands in 2015. It can be concluded that very significant expansion will take place at Vaalkop WTW, Brits WTW and Temba / Kudube WTW's. Both Kudube and Temba treatment works supply the southern part of Moretele 1 District and future planning could transfer part of this load between the works to suit water quality and space constraints. It is proposed to construct a new water treatment plant at Klipvoor Dam to serve the priority project in Central Zone. Concerning the imported water into the Rand Water and Branardsvlei Supply Areas, it has been assumed that this will increase up to the limit of the capacity of the existing infrastructure. When this is reached options are

available for relieving the demand in Soshanguve from Kudube (the preferred option proposed), relieving the Ga-Rankuwa demand from Brits or strengthening the existing supply. The latter option is undesirable when water is available locally. Three local options were evaluated for both the Klipvoor and Moretele 2 areas to determine the most preferred water source in each case.

Proposed Expansion of Water Treatment Works in the Study Area

Zone	Supply Area	Water Treatment Works	Existing Capacity* (Ml/d)	Proposed Capacity* (Ml/d)
Western	Vaalkop North	Vaalkop	120	295
	Vaalkop South	Bospoort	13.4	13.4
	Barnardsvlei	(Rand Water Importation)	(140)	(140)
	Koster	Koster Swartruggens	1.3 1.0	2.4 +0.8 (Boreholes) 1.3
Central	Brits	Brits Hartbeespoort	60 10	85 22
	Klipvoor	Klipvoor	-	3.9 / 16.4**
	Rand Water	(Rand Water Importation)	(300)	(300)
	Temba	Temba Kudube Wallmannsthal	18 20 12	99 108 14
Eastern	Weltevreden	Weltevreden	60	69
	Bronkhorstspuit	Bronkhorstspuit Cullinan	41 14	61 14

Note: * Capacities are quoted as summer peak demand.

** Figures for Klipvoor WTW are based on continuous operation or 5 day / 8 hours per day operation

5.4 Infrastructure Development Cost

During the infrastructure planning process, capital costs were estimated based on standard cost curves developed for the Study and operation and maintenance costs were also estimated for each Supply Block. These were broken down into the basic elements of water supply i.e. treatment works (new or additional capacity required), service reservoirs, pipelines, pumping stations and reticulation. Due to the need to apportion cost between the different role players and different fiscal budgets, bulk and retail costs were differentiated. Each of these costs was then further apportioned between the RDP level of service element and the remaining portion above the minimum RDP level. An allowance was added for engineering (15% of the capital costs), VAT (14% of the total capital and engineering cost), and an allowance of 20% was made for contingencies. The following table presents a summary of the infrastructure development cost for each Supply Zone to meet the projected water demand in the target year, 2015.

Summary of Cost of Infrastructure Proposals

Tier	Type of Cost	Cost Per Zone (Million Rand)			Total Cost (Million Rand)
		Western	Central	Eastern	
Bulk	Direct	403.22	224.85	94.36	722.43
	Indirect	231.12	128.89	54.08	414.09
Retail	Direct	228.51	362.76	309.27	900.54
	Indirect	130.99	207.93	177.27	516.19
Grand Total		993.84	924.43	634.98	2553.25

5.5 Sanitation Improvement

With regard to the provision of sanitation in the Study Area, it is estimated that approximately 75 % of the total population in the Study Area use a toilet which falls below the RDP level of a VIP toilet. They comprise about 94 % of the population in non-urban areas and 44 % of the population in urban areas. The percentage of households which are connected to mains sewerage is 56 % in urban areas and 22 % for the entire Study Area. There is virtually no mains sewerage in non-urban areas but about 6 % of households (4% of the total households in the Study Area), use septic tanks. With regard to the method of domestic wastewater treatment, approximately 72 % of households in the Study Area discharge domestic wastewater (toilet wastewater and other domestic wastewater), into the ground without treatment.

