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REPUBLIC OF SOUTH AFRICA

WATER REQUIREMENTS AND AVAILABILITY RECONCILIATION STRATEGY FOR THE MBOMBELA MUNICIPAL AREA

Water Conservation and Water Demand Management Potential Assessment

June 2013

APPROVAL

Report Title		Water Conservation & Demand Management
Study Name		Water Requirements and Availability Reconciliation Strategy for the Mbombela Municipal Area
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Submitted by		IWR Water Resources in association with Aurecon (Pty) Ltd SRK Consulting Engineers and Scientists (Pty) Ltd Kyamandi Development Services (Pty) Ltd, and Postnet Suite 40 Private Bag X4 Menlo Park 0102
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EXECUTIVE SUMMARY

PART A: DOMESTIC AND INDUSTRIAL WATER USE

Introduction

The Mbombela Municipality is located in the north-eastern part of South Africa within the Lowveld sub-region of the Mpumalanga Province. The local municipality includes the rapidly expanding urban centre of Nelspruit as well as other towns such as White River, Hazyview and Kanyamazane. In addition, there are numerous villages in the municipal area and this semi-rural footprint is also expanding rapidly within the areas of Nsikazi North, Nsikazi South, Ngodwana and Matsulu.

The water use within the Mbombela Local Municipality (MLM) has increased rapidly over the last few years and the available water resources will soon be insufficient to supply the users within the municipal area at an acceptable level of assurance.

Water conservation and demand management has been identified as a strategic intervention which could have a significant impact on the future demand projections of the area. The focus of this study is then to develop a comprehensive water conservation and water demand management (WC/WDM) strategy and business plan for the Mbombela Municipality

Water loss and NRW reduction targets

The status quo, realistic and optimistic targets for the study area are summarised in **Table 1**.

Table.1: Summary of total target

Indicator	Current Value	Realistic Target value 10% Reduction	Optimistic Target Value 20% Reduction
System Input volume (million m^3/a)	54.71	48.87	43.03
System Input volume (Mℓ / day)	149.79	133.80	117.80
Billed Authorised Consumption (million m^3/a)	26.73	28.62	29.07
Unbilled Authorised Consumption (million m^3/a)	8.90	8.27	6.47
Water Losses (million m^3/a)	19.08	11.98	7.49
Non-revenue Water (million m^3/a)	27.98	20.25	13.96
% Non-revenue water	51%	41%	32%
% Water Losses	35%	25%	17%
Input Volume (litres / capita / day)	277	247	218
Input Volume (m^3 / household / month)	32	29	26
Authorised Consumption (litres / capita / day)	180	187	180
Authorised Consumption (m^3 / household / month)	21	22	21

If the above targets could be achieved, the future realistic water balance for the municipality will look as shown in **Figure 1**.

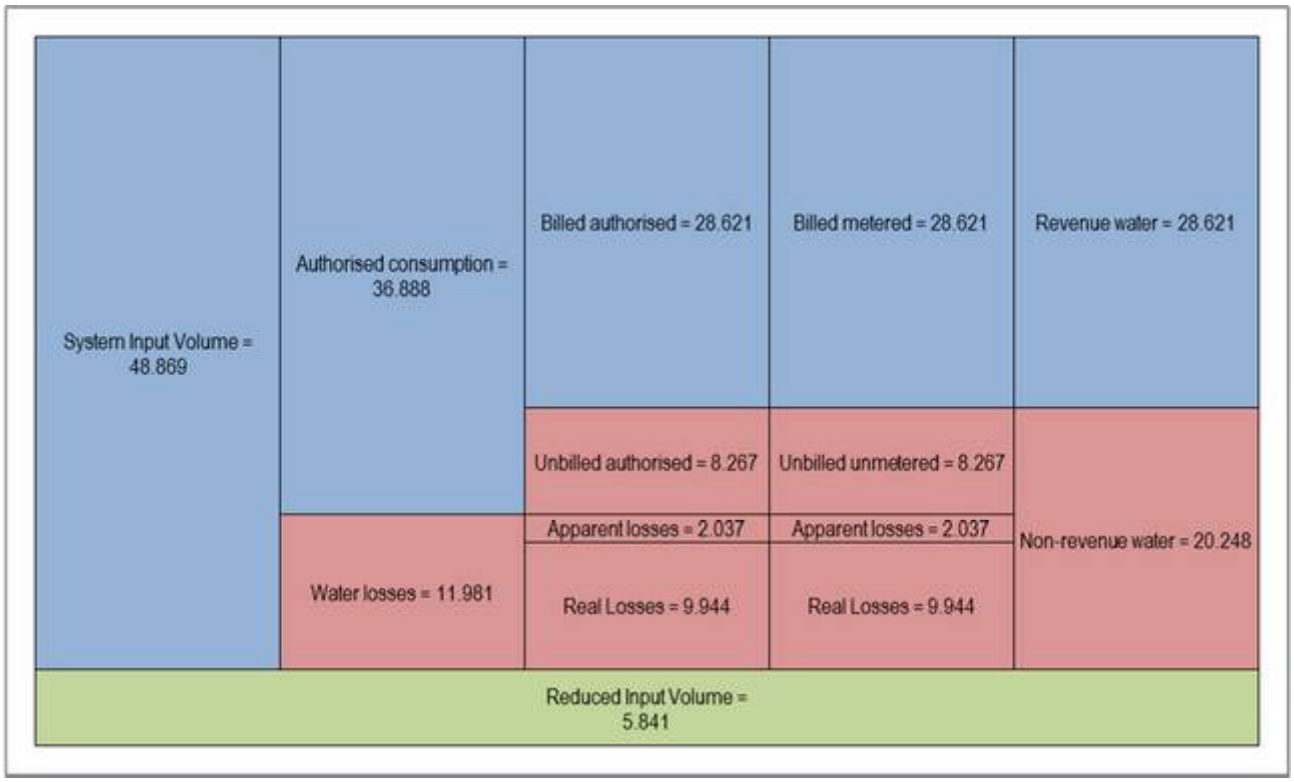

Figure 1: Target realistic water balance

The target water balance will reduce non-revenue water to 41% and total consumption by approximately 10%.

The non-revenue, water loss and efficiency targets for each demand centre are summarised in **Table 2.**

Table 2: NRW / Water loss / Efficiency target summary

Demand centre	NRW		Losses		l/c/d	
	Current	Target	Current	Target	Current	Target
Nelspruit	27%	20%	22%	15%	723	614
White River	37%	30%	32%	25%	470	423
Karino	15%	15%	10%	10%	137	137
Matsulu	80%	60%	40%	30%	292	248
Hazyview	55%	40%	48%	30%	485	413
Nsikazi North	60%	50%	33%	25%	179	170
Nsikazi South	60%	50%	45%	30%	235	211
Total	**51%**	**41%**	**35%**	**25%**	**277**	**247**

Five year budget requirements

The budget requirements for implementing WC/WDM in Mbombela municipality are shown in **Table 3.**

Table 3: WC/WDM budget summary

Component	Type	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Institutional	CAPEX	R 80 000	R 110 000	R 10 000	R 0	R 0	R 200 000
	OPEX	R 1 025 000	R 1 025 000	R 1 025 000	R 1 025 000	R 1 025 000	R 5 125 000
	TOTAL	**R 1 105 000**	**R 1 135 000**	**R 1 035 000**	**R 1 025 000**	**R 1 025 000**	**R 5 325 000**
Financial	CAPEX	R 180 000	R 140 000	R 40 000	R 0	R 0	R 360 000
	OPEX	R 26 880 100	R 26 880 100	R 26 880 100	R 26 880 100	R 26 880 100	R 134 400 500
	TOTAL	**R 27 060 100**	**R 27 020 100**	**R 26 920 100**	**R 26 880 100**	**R 26 880 100**	**R 134 760 500**
Social	CAPEX	R 3 924 032	R 3 899 032	R 3 164 032	R 3 139 032	R 3 139 032	R 17 265 160
	OPEX	R 8 459 580	R 8 459 580	R 8 459 580	R 8 459 580	R 8 459 580	R 42 297 900
	TOTAL	**R 12 383 612**	**R 12 358 612**	**R 11 623 612**	**R 11 598 612**	**R 11 598 612**	**R 59 563 060**
Technical	CAPEX	R 25 375 732	R 29 533 132	R 23 996 132	R 23 118 632	R 23 118 632	R 125 142 260
	OPEX	R 15 102 950	R 15 102 950	R 15 102 950	R 15 102 950	R 15 102 950	R 75 514 750
	TOTAL	**R 40 478 682**	**R 44 636 082**	**R 39 099 082**	**R 38 221 582**	**R 38 221 582**	**R 200 657 010**
Total	CAPEX	R 29 559 764	R 33 682 164	R 27 210 164	R 26 257 664	R 26 257 664	R 142 967 420
	OPEX	R 51 467 630	R 51 467 630	R 51 467 630	R 51 467 630	R 51 467 630	R 257 338 150
	TOTAL	**R 81 027 394**	**R 85 149 794**	**R 78 677 794**	**R 77 725 294**	**R 77 725 294**	**R 400 305 570**

The budget shows that approximately R80million per annum is required over the next 5 years to address WC/WDM.