The improvement of sanitation has two major components; improvement of the toilet itself; and improvement of the method for domestic wastewater treatment. With regard to the toilet itself, improvement to the RDP level should be implemented as soon as practicable over the entire Study Area, as it is part of the short-term sanitation policy of the Government. It is estimated that the total capital cost to achieve this objective will be approximately 350 million Rand. An on-site septic tank is recommended for per-capita water consumption rates of up to 70 lcd. Above this level, an off-site STED (Septic Tank Effluent Drainage) system with an interceptor tank at each household is proposed. It is recommended that urban areas be provided with mains sewerage.

5.6 Environmental Impact

As part of the DWAF policy of Integrated Environmental Management (IEM) for proposed developments, a Relevant Environmental Impact Prognosis (ROIP1), was prepared which comprises a scoping and screening process. Accent was placed on the impact of the proposed pipelines and other related surface structures as these were seen as the elements causing greatest concern. The construction of pipelines, reservoirs and treatment works could have an impact on the socio-economic aspects, i.e land use, settlement, infrastructure and population, and the ecological aspects, i.e. the vegetation, fauna, habitat, changes in flow regime and changes in water quality.

The ROIP 1 concluded that construction of pipelines and related infrastructure will not cause significant impacts if managed during and after construction and that the impacts of abstraction

from dams on the impounding reservoir itself and downstream of the dams are not considered to be significant. By determining the in-stream flow requirements of the river, compensation water could then be released. This would influence the yield of the dam and need to be further investigated.

An Ecological Task Group is being formed and will meet before the end of this Phase of the Study to ensure that environmental considerations receive the necessary attention in the decision making process during the Study and afterwards. It is proposed that Phase 2 of the Study will include the preparation of a ROIP 2 which will involve a site investigation and input from appropriate specialists if necessary. The ROIP 1 report recommended that during Phase 2, a socio-economic investigation be undertaken to ascertain the social and economic impacts associated with construction disturbance of farming activities along the pipeline routes and that the statement that downstream impacts associated with the proposed scheme will be minimal in view of the existing degraded river stretches be confirmed.

6. INSTITUTIONAL DEVELOPMENT PLAN

6.1 Basic Concept

The White Paper on Water Supply and Sanitation presents a vision for the transformation of the water sector. In the context of this vision Water Boards like Magalies Water are charged with two tasks: to extend areas of supply and supply capacity, thereby allowing previously unserved communities access to safe and reliable water; and to provide support to elements of the Third Tier, enabling this sector to develop the skills and resources necessary to supply and manage water at local level. Against the background of these transformation tasks, Water Boards are expected to remain self-sufficient wholesalers of bulk water, a function they will retain in the long term.

Planning for institutional development in this context has to recognise the short to medium term institutional requirements of transformation, and the need to develop and entrench the institutional arrangements that will underpin the water sector post-transformation. It also has to accommodate the interlinked roles of organisations involved in water supply and sanitation. Against this background, the institutional development plan chapter includes:

- (1) An evaluation of the capacity of the Third Tier in the Study Area. This is particularly important because Third Tier capacity will determine the nature and priority of support actions. In addition, the structure and positioning of Magalies Water has to be based on an understanding of the extent and pace of organisational development in the Third Tier.
- (2) Considerations informing the structure and positioning of Magalies Water.
- (3) Proposed programmes to address institutional development priorities in the Third Tier. The three programmes discussed are: a support and development programme for undercapacity and underdeveloped District Councils; a support and development programme for isolated and vulnerable rural and peri-urban communities; and a service support network and enabling structure for local authorities.

6.2 Capacity Building for Third Tier Actors

An evaluation of the capacity of Third Tier organisations in the Study Area reveals the following major characteristics:

- (1) District Council capacity varies widely in the Study Area. The DCs are assuming an increasingly important role in current institutional development thinking, so building the capacity of the weaker District Councils is a priority.
- (2) There is an acute lack of local capacity in rural areas, and among some TLCs. Some communities are especially vulnerable, and in need of support through extraordinary institutional channels.

- (3) Planning capacity is concentrated largely in well resourced DCs, TLCs and NGOs. The ability to plan locally to meet local needs is the essence of the demand driven water policy articulated in the White Paper. In this context, it seems necessary to give special attention to processes to build and entrench local planning.
- (4) Some organisations have capacity that might be more effectively deployed in the service of water supply and sanitation. These include LWCs, LRDCs, the larger TLCs, some NGOs, and Tribal Authorities such as the Bafokeng. Many of these would require limited institutional support to be effective in specific contexts.
- (5) Some District Councils are useful organisational models for the Third Tier, incorporating core capacity and a network of contracted skills and services.
- (6) Some forms of capacity are the foundation for growing capacity itself. Two of these are planning capacity and financial capacity. The capacity analysis shows that many Third Tier structures lack both forms of "generative" capacity.

6.3 Community Development Plan

Against the background of Third Tier capacity the structuring of Magalies Water has to take account of the following considerations:

- (1) The present status of Third Tier capacity and expected developments in various Third Tier organisations.
- (2) The nature of long term Third Tier support, especially in terms of strategies to develop new bulk markets and to promote the emergence of viable bulk customers.

Detailed structure options for MW are presented in Chapter 8. The following are programmes for parallel Third Tier institutional development.

- (1) Capacity Building in lagging District Councils. It is proposed that the six District Councils in the Study Area join to establish a District Council Institutional Development Forum, with representation from DWAF and MW. Key discussion issues will include: the nature of DC capacity shortfalls; organisational models for District Councils; relationships with Magalies Water.
- (2) A community institution building programme for the most disadvantaged communities, possibly under the umbrella of the proposed District Council Forum. Initiatives falling under the ambit of a community institution building programme might be the following: capacity audits in identified communities; exploration (with the communities and authorities concerned), of capacity needs; design and implementation of an appropriate support programme; and appropriate use of available resources, such as Organisational Development Officers (or similarly skilled officials), employed by Magalies Water, DWAF, Rand Water and possibly the larger TLCs such as Rustenburg, Brits and

Bronkhorstspuit.

- (3) An institutional support programme coordinating initiatives and resources such as training; service cooperatives; sharing of "best practice"; and the joint development of systems and key processes, such as prepaid metering, effective local accounting, community-based collection systems, and local financing systems for higher levels of service. An NGOS is seen to be the right vehicle for this programme.

6.4 Training Programs

The three initiatives outlined above have training implications. The table summarises the requirements for each of the three support programmes.

Support Programme	Implementing Agent	Training Type
District Council Capacity Building Programme	District Council Forum	<ol style="list-style-type: none"> 1. Managerial and technical training for core officials of District Councils 2. Technical training for DC project managers and field operatives
Community Institution Building Programme	District Council Forum	<ol style="list-style-type: none"> 1. Training in planning skills for local officials. These skills should include organisational planning and financial planning. 2. Reinforcement of planning skills in existing LWCs and LRDCs. Particular emphasis on technical and infrastructural planning.
Institutional Support Programme (ISP)	Selected Non-Government Organisation	<ol style="list-style-type: none"> 1. The ISP is a networking and facilitation initiative. Training for participants might include project evaluation and communication technology.

Training providers might include the private sector, DWAF, MW, the larger District Councils, TLCs and NGOs. Emphasis should be placed on practical in-service training, in the form of exchange programmes and mentorship initiatives.

6.5 Support Structure

The community development programme is seen to be situated mainly in the context of a District Council collective venture. Supporting actors, especially whilst lagging DCs are building capacity, are DWAF and MW. An NGOS is proposed as the leader of the Institutional Support Programme.

7. INITIAL CAPITAL INVESTMENT PLAN

7.1 Basic Concept and Framework

To provide infrastructure to meet the projected water demand in the target year of 2015, a total capital cost of R2.55 billion would be required both for bulk and retail water supply systems (in 1996 values), which includes the RDP contribution amounting to R0.74 billion (about 30% of total cost) consisting of R0.19 and R0.55 billions for bulk and retail supply systems, respectively.