Table 4 shows that if the municipality can reduce their consumption by approximately 10% and increase their revenue by the same volume, the project should be paying for itself within 3.1 years. This is based on the assumption that the municipality improves their water tariff structure to become more cost reflective and promote WC/WDM.

Table 4: Cost benefit ratio

Item	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Reduced input volume							
Volume	m^3/annum	1 168 400	2 336 800	3 505 200	4 673 600	5 842 000	17 526 000
Amount	R / annum	5 842 000	11 684 000	17 526 000	23 368 000	29 210 000	87 630 000
Increased revenue water							
Volume	m^3/annum	377 400	754 800	1 132 200	1 509 600	1 887 000	5 661 000
Amount	R / annum	2 858 800	5 717 600	8 576 400	11 435 200	14 294 000	42 882 000
Total							
Volume	**m^3/annum**	**1 545 800**	**3 091 600**	**4 637 400**	**6 183 200**	**7 729 000**	**23 187 000**
Amount	**R / annum**	**8 700 800**	**17 401 600**	**26 102 400**	**34 803 200**	**43 504 000**	**130 512 000**

Payback period - years	**3.1**

Unit reference values

The unit reference values for the demand centres are summarised in **Table 5.** The unit reference values have been discounted over 20 years at 6, 8 and 10%**.**

Table 1.1: Summary of Unit Reference Values

Demand Centre	Scenario	6%	8%	10%
Nsikazi North	Realistic	R 20.15	R 20.65	R 21.17
	Optimistic	R 10.50	R 10.76	R 11.03
Nsikazi South	Realistic	R 13.86	R 14.20	R 14.55
	Optimistic	R 7.43	R 7.60	R 7.79
Nelspruit	Realistic	R 7.99	R 8.18	R 8.39
	Optimistic	R 1.84	R 1.88	R 1.93
White River	Realistic	R 18.35	R 18.82	R 19.31
	Optimistic	R 7.98	R 8.19	R 8.40
Matsulu	Realistic	R 4.90	R 5.03	R 5.16
	Optimistic	R 2.73	R 2.80	R 2.88
Hazyview	Realistic	R 14.70	R 15.09	R 15.50
	Optimistic	R 8.19	R 8.41	R 8.64
Total	Realistic	R 12.29	R 12.59	R 12.91
	Optimistic	R 5.29	R 5.42	R 5.55

Summary and conclusions

Results from the study are summarised as follows :

- There is a large part of the study area which has formal infrastructure which enables effective metering and billing.
- The average consumption in the urban areas is very high and there is scope for reduction which is expected to reduce the total demand and non-revenue water.
- The rural areas are characterised by intermittent supply with limited cost recovery and consumers revert to illegal connections on the bulk supply to obtain water.
- The average consumption in the rural areas is within the acceptable range, but there is huge inequality of supply. Any reduction will be redistributed with limited or no reduction in the total demand;
- The water tariffs in areas outside the concession area are not cost reflective and not promoting water conservation and water demand management
- The municipality lack funding to implement WC/WDM;
- The municipality and Sembcorp Silulumanzi require additional staff to address and implement WC/WDM.
- Asset management is lacking in some areas, which impacts on the assurance of supply;

Based on the above the following key strategic focus areas are recommended :

- Raise WC/WDM awareness within the organisation by setting-up a WC/WDM task team, chaired by senior officials to meet on monthly basis to address WC/WDM issues;

- Fill vacant positions and provide training and capacity building
- Improve metering, reading, billing and cost recovery;
- Review the water tariff structure to be most cost reflective and promote WC/WDM;
- Improved tariff structures and the cost recovery will increase revenue for the municipality which can be used to address the backlog in maintenance and improve service delivery;
- Implementing metering and cost recovery in the rural areas does present several challenges and fixing internal plumbing leak using local plumbers is recommended until such time as the system has stabilised and service delivery has improved;
- Implement awareness campaigns across all consumers to use water efficiently; and
- Improve management information through proper monthly reporting and records keeping. These reports should be discussed at the monthly EXCO meeting.

PART B: IRRIGATION SECTOR

Introduction

While irrigation is not the main focus of this study, one of the reconciliation options is to reduce inefficiencies in irrigation use (if any) so as to make more water available for domestic and industrial purposed. This Part B of this report specifically with Water Conservation and Water Demand Management Options for the Irrigation sector.

The approach to this task involved the review of reports which address the issue of irrigation and water conservation and water demand management and to hold meetings with all the Irrigation Boards and Water Authorities operating within the study area or influencing irrigation water use in the study area.

The water authorities visited included:

- Sabie Irrigation Board
- Sand River Irrigation Board
- White River Irrigation Board (incorporating the minor Boards:
    - White river estates
    - Curlew IB
    - Manchester IB
    - Karino IB
    - Goedehoop IB
    - Prinsloo IB
- Crocodile Irrigation Board (Main Boards).

Conclusions

Irrigated agriculture in the Mbombela Municipal area is generally under serious threat due to a number of key challenges outlined below:

- Except for the Sabie Irrigation Board, every other irrigation water distribution authority in the study area experiences increasing restriction on licensed irrigation water allocations to farmers. In the case of the Crocodile Irrigation Board for example, this has effectively resulted in a reduction of surety of supply from 80% to 60% in recent years.
- Rapid urban development is taking place in the study area. However the Environmental Impact Assessment process on these developments seldom takes cognisance of the impact of the increasing water demand on existing licensed water users.
- Rapid urbanisation (formal and informal) and industrial development within the study area is having a serious impact on the quality of agricultural produce which in turn can seriously compromise the marketing of the produce, particularly if it is for export.
- Rapidly escalating pumping (electricity) costs are affecting the viability of most cropping enterprises. Ironically however this escalating production cost does have the effect of honing in-field irrigation efficiency.
- The many challenges facing irrigation farmers have been responsible for a generally low morale in the industry which is affecting investment and productivity.
- None of the Irrigation Boards have yet been converted to Water User Associations (WUA) despite application having been lodged to DWA by most Boards. The main constraining factor appears to be the issue of the ownership of the fixed assets of the Irrigation Boards, most of which has been paid for by the irrigators themselves.

  The establishment of a WUA, with related implementation of a Water Management Planning process is an essential step in stabilising the extremely volatile situation that exists in the area in terms of water management and water use efficiency. The introduction of a Water Management Plan (a statutory requirement of WUA's) and its systematic implementation is the most practical and effective mechanism for the equitable allocation and sharing of water and the consequent improvement in water use efficiency.
- Unauthorised water use appears to be widespread in the study area. There are two main sources of unauthorised water use. Firstly, a major concern is the unlicensed use of water for irrigation mainly in the tributaries of the White River and the Sand River. Secondly there is a growing use of water for irrigation on subdivided farms without water allocations. It is understood that this unauthorised use of water is presently being quantified in a validation study and should be an area of focus for significant water saving.
- Bulk water reticulation in the study area is dominated by open canals some of which are unlined. The common inefficiencies of these systems, including direct evaporation and seepage, is responsible for an estimated 13% gross loss, which, in the context of the whole irrigation industry, is a very significant volume of water.

GLOSSARY OF TERMS

NRW	**:**	Non-Revenue Water
DWA	**:**	Department of Water Affairs
ILI	**:**	Infrastructure Leakage Index
WTW	**:**	Water Treatment Works
m^3	**:**	cubic meter
MNF	**:**	Minimum Night Flow
ALC	**:**	Active Leakage Control
PRV	**:**	Pressure Reducing Valve
WC/WDM	**:**	Water Conservation and Water Demand Management
SIV	**:**	System Input Volume
MLM	**:**	Mbombela Local Municipality
AZP	**:**	Average Zone Pressure
ℓ / c / d	**:**	Litres / Capita / Day
WSP	**:**	Water Services Provider
WSA	**:**	Water Services Authority
WSDP	**:**	Water Services Development Plan
WMA	**:**	Water Management Area
RPMS	**:**	Regulatory Performance Management System
KPI	**:**	Key Performance Indicator

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PART A: DOMESTIC AND INDUSTRIAL WATER USE

1 INTRODUCTION

1.1 BACKGROUND

The Mbombela Municipality is located in the north-eastern part of South Africa within the Lowveld sub-region of the Mpumalanga Province. The local municipality includes the rapidly expanding urban centre of Nelspruit as well as other towns such as White River, Hazyview and Kanyamazane. In addition, there are numerous villages in the municipal area and this semi-rural footprint is also expanding rapidly within the areas of Nsikazi North, Nsikazi South, Ngodwana and Matsulu.

Mbombela Local Municipality forms part of the Ehlanzeni District Municipality and is bordered by Thaba Chweu Local Municipality to the west, Bushbuckridge Local Municipality to the north, Umjindi Local Municipality to the south and both Mozambique and Swaziland to the east. The municipal area straddles the Sabie and Crocodile River catchments, both of which are fully or over-allocated in terms of their currently available water resource.

The municipality was formed in 2000 by the merger of Hazyview, Nelspruit, and White River Local Councils.

Key features of the study area include:

- The largest towns in the municipality are Nelspruit and White River;
- Urban areas include Hazyview, Kabhokweni, Tekwane, Matsulu and Kanyamazane;
- The town of Nelspruit is the major economic driver within the study area and Mpumalanga, and it is the capital city of Mpumalanga province;
- The N4 freeway passes through the municipal area which forms the main link for transportation of goods to and from metropolitan areas such as Johannesburg, the City of Tshwane and other parts of the country;
- Rail routes, mainly used for the transportation of goods, run through Nelspruit from Gauteng to Mozambique and Swaziland; and
- The main land use in the area is commercial farming which includes the timber industry, citrus and other subtropical fruits.

1.2 STUDY AREA

The study area is shown in **Figure 1.1** and comprises the Mbombela municipal area including all Demand Centres, water supply schemes, towns and rural settlements. A large part of the area is currently under concession to Sembcorp Silulumanzi.

The Demand Centres include Nelspruit, White River, Nsikazi North, Nsikazi South, Hazyview, Matsulu, Karino Plaston Corridor, Ngodwana and Elandshoek.

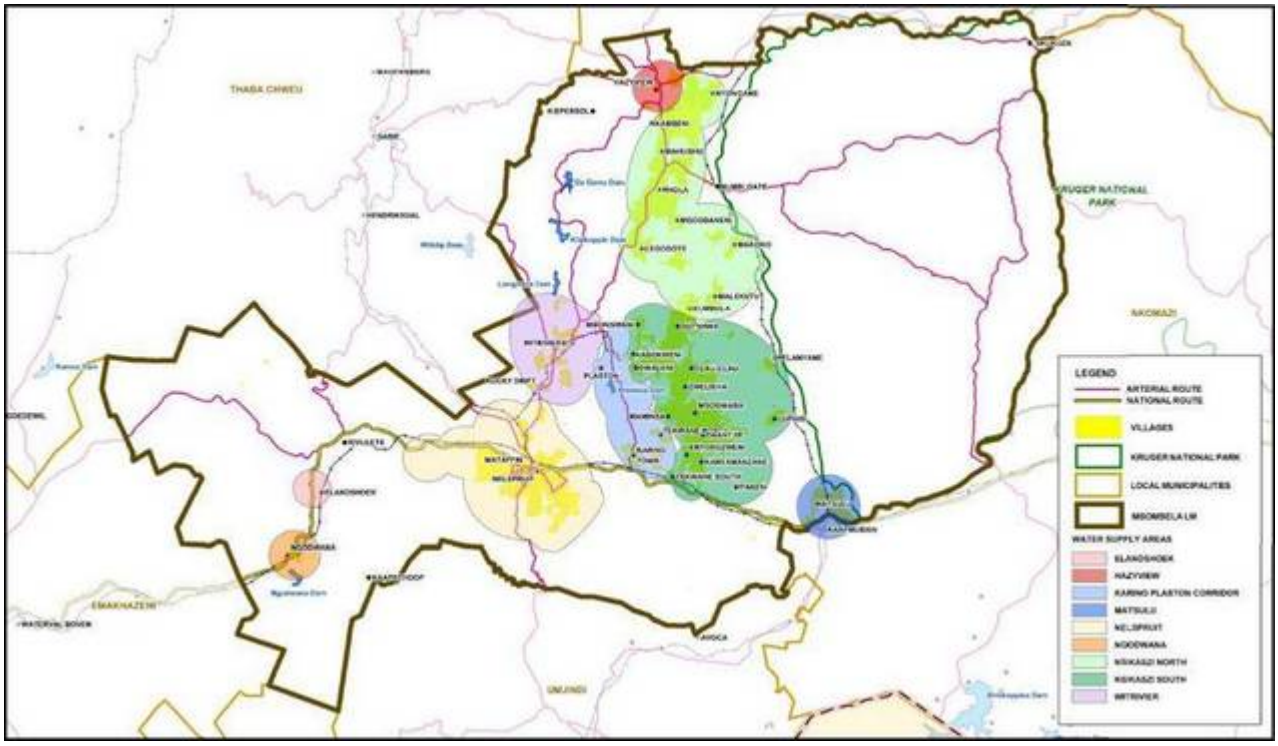

Figure 1.1 Study Area

1.3 OBJECTIVES OF THE RECONCILIATION STUDY

The overall objective of the study is to provide comprehensive water requirement and availability reconciliation strategies for the Demand Centres and groupings of towns and rural settlements of the Mbombela Municipal area, up to the year 2035.

The specific primary objectives of this study are to:

- To assess current water availability and water deficit/surplus,
- Identify resource management and development options,
- To develop realistic water saving targets for the respective water use sectors and quantify the impact on current and future water requirements in the study area;
- To recommend and sequence management and structural reconciliation interventions,
- To address growing water demands as well as quality problems experienced in the catchment,
- To conserve water and avoid / delay the implementation of further expensive transfer and storage schemes, and
- To provide necessary information to support the implementation of compulsory licensing and related water allocation reforms.

1.4 OBJECTIVES OF THIS STUDY

The water use within the Mbombela Local Municipality (MLM) has increased rapidly over the last few years and the available water resources will soon be insufficient to supply the users within the municipal area at an acceptable level of assurance. From the prioritisation process by DWA, Mbombela LM emerged as one of the municipalities most in need of a comprehensive

reconciliation strategy.

Water conservation and demand management has been identified as a strategic intervention which could have a significant impact on the future demand projections of the area. The focus of this study is then to develop a comprehensive water conservation and water demand management (WC/WDM) strategy and business plan for the Mbombela Municipality.

The purpose of this study is thus to identify current water uses and analyse current practices in order to determine applicable WC/WDM measures to facilitate, amongst others, the following:

- To make more effective and efficient use of the existing available water resources by the urban sector in the study area;
- To develop realistic water saving targets and quantify the impact on current and future water requirements in the study area;
- To explore potential interventions and possible savings, which can be put to beneficial use in the public interest; complete with cost implications and programme of implementation; and
- To conserve water and avoid or delay the development of expensive interventions which may not be essential if water is used efficiently.

1.5 METHODOLOGY

The WC/WDM portion of the study was divided into six sub-tasks. The main tasks completed as part of this component were:

- Task 1: Desk top study and summary of information available from previous and current studies;
- Task 2: Data collection and collation;
- Task 3: Status quo assessment for all Demand Centres;
- Task 4: Selected site visits and inspection of existing infrastructure;
- Task 5: Development of Water Conservation and Water Demand Management strategies;
- Task 6: Identification of potential savings and interventions.

One of the main tasks undertaken in this study was the acquisition of all possible information and data from secondary sources (i.e. that which is already contained in reports from previous DWA studies or projects).

As part of the information gathering process, a strength, weaknesses, opportunities and threats (SWOT) analysis was performed with the Mbombela LM (WSA) and Sembcorp Silulumanzi (WSP) to assess the status quo of the Demand Centres.

1.6 MAIN SOURCES OF INFORMATION

The information for the study has been collected from different sources such as the WSDP, IDP, Blue Drop Reports, Water Affairs data sources (NIS, RPMS, Water Services Information Reference Framework and FBW); previous All Town studies undertaken with particular reference to the Ministerial Reporting on Non-Revenue Water; as well as the municipal strategic self-assessments and existing WC/WDM strategies.

2 SYSTEM OVERVIEW

2.1 DEMOGRAPHICS

This WC/WDM strategy will use the same population figures and Demand Centres or groupings of towns and rural settlements as identified in the main reconciliation strategy document. The demographic profiles of the various Demand Centres are summarised in **Table 2.1**.

Table 2.1: Demographic profile of Mbombela Local Municipality

Area	Population	Households
Nelspruit	53 137	15 714
White River	15 595	5 625
Nsikazi North	163 648	38 850
Nsikazi South	225 000	58 846
Hazyview	7 839	2 484
Matsulu	49 634	12 378
Karino Plaston Corridor	26 263	6 549
Ngodwana	1 530	425
Elandshoek	416	254
Total	**543 062**	**141 125**

Source: Department of Water Affairs, Water Requirements and Availability Reconciliation Strategy for the Mbombela Municipal Area – 2013.

2.2 INSTITUTIONAL ARRANGEMENTS

The institutional arrangements for water services in the Mbombela Local Municipality are summarised in **Table 2.2**. Mbombela Local Municipality remains the Water Services Authority.

Table 2.2: Summary of institutional arrangements

Demand Centre	Water Services Provider	Bulk Water Services Provider
Nelspruit	Sembcorp Silulumanzi	Sembcorp Silulumanzi
White River	Mbombela LM	Mbombela LM
Nsikazi North	Mbombela LM	Bushbuck Ridge Water
Hazyview	Mbombela LM	Mbombela LM
Nsikazi South	Sembcorp Silulumanzi	Bushbuck Ridge Water
Matsulu	Sembcorp Silulumanzi	Sembcorp Silulumanzi
Karino Plaston Cor.	Mbombela LM	Sembcorp Silulumanzi
Ngodwana	Mbombela LM	Mbombela LM

Sembcorp Silulumanzi's concession area covers the city of Nelspruit, and the main Nsikazi townships of Kanyamazane, Tekwane, Msogwaba and Matsulu. The service coverage also extends to other peri-urban areas around these townships, such as Zwelisha, Mpakeni and Luphisi.