Several attempts were made to examine the implications of this huge capital expenditure and to seek realistic ways of tackling the issue, these included (i) a simulation analysis of cash flow and (ii) a case study for tariff calculation under the user pays principle using loan conditions as a key parameter.

7.2 Cash Flow Simulation

The major emphasis is on relevant net cash flow which is defined as *total cash inflow associated with the capital investment less its net cash outflow*. In order to make the cash flow analysis, a simplified model has been established, with no income tax implications because of the project nature of a not-for-profit basis, in which several basic assumptions were introduced: (i) the implementing agency is not specified; (ii) no initial working capital has been taken into account, and RDP funding is treated as a grant; (iii) interest on outstanding of capital is accumulated onto the principles and repayment terms are 25 years with annual amortization (iv) applicable water tariffs are 1.20 and 1.30 R/kI for bulk and retail supply, respectively.

A series of simulations has concluded that an interest rate of approximately 10 percent for mobilised loans could offset any negative balance in the cash flow analysis in the Eastern and Western Zone by the central zone positive balances, under a full cost recovery scenario. In case of 30% cost recovery, only Barnardsvlei could show a positive rate of 6%.

7.3 Preliminary Tariff Calculation (Case Study)

Preliminary water tariffs were calculated on a full cost recovery basis and the *user pays principle* with three scenarios for repayment of loans borrowed, in terms of the interest rate on the loan: 18% was based on the current rates paid on loan stock; 12% on loans borrowed by public institutions; and 6% on low interest rate or soft loans. The basis for other costs was fundamentally MW's historical experience.

Taking an assumed affordability of 2 to 3 R/kI based on the Situational Analysis, the case study reveals that the four Supply Areas of Barnardsvlei, Brits, Temba and Rand Water would be viable even with highest interest rate. On the other hand, only the two areas of Vaalkop South and Koster would become marginally viable at a 6% interest rate.

7.4 Fund Mobilization

Possible sources of loan capital for the financing of the master plan include: (i) *Government Agencies* such as Central Government, Provincial government, local government and the Development Bank for South Africa (DBSA); (ii) *International Agencies/Multilateral Development Institutions* such as World Bank, African Development Bank, Asian Development Bank and Arab Development Bank; (iii) *Bilateral Development Aid Organizations* such as Japan's Overseas Economic Cooperation Fund (OECD) and European Union; and (iv) *Domestic Capital Market* such as Institutional Investors, Major Commercial Banks and Development Finance Institutions, Insurance Companies and Pension Funds.

Central Government can provide financing through the capital budget (treasury), by raising loan financing through the issue of Government stock and bonds, and by guaranteeing debt raised by quasi-government organizations. Provincial and local governments can also raise debt financing directly by issuing stock/bonds on the capital market. DBSA is a Government agency which focuses on mobilizing financial resources directly through the sale of its own financial instruments.

7.5 Financial Viability of Stakeholders/Role Players

(1) Public Sector (statutory institutions)

Central Government is the custodian of the nation's water resources. Ordinarily, Provincial governments do not play a major role in the distribution of water or water supply infrastructure because of: (i) the nature of the management and distribution chain of water supply; and (ii) the limited powers of Provincial governments to raise revenues. Provincial governments could probably assist Second and Third Tier institutions with loan guarantees on their behalf. Loan guarantees can also be provided by Central Government which is currently providing similar guarantees to water boards. Local government institutions still have a long way to go in establishing the required capacity and financial autonomy needed to effectively manage retail water supply services. Thus, it seems that under the constitution, only the Central Government has sufficient financial autonomy to raise or guarantee adequate funding for the undertaking of water supply infrastructure.

(2) Quasi-government (second tier) institutions

Second Tier institutions are primarily water boards, most of which are financially self-sufficient. Although debt financing by water boards is guaranteed by the Central Government, they have to raise their own financing and are responsible for repaying the interest and redeeming the loan when it is due.