2.3 WATER REQUIREMENTS

The Mbombela municipal area obtains water mainly from surface water sources of the Sabie and Crocodile River sub-catchments. The current allocation from Sabie River supplies Hazyview and Nsikazi North, while the Crocodile River supplies Nelspruit, White River, Nsikazi South and Matsulu. There are also a number of dams used to capture and store water in the two sub-catchments (Crocodile sub-catchment; Ngodwana Dam; Kwena Dam; Witklip Dam; Longmere Dam and Klipkoppie Dam; Sabie River sub-catchment; Inyaka Dam and Da Gamma Dam).

The current consumption characteristics for each Demand Centre are summarised in **Table 2.3.**

Table 2.3: Current Domestic Water Usage

Demand Centres	Population	Current Allocation (million m^3/ a)	System Input Volume (million m^3/a)	Water Source (WTW)	Treatment Works
Nelspruit	53 137	10.00	14.03	Crocodile River	Nelspruit WTW
White River	15 595	7.50	2.68	Crocodile River	White River WTW
Nsikazi North	163 648	8.00	10.70	Sabie River	Nyongane PS
Hazyview	7 839	0.35	1.39	Sabie River	Hazyview WTW
Nsikazi South	225 000	17.50	19.30	Crocodile River	Kanyamazane WTW
Matsulu	49 634	4.30	5.30	Crocodile River	Matsulu WTW
Karino Plaston Cor.	26 263	1.50	1.31	Primkop Dam	Primkop WTW
Ngodwana	1 530	0.50	0.5	Various	
Total	**542 646**	**49.65**	**55.21**		

Source: Department of Water Affairs, Water Requirements and Availability Reconciliation Strategy for the Mbombela Municipal Area – 2013.

Mbombela Local Municipality has a water loss problem in many areas within the Demand Centres but is unable to define the quantity of the water losses or where the water is being lost. The available and previous reports indicate an estimated system input volume of 56 million m³/a. The NRW is estimated above 50% and in view of the magnitude of losses and value of water, it is important to know where the water is being lost in all Demand Centres and to verify the figures utilised for this assessment.

Developing an accurate water balance for each Demand Centre within Mbombela LM will allow the municipality to:

- Determine the volume of Non-Revenue Water (NRW);
- Determine the average consumption per capita per day;
- Identify real and apparent losses.

The standard IWA Non Revenue Water Balance template utilised to capture and calculate the water balances for each of the Demand Centres is shown in **Figure 2.1**. Both Mbombela Municipality (WSA) and Sembcorp Silulumanzi (WSP) were requested to complete a quantitative score card which allowed the WSA and WSP to assess the areas of WC/WDM that require more concerted effort. In addition to the quantitative data component, a comprehensive qualitative questionnaire was used for discussion purposes during workshops with both stakeholders to

understand the status quo within the Demand Centres.

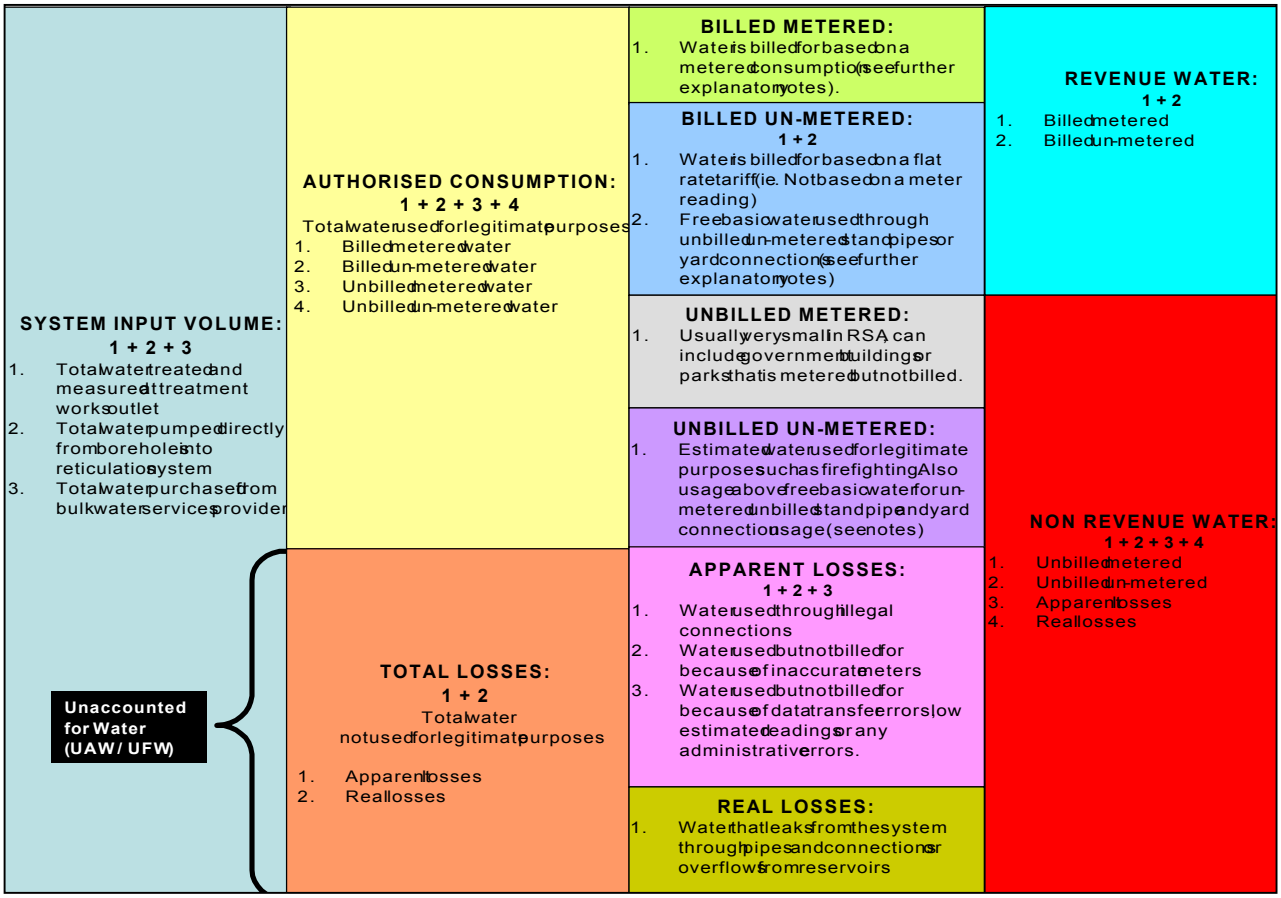

Figure 2.1: Standard IWA Water Balance

2.4 KEY PERFORMANCE INDICATORS FOR STUDY AREA

The available information from previous reports and the WSDP was collated, reviewed and the relevant data and information was extracted. Past studies, reports and Silulumanzi documents were used for the formulation of the water requirements. The key performance indicators for the entire Mbombela LM are summarised as shown in **Table 2.4**.

Table 2.4: Key Performance Indicators

Indicator	Current Value
Population (2012)	541 116
Households (2012)	140 446
System Input volume (million m^3/a)*	54.71
System Input volume (Mℓ / day)	149.79
Billed Authorised Consumption (million m^3/a)	26.73
Unbilled Authorised Consumption (million m^3/a)	8.90
Water Losses (million m^3/a)	19.08
Non-revenue Water (million m^3/a)	27.98

Indicator	Current Value
% Non-revenue water	51%
% Water Losses	35%
Input Volume (litres / capita / day)	277
Input Volume (m^3 / household / month)	32
Authorised Consumption (litres / capita / day)	180
Authorised Consumption (m^3 / household / month)	21

* The input volume excludes the supply to Ngodwana

From the average consumption it is clear that WC/WDM has to be implemented in the Mbombela municipal area as a matter of priority.

The purpose of this report is to indicate the potential for WC/WDM in the Mbombela municipal area. The report includes details on the status quo of all Demand Centres, and provides recommendations on how to address the challenges within these areas.

The current water balance for Mbombela is shown in **Figure 2.2**.

Figure 2.2: Mbombela IWA water balance

The IWA water balance indicates non-revenue water in Mbombela to be in the order of 56.2% and water losses to be in the same order. The high water loss figure is supported by a high average consumption figure in most areas which indicates inadequate metering and billing systems.

The water figures need to be improved as only Sembcorp Silulumanzi was able to provide accurate water loss information.

3 NELSPRUIT DEMAND CENTRE

Nelspruit is located in the south of the Mbombela Local Municipality along the N4 Maputo Development Corridor. Both Nelspruit, the capital of the province and White River have seen significant growth in recent years because of commercial and industrial development linked to the Maputo Corridor and the tourism potential of the surrounding area such as the Mpumalanga Escarpment and Lowveld as well as the Kruger National Park.

The existing developments in the town and surrounding areas provide great opportunity for a structured WC/WDM programme. WC/WDM measures such as pressure management, sectorisation, metering and billing are being carried out by the WSP Sembcorp Silulumanzi.

3.1 STATUS QUO ASSESSMENT

This Demand Centre is operated and maintained under concession by Sembcorp Silulumanzi under the jurisdiction of Mbombela Local Municipality. It comprises mostly formal areas with formal infrastructure, which enables metering, billing and cost recovery systems to take place adequately. The status quo of Nelspruit Demand Centre is summarised in **Table 3.1** and is based on discussions held with the concessionaire**.**

Table 3.1 Nelspruit Status Quo

Institutional	Financial
• The WSP managing the area is well structured and has capacity to implement WC/WDM activities; • All vacancies are filled in the technical department of the WSP; • Limited enforcement of municipal bylaws; • Vehicles and support structures are available for operation and maintenance; • The concessionaire has extensive training and capacity building programmes but it does not address WC/WDM sufficiently.	• The current metering and cost recovery systems are adequate; • The water tariff structure is cost reflective; • Rising block tariffs are promoting WC/WDM; • There is informative billing within the Demand Centre.
Social	**Technical**
• The relationship between the WSP and community is generally positive; • Excessive garden watering is a common phenomenon in summer; • Water is paid for but not valued very highly by the community; • The WSP has an effective 24 hour customer call centre and promotes reporting and fixing of leaks.	• WC/WDM activities such as bulk metering, pressure management, sectorisation and leak repair are taking place; • Sufficient macro management information is available to perform a proper assessment of the water losses and potential savings in the Demand Centre; • An active telemetry system is in place to improve monitoring of reservoirs; • There is existing water loss equipment such as loggers and leak detectors; • Limited consumer meter replacement programmes; • Aging network in most parts of the Demand Centre.

3.1.1 Site Inspection

Site visits were undertaken to gain a better understanding of the status quo and actual operation of the Nelspruit system. During the field visits the following were observed:

- There is bulk metering in place as shown in **Figure 3.1**;
- The system in well metered and there is good record keeping;
- The system has limited operational problems;
- Some consumer meters are old and possibly under read and require replacement;
- The area is sectorised and there is zone metering in place;
- Pressure management is taking place

Figure 3.1: Netspruit WTW inlet and typical bulk meter

3.1.2 Key Performance Indicators

Key performance indicators for Nelspruit Demand Centre are summarised in **Table 3.2.**

Table 3.2 Key Performance Indicators for Nelspruit

Indicator	Current Value	Realistic Target value 15% Reduction	Optimistic Target Value 30% Reduction
System Input volume (million m^3/a)	14.03	11.93	9.82
System Input volume (Mℓ / day)	38.4	32.7	26.9
Billed Authorised Consumption (million m^3/a)	10.24	9.54	8.35
Unbilled Authorised Consumption (million m^3/a)	0.70	0.60	0.49
Water Losses (million m^3/a)	3.09	1.79	0.98
Non-revenue Water (million m^3/a)	3.79	2.39	1.47
% Non-revenue water	27%	20%	15%
% Water Losses	22%	15%	10%
Input Volume (litres / capita / day)	723	614	506

Indicator	Current Value	Realistic Target value 15% Reduction	Optimistic Target Value 30% Reduction
Input Volume (m^3 / household / month)	74	63	52
Authorised Consumption (litres / capita / day)	564	522	455
Authorised Consumption (m^3 / household / month)	58	54	47

Based on the unit consumption it is clear that WC/WDM should be implemented as a matter of priority. The current consumption is three times the national average of 235 ℓ/c/d. The non-revenue water is within the acceptable range and below the national average of 36.8%. Realistic and optimistic target reductions of 15 and 30% respectively have been set, although further reductions could be achieved in time.

3.2 STRATEGY

Undertaking water demand management requires commitment and technical expertise, which can be developed over a period of time. The current staff complement within Sembcorp Silulumanzi has sufficient capacity to maintain and adequately address water demand management issues within the Demand Centre. In addition to the current activities, training and skills transfer is required to address many of challenges.

The strategy for Nelspruit Demand Centre is summarised below:

- The Demand Centre should set up a WC/WDM task team, chaired by senior officials to meet on a monthly basis to address WC/WDM issues;
- Improve micro management information through proper sectorisation to obtain a better understanding of problem areas;
- Improve WC/WDM skills transfer and capacity building within operation and maintenance staff of WSP;
- Enforce policies and bylaws to promote WCWDM;
- In view of the scarcity of water in the area, and the unacceptably high consumption figures consideration should be given to increasing the top block of the domestic rising block tariff to the region of R15/kℓ, which is in line with metros;
- Promote water wise gardening and implementation of rain water harvesting in formal areas;
- Provide training for meter readers to improve meter reading and reporting of leaks;
- Expand schools awareness programme to promote reporting of leaks and water wise practices;
- Implement and maintain sectorisation to identify key problem areas, maintain pressure management and reduce burst frequency;
- Expand existing pressure management programme and focus on maintenance and monitoring, as this will result in a reduced number of bursts and prolong infrastructure design life;
- Implement a consumer meter replacement programme, starting with the top consumers, whereby 10% of all consumer meters are replaced on an annual basis.

3.3 SUMMARY OF CONCLUSIONS

Sembcorp Silulumanzi has made considerable progress with implementing WC/WDM but there is still tremendous scope for WC/WDM in the Nelspruit area which will result in both reduction of non-revenue water and the total system input volume. The institutional capacity and skills are available within the WSP to embark on such a programme and should focus on the following interventions:

- Zone metering and sectorisation to improve macro management information;
- Improve analysis of system losses;
- Improve pressure management programme in conjunction with sectorisation and continuous monitoring;
- Consumer meter replacement programme, starting with the top consumers, whereby 10% of all consumer meters are replaced on an annual basis;
- Increase the high end of the domestic water tariffs to promote WC/WDM;
- Community awareness programme that promotes the value of water and water wise gardening;
- Development of private household retrofitting programmes to minimise water losses;

4 WHITE RIVER AND ROCKY'S DRIFT DEMAND CENTRE

A portion of White River that includes Rocky's Drift, is currently getting water from the Nelspruit Water Treatment Works through a dedicated pipeline, while other areas receive water from the White River Water Treatment Works.

4.1 STATUS QUO ASSESSMENT

This Demand Centre is operated and maintained by Mbombela Local Municipality. It comprises mostly formal areas with formal infrastructure which enables metering, billing and cost recovery systems to take place adequately. The status quo for White River is summarised in **Table 4.1.**

Table 4.1 White River Status Quo

Institutional	Financial
• The Mbombela municipality technical department lacks capacity (45% vacancy) and necessary skills to implement WC/WDM activities; • The municipal bylaws are currently under review but no enforcement is taking place; • Political support is acceptable but politicians lack understanding of the water business; • There is no customer services charter in place; • Lack of availability of vehicles and support structures for operation and maintenance; • Training and capacity building not taking place.	• The relationship between the technical and finance department can improve with access to information being a problem. • The existing metering, billing and cost recovery system is fair, but can improve. • Non-revenue water is estimated to be in the order of 35%. • Water tariffs are not cost reflective with limited input from technical department. A declining block water tariff structure is in place which does not promote WC/WDM. • Meter reading is not up to standard and often estimated. • Billing is informative and shows 2 months of consumption.
Social	**Technical**
• The relationship with the community is generally positive in the formal and high income areas while strained in rural (informal) areas. • Water is paid-for in formal areas but not valued very highly and excessive garden watering is a common phenomenon. • Illegal connections and non-payment is widely prevalent in rural (informal) areas. • WSP has an effective customer call centre and promotes reporting of leaks. • Rain water harvesting is promoted with Parks department.	• There is very little macro and no micro management information available to perform a proper assessment of the water losses and potential savings. • No zone metering, pressure management or sectorisation is being done. • Consumer meters are generally in excess of 5 years old and under-recording. • The WSP has no loggers or leak detection equipment. • Existing telemetry system in some areas. • Top consumers are not pro-actively monitored. • High burst frequency (approximately 10/ week)

4.1.1 Site Inspection

Site visits were undertaken to get a better understanding of the existing infrastructure conditions and the operation of the system. During the site visits the following was observed:

- Most of the bulk water infrastructure in this area is clearly visible and easy to access. Some of

the key operational components of the network such as internal network valves, air valves and bulk water meters do require urgent maintenance to ensure proper operation of the network;

- The area is not sectorised into zones.
- Pressure management is not taking place.
- The system has limited operational problems and currently the supply of water to the area is consistent;
- There were no visible leaks observed in the network;
- Bulk meters are secured inside chambers; and
- Most consumer meters are very old and covered with soil in some areas, which is an indication of poor meter reading and accuracy of the data in the area as shown in **Figure 4.1.**

Figure 4.1: Bulk meter and buried consumer meter

It was apparent that the Demand Centre does have limited management information but lacks record keeping. The Demand Centre has no infrastructure replacement programme in place as some of the infrastructure requires urgent maintenance to prevent further deterioration.