(3) Private Sector

Although private sector participation is not legalised in RSA, due attention should be given to the subject, because the private sector is financially autonomous and able to participate in the management and provision of water supply services in various innovative ways including lease contracts and concessions, usually secured through competitive bidding. In concession contracts, facilities are leased to a private sector operator, who contributes investment capital and who operates and maintains the facilities for a twenty to thirty year period. The private sector is also able to raise finance more readily than local government because of their track record and financial history.

8. IMPLEMENTING ARRANGEMENT

8.1 Implementation Schedule

The entire master plan consists of two major components, namely infrastructure development and institutional development. The former is further divided into priority projects (or accelerated programme(s)), and ordinary projects (or continuous investment programmes). The institutional development component also addresses aspects of the Second Tier, including its restructuring, as well as the Third Tier including its support, reinforcement and strengthening. These two development components are inseparable for implementation of the master plan on a sustainable basis.

(1) Infrastructure Development

Basically the infrastructural development will be implemented in three stages. Stage 1 aims to meet the projected water demand in the year 2002 by which time everybody should enjoy the RDP standard. The remaining work will be treated and divided into two stages to be implemented between 2003 and 2015. Each stage comprises a feasibility study and arrangement of funding lasting one year, another one year for detailed design and three to five years for construction of facilities. A feasibility study for the accelerated project(s) will be carried out within the framework of the master plan in 1997.

(2) Institutional Development

Institutional development will definitely play a vital role in achieving the development objectives of the master plan, therefore, various components of the plan will be carried out in conjunction with the infrastructural development. The four components of (i) peripheral area issues, (ii) pilot project set-up, (iii) roles and responsibilities and (iv) restructuring of the Second Tier will be carried out in the initial stages of Phases 2 and 3 and will be completed by the year 2002. The last component of (v) Third Tier support and strengthening will take place at the same time as implementation of staged infrastructural development.

(3) Monitoring and Post Project Evaluation

The master plan has identified a series of capital investment projects for implementation by the target year of 2015. It is considered to be a prerequisite to carry out a continuous monitoring process for project implementation and a post project evaluation, through which both best practice and lessons from problem areas can be accumulated and used as various vital input succeeding projects.

8.2 Management Structures

8.2.1 Second Tier

The Second Tier of which MW is the principal institution in the study area will change considerably over the period 1997 - 2015. In this regard the main changes will be :

- (1) Existing structures within each zone will need to undergo significant change. None of the zones currently has an appropriate and/or adequate structure in place to meet the challenges of interacting directly with communities and customers.
- (2) Each of the three zones will require both implementation and O&M capacity to manage the required changes. This will require appropriate structures to be set up in each zone to accommodate additional resources.
- (3) In the absence of Third Tier capacity MW will need to be actively involved in supporting development in the Tier in the interests of securing long term expansion of bulk water supplies.
- (4) MW will be involved in significantly different roles as indicated above and this will require a number of new functions to be carried out by MW.

In response to these change requirements restructuring will need to take place. Proposals in the report address:

- (1) An overall framework for restructuring which differentiates between functions needing to be performed at a central level in the Study Area, those which should be decentralised and those which need to be integrated between the two levels. In general it is proposed that functions should be decentralised where possible.
- (2) A proposed functional structure which has a target date of 2002: This introduces the additional overall function of Bulk Water Supply Development and a number of organisational development functions. It also aligns structure with the technical proposals which are based on three zones. The focus of this proposal is on the development of the Third Tier.
- (3) A proposed functional structure which has a target date of 2015: This shows a rationalisation of structure to reflect a return to the Second Tier long term focus which is bulk water supply.

The proposal reflects significant change and this will need to be carefully considered and consensus achieved with the key stakeholders.

8.2.2 Third Tier

The Third Tier in the Study Area comprises a number of institutions. The initiatives described in Sections 3.6 and 6.3 are placed, as far as possible, under the control of existing structures. In the case of the Community Development Plan, joint management by a District Council Forum is proposed, with start-up support from DWAF and MW.

8.3 Budget Arrangement

In order to supply stable and safety water to the consumers in the ESA, the following budget has been estimated for successful implementation of the Projects.