4.1.2 Key Performance Indicators

The key performance indicators for the White River Demand Centre are summarised in **Table 4.2**.

Based on the unit consumption it is clear that WC/WDM should be implemented as a matter of priority. The current consumption is double the national average of 235 ℓ/c/d. The non-revenue water is similar to the national average of 36.8%, but high considering the formal supply area and infrastructure. A NRW figure of below 30% would be considered acceptable for the supply area. Realistic and optimistic target reductions of 10 and 20% respectively have been set, although further reductions could be achieved with time.

Table 4.2 White River KPI's

Indicator	Current Value	Realistic Target value 10% Reduction	Optimistic Target Value 20% Reduction
System Input volume (million m^3/a)	2.68	2.41	2.14
System Input volume (Mℓ / day)	7.3	6.6	5.9
Billed Authorised Consumption (million m^3/a)	1.69	1.69	1.61
Unbilled Authorised Consumption (million m^3/a)	0.13	0.12	0.11
Water Losses (million m^3/a)	0.86	0.60	0.43
Non-revenue Water (million m^3/a)	0.99	0.72	0.54
% Non-revenue water	37%	30%	25%
% Water Losses	32%	25%	20%
Input Volume (litres / capita / day)	470	423	376
Input Volume (m^3 / household / month)	40	36	32
Authorised Consumption (litres / capita / day)	320	318	301
Authorised Consumption (m^3 / household / month)	27	27	25

4.2 STRATEGY

The strategy for White River is summarised below:

- Improve micro management information through proper sectorisation to obtain a better understanding of problem areas;
- The Demand Centre should set up a WC/WDM task team, chaired by senior officials to meet on monthly basis to address WC/WDM issues;
- Implement a consumer replacement programme, starting with the top consumers;
- Provide training to meter readers to improve meter reading and reporting;
- Water tariffs should be reviewed so as to be cost reflective and promote WC/WDM;
- Perform Councillor training programme on water business and WC/WDM;
- Prepare and advertise customer service charter;
- Finalise review of current bylaws to include promotion of WC/WDM and implement enforcement;
- Embark on a community awareness programme that emphasises fixing of internal plumbing leaks;
- Embark on a schools awareness programme promoting reporting of leaks and water wise practices;
- Implement a pressure management programme and focus on maintenance and monitoring.

4.3 SUMMARY AND CONCLUSIONS

There is scope for WC/WDM in the White River area which will result in both reduction of non-revenue water and the total system input volume. There is limited institutional capacity and skills available to embark on such a programme which should be resolved first before focusing on the following interventions:

- Improve political support through a Councillor awareness programme focusing on the water business;
- Review water tariffs to reflect cost of water and promote WC/WDM;
- Train meter readers and perform monthly audits to eliminate estimates and other inaccuracies;
- Undertake a community awareness programme that promotes the value of water and water wise gardening;
- Implement zone metering and sectorisation to improve micro management information. This will assist with the identification of key water loss areas and reduce the number of bursts;
- Implement a pressure management programme in conjunction with sectorisation and continuous monitoring;
- Undertake a consumer meter replacement programme, starting with the top consumers, whereby 10% of all consumer meters are replaced on an annual basis.

5 HAZYVIEW DEMAND CENTRE

This Demand Centre gets water from Sabie River through a canal and Sabie pump station operated by Bushbuckridge Water Board.

5.1 STATUS QUO ASSESSMENT

The Demand Centre is operated and maintained by Mbombela Local Municipality. It comprises mostly formal areas with formal infrastructure which enables metering, billing and cost recovery systems to take place adequately. The status quo of Hazyview is summarised in **Table 5.1**.

Table 5.1 Hazyview Status Quo

Institutional	Financial
• Limited human capacity and technical skills in the operation and maintenance department; • The political support is acceptable but the understanding of the water business can improve; • Municipal bylaws are under review; • No enforcement of municipal bylaws; • No training and capacity building is taking place; • Shortage of vehicles and support materials.	• The Demand Centre is mostly metered • The current metering and cost recovery systems are fair but can improve; • Meter reading is not acceptable and often estimated; • Municipal water tariff structure is not cost reflective (declining tariff structure), thus not promoting WC/WDM; • Billing is informative showing 2 months of consumption; • Domestic and non-domestic meters are more than 10 years old.
Social	**Technical**
• The relationship with the community is generally positive in formal and high income areas while strained in rural (informal) areas; • Mbombela LM has an effective customer call centre and promotes reporting of leaks; • Water is paid for, but not valued very highly by community; • Rain water harvesting is promoted through the Parks department; • Illegal connections and non-payment for services is widely prevalent in rural (informal) areas.	• There is very little macro and no micro management information available to perform a proper assessment of the water losses and potential savings; • Consumer meters are generally in excess of 5 years old and under-reading; • The WSP has no loggers or leak detection equipment; • No zone metering, pressure management or sectorisation is being done; • Existing telemetry system in some areas; • Top consumers are not pro-actively monitored.

5.1.1 Site Inspection

Site visits were undertaken to gain a better understanding of the status quo and actual operation of the Hazyview system. During the field visits the following were observed:

- The Hazyview water supply system is reasonably maintained in most areas however there are areas with visible leaks and wastages.
- There are bulk meters in place as shown in **Figure 5.1** but very limited management information is available.


Figure 5.1: WTW inlet meter and leak at balancing reservoir

- The system has limited operational problems and the water supply is consistent in town.
- There is no sectorisation taking place with the result that problem areas cannot be identified.
- No pressure management is undertaken.
- Most consumer meters are old and possibly under reading and require replacement.
- Leak reporting and repair is inadequate.
- Flooded meters are in poor condition and not being read as shown in **Figure 5.2**.


Figure 5.2: Examples of leaking domestic meters

5.1.2 Key Performance Indicators

The key performance indicators for Hazyview are summarised in **Table 5.2.**

Based on the unit consumption it is clear that WC/WDM should be implemented as a matter of priority. The current consumption is more than double the national average of 235 ℓ/c/d. The non-revenue water is also above the national average of 36.8% and very high considering the formal supply area and infrastructure. A NRW figure of below 30% would be considered acceptable for the supply area. Realistic and optimistic target reductions of 15 and 30% respectively have been set, although further reductions could be achieved with time.

Table 5.2 Hazyview KPI's

Indicator	Current Value	Realistic Target value 15% Reduction	Optimistic Target Value 30% Reduction
System Input volume (million m^3/a)	1.39	1.18	0.97
System Input volume (Mℓ / day)	3.8	3.2	2.7
Billed Authorised Consumption (million m^3/a)	0.63	0.71	0.73
Unbilled Authorised Consumption (million m^3/a)	0.10	0.12	0.05
Water Losses (million m^3/a)	0.67	0.35	0.19
Non-revenue Water (million m^3/a)	0.76	0.47	0.24
% Non-revenue water	55%	40%	25%
% Water Losses	48%	30%	20%
Input Volume (litres / capita / day)	485	413	340
Input Volume (m^3 / household / month)	47	40	33
Authorised Consumption (litres / capita / day)	252	289	272
Authorised Consumption (m^3 / household / month)	24	28	26

5.2 STRATEGY

The strategy for Hazyview is summarised below:

- The Demand Centre should set up a WC/WDM task team, chaired by senior officials to meet on monthly basis to address WC/WDM issues;
- Fill all vacant positions and strengthen technical skills and capacity building;
- Repair all visible leaks;
- Improve macro and micro management information through proper sectorisation to obtain a better understanding of problem areas;
- Implement a consumer meter replacement programme, starting with the top consumers;
- Provide training for meter readers to improve meter reading and reporting;
- Water tariffs should be reviewed to become cost reflective and promote WC/WDM;
- Perform a Councillor training programme on water business and WC/WDM;
- Prepare and advertise a customer service charter;
- Review current bylaws to include promotion of WC/WDM and implement enforcement;
- Embark on a community awareness programme that emphasises fixing of internal plumbing leaks;
- Embark on a schools awareness programme that promotes reporting of leaks and water wise practices;
- Implement a pressure management programme and focus on maintenance and monitoring.

5.3 SUMMARY AND CONCLUSIONS

There is scope for WC/WDM in the Hazyview area which will result in both reduction of non-revenue water and the total system input volume. There is limited institutional capacity and skills available to embark on such a programme which should be resolved before focusing on the following interventions:

- Improve political support through a Councillor awareness programme focusing on the water business;
- Review water tariffs to reflect cost of water and promote WC/WDM;
- Train meter readers and perform monthly audits to eliminate estimates and other inaccuracies;
- Perform a meter audit and cleaning to improve meter reading and accessibility;
- Undertake a community awareness programme that promotes the value of water and water wise gardening;
- Implement zone metering and sectorisation to improve micro management information. This will assist with the identification of key water loss areas and reduce the number of bursts;
- Implement a pressure management programme in conjunction with sectorisation and continuous monitoring;
- Undertake a consumer meter replacement programme, starting with the top consumers, whereby 10% of all consumer meters, are replaced on an annual basis.