(Unit : Million Rand)

	Particular	Bulk Water	Retail Water	Total
1.	Infrastructure Development			
	1.1 Stage 1 (1998 / 2002)	506	641	1,147
	1.2 Stage 2 (2003 / 2009)	335	448	783
	1.3 Stage 3 (2010 / 2015)	295	328	623
	Total	1,136	1,417	2,553
2.	Institutional Development			
	2.1 Training	-	43	43
	2.2 Communication	-	28	28
	2.3 Others	-	26	26
	Total	-	97	97
	Grand Total	1,136	1,514	2,650

9. EVALUATION AND PRIORITISATION

9.1 Project Evaluation

9.1.1 Basic Dimensions

Beneficiaries under this master plan can be divided into two, namely, primary and secondary groups. The former is further divided and comprises : (i) Those people who will be served by the proposed infrastructure, and who are presently not obtaining water from a surface water supply system (1,601,040); (ii) Additional population who are located in the supply area of existing surface water systems (1,528,072); and (iii) A very limited number of people dwelling in the towns of Koster and Swartruggens who could be supplied by the proposed boreholes (6,153). In addition, (iv) Those people who will be able to enjoy higher level of services, who are located in the existing supply area of surface water systems (1,924,416).

On the basis of projected population and mixture of water supply services, the primary water demand is summarised below:

	Water Demand (mcm/year)			Increment (mcm/year)	
	1995	2002	2015	1995-2002	1995-2015
Western Zone	77.590	102.350	121.030	24.760	43.440
Central Zone	64.473	114.864	163.066	50.391	98.593
Eastern Zone	21.545	31.223	36.834	9.678	15.289
Total for Study Area	163.608	248.437	320.930	84.829	157.322

The projected annual growth rate of water demand between 1995 and 2015 is the highest in Central Zone 4.7%, followed by 2.7% in Eastern Zone and 2.2% in Western Zone, resulting in an average for the Study Area of 3.4%.

The required initial capital costs, amounting to about 2.553 billion Rand at 1996 prices, contains infrastructure for both bulk supply and for retail supply systems, and consists of direct costs and indirect costs, including engineering services, VAT and an allowance for physical contingencies.

The per capita cost based on the primary beneficiaries, works out at 302 R/capita in the Rand Water Supply Area which is the lowest and 4,152 R/capita in Vaalkop North Supply Area, the highest. For the Rand Water Supply Area the cost required for uprating the system upstream of Hartbeeshoek service reservoir is not included in the cost estimate because such facilities have been provided by Rand Water Board already.

9.1.2 Financial Aspect (Financial Rate of Return)

In similar manner to the cash flow analysis, a financial internal rate of return for the respective supply areas and zones as well as the Study Area has been worked out. In this analysis, sensitivity to cost recovery was also carried out. The results of the analysis show that every case has a positive rate, 2.0% in Weltevreden as the lowest, 73.9% in Barnardsvlei as the highest, and

13.3% for the entire Study Area when 100% cost recovery is assumed. Under a 60 percent cost recovery the overall rate for the Study Area decreases to 6.1% and the rates in each area also decrease to an unfavourable situation, except the three areas of Barnardsvlei, Temba and Rand Water. Only Barnardsvlei seems to be viable for a cost recovery rate of 30 percent. (In all cases a market cost of capital is assumed to be 18%).

9.1.3 Technical/Engineering Aspect

Judging from the water balance study, it is unnecessary to construct new water resources facilities (such as storage dams) until the target year of 2015, due to the increasing amount of return flows from the PWV area. However, as an emerging issue, due attention should be paid to water quality in the river systems which will receive the return flows, given that the water quality of the Apies River from which Kudube WTW obtains raw water is already poor.

9.1.4 Institutional and Organisational Aspect

It is rather difficult at this stage to clearly demarcate which role players should be responsible for implementation of the proposed projects. The total funding requirement of 2.55 billion Rand is divided into a bulk portion of 1.14 billion Rand and 1.41 billion Rand for the retail portion, for which the Second Tier and the Third Tier are basically responsible, in the long term. The key issue is deciding whether the Third Tier concerned can manage the huge amount of capital expenditure. Every effort should be made to utilise available resources belonging to the upper Tiers, external or internal loan agencies and statutory or non-statutory organisations.

The issue is closely related to the proposed project management structure which is difficult to finalise at this master plan stage.

9.1.5 Economic Evaluation

In order to briefly examine the economic impact of implementation of the proposed project(s) on the RSA's economy, the economic internal rate of return (EIRR) of each project has been calculated. This should be compared with the opportunity cost of capital (real value of interest rate), in the RSA which is roughly estimated to be 10%. Taking into account the average affordability of one household comprising six members as 15 Rand per month, the willingness to pay can be worked out as approximately 3 R/kl.

Using the assumptions stated above, the disbursement schedule based on the implementation schedule and a project life of 40 years, an economic internal rate of return has been computed by Supply Zone, of which the results are summarised below:

Supply Area	Total Cost (Million Rand)	Total Benefit (Million Rand)	Net Benefit (Million Rand)	EIRR (%)
Western Zone	1,781.2	4,024.1	2,243.0	10.6
Central Zone	2,512.6	8,843.7	6,311.2	22.7
Eastern Zone	1,059.0	1,494.9	435.9	3.8
Study Area	5,352.8	14,362.7	9,010.1	12.7

Although it is necessary to incorporate the prior investment made by Rand Water in the supply areas of Barnardsvlei and Rand Water, the calculated EIRRs vary from being negative in Klipvoor, and 3.2% in Weltevreden as the lowest, to 46.4% in Barnardsvlei as the highest, and 12.7% for the Study Area.

From a strict economic viewpoint, those Supply Areas having a lower EIRR than 10% (the assumed opportunity cost of capital), seem not to be viable for further implementation. However, various efforts should be made to increase the calculated rate through revised planning of the present proposals in future.

9.1.6 Social Consideration

The community case study found a typical the example to show how women play a vital role in the community water supply management. In Norokie Community of Moretele 1, women discussed how to operate and maintain their community water supply system consisting of a diesel driven pump and a elevated water tank, including cost recovery. They are practising efficient water management by dividing the community into two sections each of which fix the day when people can draw water. Nobody can draw water without paying. The community's water management and cost recovery system seems to be a model for other communities and the sharing "Best Practices".

Although many key role players recognise non-payment as the biggest issue requiring urgent attention (not only in the Study Area but on a nation wide basis, few positive initiatives on the issue have been taken. In order to make the Third Tier sustainable and a key player for retail water supply, due consideration should be paid to the support and strengthening of such organizations by the upper tiers, by the establishment of a cost recovery attitude through positive participation of beneficiaries.

9.2 Prioritisation

Although it may need time to prioritise the proposed projects, three areas have been identified: (i) Northern Mankwe in the Vaalkop North Supply Area, (ii) the entire Klipvoor Supply Area; and (iii) Moretele 2 District in the Weltevreden Supply Area. These are areas in which most people are not served by a surface water supply system at present, and have been given higher priority in the short-term. This selection is based on the primary objective of this master plan that those communities which have inadequate water supply and sanitation to at least meet the RDP standard by the year 2002 be addressed first.

10. T.O.R FOR PHASE 2 AND 3

10.1 Major Outstanding Issues in Phase 1

The boundary issues between Magalies Water and Rand Water relate to two separate Supply Areas as described in the previous chapter.

The debate is ongoing and will continue independent of the findings of the Study. The results of the master plan study showed that the capacity of the existing water supply pipeline from Rand Water is not sufficient to meet the water requirements of the Western Zone Supply Area and the shortfall will be supplemented from the Crocodile River basin.

The water supply for Rand Water Supply Area in the Central Zone, however the Western Zone Area in the Central Zone, is at present being upgraded by Rand Water from a capacity of 140MI/day to 300MI/day (mean annual 87 mcm/a). The shortfall in the target year 2015 in this Supply Area will be met from the Crocodile River and or Kudube WTW.