6 NSIKAZI NORTH DEMAND CENTRE

Nsikazi North receives water from the Sabie River. This water is pumped by the Nyongane pump station to the Nyongane Water Treatment Works treatment works for chlorination, then distributed to the community. The Demand Centre is operated and maintained by Mbombela Local Municipality with the treatment plants operated by Bushbuckridge Water Board.

6.1 STATUS QUO ASSESSMENT

This Demand Centre comprises mostly informal areas with informal infrastructure which has no bulk or domestic metering. Billing and cost recovery are thus not taking place. The level of service within the Demand Centre is mostly below the RDP standard. The status quo of Nsikazi North is summarised in **Table 6.1**.

Table 6.1 Nsikazi North Status Quo

Institutional	Financial
• Limited human capacity and skills to embark on WC/WDM activities; • Municipal bylaws are currently under review and not enforced; • Political support is reasonable but the understanding of water business can improve; • There is no customer services charter.	• Metering and cost recovery system is non-existent; • Non-revenue water is estimated to be above 50%.
Social	**Technical**
• The relationship between the municipality and community is generally positive; • High level of low income earners and indigents consumer base; • Infrastructure vandalism and illegal connections is problematic in the area; • Rain water harvesting is promoted through Parks Department; • There is no community education and awareness programme taking place.	• No bulk metering in the area; • The level of service is very poor, in most areas below RDP standard; • The system is characterised by intermittent supply and poor service; • High prevalence of illegal connections with consumers trying to gain access to water supply; • Insufficient support structures and materials; • No WC/WDM such as pressure management and sectorisation is being done.

6.1.1 Site Inspection

The Demand Centre is mostly rural and the level of service is standpipes, however there are some areas that are formal RDP developments with formal infrastructure, which makes it possible to implement proper metering.

Most of the bulk infrastructure requires urgent maintenance and upgrading. It is recommended that this should be undertaken as a priority to prevent further deterioration of certain components such as pumps and motors which might lead to system failure.


Figure 6.1: Sabie pump station

- Water supply to the area is very poor and there are scheduled interrupted water supplies;
- The level of service is largely below or equal to RDP standards;
- Sabie Pump Station requires urgent maintenance as some of the pumps are not in operation due to lack of spares;
- There are no bulk meters in place and system losses are not known;
- Most villages receive water through water tankers;


Figure 6.2: Leaking illegal connection and air valve

Some consumers resort to vandalism of infrastructure and illegal connections to access water.

The current upgrading of Nyongane pump station will assist in improving the current water shortages in the area. The lack of bulk metering makes it difficult to analyse and understand the system characteristics and to identify critical areas.


Figure 6.3: Upgrades at Nyongane pump station and water tanker

Consumers in villages such as Nyongane, Shabalala, Numbi and other large parts of Nsikazi North experience intermittent water supply. As a result most consumers erected on-site storage tanks that are filled during periods that the network is pressurised. Consumers without additional storage tanks leave their taps open to fill buckets and bathtubs as a means of temporary storage.

Due to the obvious water shortages in the area, the negative impact on the infrastructure lifespan can be compromised severely and possible water quality and health issues may arise.

6.1.2 Key Performance Indicators

The key performance indicators for Nsikazi North are summarised in **Table 6.2**.

Table 6.2 Nsikazi North KPI's

Indicator	Current Value	Realistic Target value 5% Reduction	Optimistic Target Value 10% Reduction
System Input volume (million m^3/a)	10.7	10.17	9.63
System Input volume (Mℓ / day)	29.3	27.8	26.4
Billed Authorised Consumption (million m^3/a)	4.28	5.08	5.78
Unbilled Authorised Consumption (million m^3/a)	2.89	2.54	1.93
Water Losses (million m^3/a)	3.53	2.54	1.93
Non-revenue Water (million m^3/a)	6.42	5.08	3.85
% Non-revenue water	60%	50%	40%
% Water Losses	33%	25%	20%
Input Volume (litres / capita / day)	179	170	161
Input Volume (m^3 / household / month)	23	22	21
Authorised Consumption (litres / capita / day)	120	128	129
Authorised Consumption (m^3 / household / month)	15	16	17

The average consumption for Nsikazi North is already very low and very little further reduction in overall consumption is expected, considering the level of service. Some reduction in total consumption can be expected but most savings will be redistributed. Realistic and optimistic target reductions of 5 and 10% respectively have thus been set.

6.2 STRATEGY

The strategy for Nsikazi North is summarised below

- The Demand Centre should focus on improving the level of service to address the water supply challenges in the area;
- Install bulk meters to improve management information;
- Fill all vacant positions and strengthen technical skills and capacity building;
- Repair all visible leaks;
- Start a retrofitting programme whereby all internal plumbing leaks are fixed regardless of metering status;
- Improve micro management information through proper sectorisation to obtain a better understanding of problem areas;
- Implement a consumer meter replacement programme where possible, starting with the top consumers;
- Undertake Councillor training programme on water business and WC/WDM;
- Review current bylaws to include promotion of WC/WDM and implement enforcement thereof;
- Undertake a community awareness programme that emphasises fixing of internal plumbing leaks;
- Embark on a schools awareness programme promoting reporting of leaks and water wise practices;
- Implement a pressure management programme and focus on maintenance and monitoring.

6.3 SUMMARY AND CONCLUSIONS

There is scope for WC/WDM in the Nsikazi North area however this will not necessarily result in the reduction of non-revenue water and the total system input volume. The focus in this area should be on improving service delivery, fixing visible leaks and creating awareness:

- Improve political support through a Councillor awareness programme focusing on the water business;
- Ensure continuous supply by improving the operation and maintenance of the Sabie pump station and Nyongane WTW.;
- Deploy community plumbers to fix internal plumbing leaks and create community awareness;
- Install bulk meters and obtain macro management information;
- Consider installing zone meters and sectorisation to improve micro management information. This will assist with the identification of key water loss areas and reduce the number of bursts;
- Implement a pressure management programme in conjunction with sectorisation and continuous monitoring;
- Implement a community awareness programme that promotes the value of water and water wise gardening;

- Once the system has stabilised and the relationship between stakeholders has improved, consider implementing metering, billing and cost recovery;
- Embark on an infrastructure maintenance and replacement programme.

7 NSIKAZI SOUTH

This Demand Centre receives water from the Crocodile River. A portion of Nsikazi South is operated and maintained under concession by Sembcorp Silulumanzi under the jurisdiction of Mbombela Local Municipality with the treatment plant operated by Bushbuckridge Water Board.

7.1 STATUS QUO ASSESSMENT

Most of the Demand Centre is informal and levels of services are below or at RDP standards, however there are formal areas with formal infrastructure in a relatively large area of Kanyamazane, Tekwane South and Entokozweni Townships which enables metering, billing and cost recovery systems to be adequately implemented within this area. The status quo of Nsikazi South is summarised in **Table 7.1.**

Table 7.1Nsikazi South Status Quo

Institutional	Financial
• The relationship between the municipality and politicians has improved but can be better; • Sembcorp Silulumanzi is well structured and has sufficient capacity to implement WC/WDM in the areas of service, but training and an increase in capacity is required in their WC/WDM section. • The Water Services Provider (WSP) uses the municipal bylaws which are currently under review, but have their own customer charter.	• Metering and cost recovery system is non-existing in the Mbombela supply area but acceptable in the concession area; • The non-revenue water in the area is estimated to be above 50%; • Water tariffs are cost reflective and the organisation is run on business principles; • The rising block water tariff structure is in place to promote WC/WDM; • Billing is informative • Metering and billing is generally problematic and non-existent in the informal areas; • Reluctance to pay for services and illegal connections.
Social	**Technical**
• The relationship between the municipality and community is generally positive in the concession area but strained in the Mbombela supply area; • The WSP has an effective customer call centre and promotes reporting of leaks in the area of service; • High level of low income earners and indigents consumer base; • Infrastructure vandalism and illegal connections is problematic in the area; • Rain water harvesting is promoted through the Parks Department; • There is no community education and awareness programme taking place.	• There is bulk metering in the area; • The system is characterised by intermittent supply and poor level of services. • High prevalence of illegal connections with consumers trying to gain access to water supply. • There is no proactive maintenance taking place; • It is very difficult to implement metering and billing in rural or informal areas; • System losses are not measured in large areas of the Demand Centre.

7.1.1 Site Inspection

The Kanyamazane Water Treatment Plant supplies a large part of Nsikazi South of which some areas are managed by the concession and the rest is operated by MLM. There is metering, billing and cost recovery taking place in the concession areas, however there are a number of illegal connections taking place in most areas of South Nsikazi. The level of service varies from house or yard connections to stand pipes. In most areas outside the concession there are mostly yard connections. The Nsikazi South system is failing to deliver a 24hr consistent supply; and reservoirs are not fully recharged to maintain peak hour demands.

Typical Illegal Connections

Illegal Connections from the Scour Valve

Figure 7.1: Examples of illegal connections to obtain access to water

- The system has a number of operational issues;
- The level of service is very poor to some extent water services are unknown in the villages;
- Water supply to the area is poor and there are scheduled interrupted water supplies,
- Water tankers are used to supplement water supply in the area;
- System losses are not measures.