Long term supply boundary issues between Magalies Water and Rand Water will be carefully discussed taking into account the technical alternatives in the wide range of the related catchment areas, like the Vaal River basin and its surroundings, considering economical feasibility, institutional rationalization and political considerations as mentioned in the previous chapter.

10.2 T.O.R. for Phase 2 and Phase 3

(1) Feasibility Study (Phase 2)

Phase 1 of the JICA Study (Master Plan) identified three Priority Projects for early implementation. These Priority Projects are:

- (a) Northern Mankwe Priority Project in Mankwe Magisterial District;
- (b) Klipvoor Priority Project in the Magisterial Districts of Odi 1 and Moretele 1; and
- (c) Moretele 2 Priority Project in Moretele 2 Magisterial District.

Communities in all three of these three Priority Project areas are currently entirely dependent on groundwater which is generally poor in terms of quality and yield, with the level of supply below the RDP standard. The proposed Priority Projects intend to provide a surface water supply and upgrade water supply in these communities, at least to the RDP level of service. A Feasibility Study will be conducted separately for each of these three areas in close consultation with respective local authorities and other stakeholders.

(2) Pilot Project (Phase 3)

Phase 1 of the JICA Study (Master Plan) selected four communities, each for implementation of a Pilot Project. Those communities are:

- (a) Kameelboom Agricultural Holdings in the Mankwe Magisterial District;
- (b) Ga-Rasai in the Odi 1 Magisterial District;
- (c) Sehoko in the Moretele 2 Magisterial District; and
- (d) Bapong in Odi 2 Magisterial District.

Of these, the first three communities are located in each of the Priority Project areas described in Section 10.1. Bapong is located south-west of Brits TLC and forms part of the area currently supplied by Rand Water. The Phase 1 Study indicated that there is an outstanding issue of unauthorised connection and non-payment in the community.

The Pilot Projects in the first three communities are expected to establish general rules and lessons with respect to the demarcation among First, Second and Third Tiers of the roles required for the implementation and operation/maintenance (including water tariff collection) of a water supply project at each specific location. The project in Bapong is expected to produce recommendations on preventative measures to address the problems of unauthorised connection and non-payment which could be used in other areas. The findings and recommendations from these Pilot Projects will be incorporated into the Feasibility Study of Priority Projects (Phase 2).

- (3) The set up for phases 2 and 3 and subsequent work programmes make adequate provision for addressing the institutional change and support requirements identified in Phase 1.

11. CONCLUSION AND RECOMMENDATION

In order to implement the proposals presented in this master plan report successfully, it is required that all stakeholders understand and accept their roles and responsibilities and that they make a purposeful effort to cooperate with each other to realise the development objectives. Despite the distinction often made between the various tiers, a fundamental theme that underpins the master plan is the need for all actors in the water sector to work together to transform the sector as envisaged in government policy.

Key considerations for the implementation of the proposals are the following:

- (1) Overall policy review must continue to ensure an enabling environment for practical action.
- (2) Institutional development in the short and medium terms must meet the requirements of transformation, but must also entrench arrangements that will underpin the water sector post-transformation.
- (3) To implement projects in each zone, the infrastructural development plan must recognise and accommodate the capacity of institutions and communities.
- (4) Third tier capacity development remains a priority and should be closely linked to the local authority transformation process, especially up to 1999. This development requires support from the other tiers, and also among the actors in the third tier.
- (5) Many of the potential projects in the study area will address the needs of beneficiaries with very low incomes. In this context, implementation will have to face challenges related to rural water supply, many of which remain to be satisfactorily resolved in the study area and elsewhere. Among the measures that might have to be considered are government assistance in the form of welfare subsidies, or subsidies on loan interest. Also, it might be necessary to consider various forms of cross-subsidisation, including the implementation of sliding tariffs in the context of an integrated tariff system.

JICA