Figure 7.2: Valve chamber and water tanker

- There is no proactive maintenance of infrastructure taking place;
- Bulk metering is taking place;
- The system is not sectorised into zones in most areas.

The bulk transmission mains from Kanyamazane WTW used to supply the areas such as Kabokweni is one of the worst affected by vandalism and illegal connections. Most consumers erected storage tanks on site that are filled during periods when the network is pressurised.

7.1.2 Key Performance Indicators

The key performance indicators for Nsikazi South are summarised in **Table 7.2**.

Table 7.2 Nsikazi South KPI's

Indicator	Current Value	Realistic Target value 10% reduction	Optimistic Target Value 20% reduction
System Input volume (million m^3/a)	19.3	17.37	15.44
System Input volume (Mℓ / day)	52.8	47.6	42.3
Billed Authorised Consumption (million m^3/a)	7.72	8.69	9.26
Unbilled Authorised Consumption (million m^3/a)	2.90	3.47	3.09
Water Losses (million m^3/a)	8.69	5.21	3.09
Non-revenue Water (million m^3/a)	11.58	8.69	6.18
% Non-revenue water	60%	50%	40%
% Water Losses	45%	30%	20%
Input Volume (litres / capita / day)	235	211	188
Input Volume (m^3 / household / month)	27	25	22
Authorised Consumption (litres / capita / day)	129	148	150
Authorised Consumption (m^3 / household / month)	15	17	17
System Input volume (million m^3/a)	19.3	17.37	15.44
System Input volume (Mℓ / day)	52.8	47.6	42.3
Billed Authorised Consumption (million m^3/a)	7.72	8.69	9.26

The current unit consumption is in line with the national average of 235ℓ/c/d but high for the level of service, but there is a huge inequity in the supply and any savings will be redistributed. Realistic and optimistic target reductions of 10 and 20% respectively have thus been set.

7.2 STRATEGY

The strategy for Nsikazi South is summarised below

- The Demand Dentre should set up a WC/WDM task team, chaired by senior officials to meet on a monthly basis to address WC/WDM issues;
- Improve the level of service which will minimise illegal connections;

- Fill all vacant positions and strengthen technical skills and capacity building;
- Repair all visible leaks;
- Embark on an internal plumbing retrofitting programme whereby leaks are fixed by local plumbers irrespective of metering and billing status;
- Improve micro management information through proper sectorisation to obtain a better understanding of problem areas;
- Implement a consumer meter replacement programme, starting with the top consumers;
- Provide training for meter readers to improve meter reading and reporting;
- Water tariffs should be reviewed to become cost reflective and promote WC/WDM;
- Perform Councillor training programme on water business and WC/WDM;
- Prepare and advertise customer service charter;
- Review current bylaws to include promotion of WC/WDM and implement enforcement thereof;
- Embark on a community awareness programme that emphasises fixing of internal plumbing leaks;
- Embark on a schools awareness programme promoting reporting of leaks and water wise practices;
- Implement a pressure management programme and focus on maintenance and monitoring.

7.3 SUMMARY AND CONCLUSIONS

There is scope for WC/WDM in the Nsikazi South area but will not necessarily result in the reduction of non-revenue water and the total system input volume. The main focus in this area should be on improving service delivery, fixing visible leaks and creating community and institutional awareness programmes:

- Improve service delivery and strengthen relationship with community;
- Ensure continuous supply by improving Kanyamazane WTW operation and maintenance.
- Create job opportunities by employing community plumbers to repair internal plumbing leaks and create awareness;
- Improve political support through Councillor awareness programme focussing on water business;
- Maintain bulk metering and macro management information;
- Implement community awareness programme that promotes the value of water and water wise gardening;
- Implement zone metering and sectorisation to improve micro management information. This will assist with the identification of key water loss areas and reduce the number of bursts;
- Maintain pressure management programme in conjunction with sectorisation and continuous monitoring.

8 KARINO PLASTON CORRIDOR

This Demand Centre is getting water from Primkop Dam and this is treated in Tekwane (Primkop) WTW, which is operated by Silulumanzi. Most of the Demand Centre is formal with formal infrastructure and the level of service is at RDP standards.

8.1 STATUS QUO ASSESSMENT

The area, which includes Mamelodi, Tekwane North and Emoyeni, is operated and maintained under concession by Sembcorp Silulumanzi under the jurisdiction of the Mbombela Local Municipality. There is an informal area, with informal infrastructure, in a relatively small area within Emoyeni Township, which has limited metering, billing and cost recovery. The status quo of Karino Plaston Corridor is summarised in **Table 8.1** below:

Table 8.1 Karino Plaston Corridor Status Quo

Institutional	Financial
• The WSP managing the area is well structured and has capacity to implement WC/WCM activities; • All vacancies are filled in the WSP,s technical department; • No enforcement of municipal bylaws; • There are vehicles and support structures available for operation and maintenance.	• The current metering and cost recovery systems are generally adequate but can improve; • The reading of meter is outsourced; • There is a high level of non-payment of services in the area, estimated to be above 50%; • Water tariff structure is cost reflective; • Rising block tariffs promote WC/WDM; • There is informative billing within the Demand Centre.
Social	**Technical**
• The relationship between the WSP and community is generally positive; • Excessive garden watering is a common phenomenon in summer; • Water is paid for but not valued very highly by community; • The WSP has an effective 24 hour customer call centre and promotes reporting and fixing of leaks. • The illegal connections and non-payment of services is prevalent in rural (informal) areas. • The consumer profile is one of a high level of low income earners and indigents. • Vandalism of infrastructure is a major concern.	• There are WC/WDM activities taking place such as bulk metering, pressure management, sectorisation and leak repair; • Sufficient macro management information is available to perform a proper assessment of the water losses and potential savings in the Demand Centre; • An active telemetry system is in place to improve monitoring of reservoirs; • There is existing water loss equipment such as loggers and leak detectors; • No consumer meter replacement programmes;

8.1.1 Key Performance Indicators

The key performance indicators for Karino Plaston Corridor are summarised in **Table 8.2.**

Table 8.2 Karino Plaston KPI's

Indicator	Current Value	Realistic Target value 0% Reduction	Optimistic Target Value 0% Reduction
System Input volume (million m^3/a)	1.31	1.31	1.31
System Input volume (Mℓ / day)	3.6	3.6	3.6
Billed Authorised Consumption (million m^3/a)	1.11	1.11	1.11
Unbilled Authorised Consumption (million m^3/a)	0.07	0.07	0.07
Water Losses (million m^3/a)	0.13	0.13	0.13
Non-revenue Water (million m^3/a)	0.20	0.20	0.20
% Non-revenue water (estimated)	15%	15%	15%
% Water Losses (Sembcorp)	10%	10%	10%
Input Volume (litres / capita / day)	137	137	137
Input Volume (m^3 / household / month)	17	17	17
Authorised Consumption (litres / capita / day)	123	123	123
Authorised Consumption (m^3 / household / month)	15	15	15

The average consumption for Karino Plaston is already very low and very little further reduction in overall consumption is expected considering the level of service. No realistic and optimistic target reductions have been set.

8.2 STRATEGY

The strategy for Karino Plaston Corridor is summarised below:

- The Demand Centre should focus on improving the level of service to address the water supply challenges in the areas of Emoyeni Township;
- Increase human capacity and strengthen technical skills and capacity building;
- Employ local plumbers to repair all visible leaks on private property. leaks as well as indigent households; Indigents are also on private property, are we prioritising them?
- Improve micro management information through proper sectorisation to obtain a better understanding of problem areas;
- Implement a consumer meter replacement programme where possible, starting with the top consumers;
- Undertake CCouncillor training programme on water business and WC/WDM;
- Review current bylaws to include promotion of WC/WDM and implement enforcement;
- Undertake a community awareness programme that emphasises fixing of internal plumbing leaks;
- Embark on schools awareness programme promoting reporting of leaks and water wise practices;
- Implement a pressure management programme where possible and focus on maintenance and monitoring.

8.3 SUMMARY AND CONCLUSIONS

There is scope for WC/WDM in the Karino Plaston Corridor area, howeverthis will not necessarily result in the reduction of non-revenue water and the total system input volume. The focus in this area should thus be on improving service delivery, removing illegal connections, fixing visible leaks and implementing a community education and awareness programme:

- Implement community awareness programme that promotes the value of water and water wise gardening;
- Ensure continuous supply by improving Tekwane (Primkop) WTW and commissioning of Karino WTW;
- Improve political support through Councillor awareness programme focusing on the water business;
- Review water tariffs to reflect cost of water and promote WC/WDM;
- Implement zone metering and sectorisation to improve micro management information. This will assist with the identification of key water loss areas and reduce the number of bursts;
- Train meter readers and perform monthly audits to eliminate estimates and other inaccuracies;
- Consider implementing pressure management in areas experiencing high pressures;
- Perform meter audit and cleaning to improve meter reading and accessibility.

9 MATSULU DEMAND CENTRE

This Demand Centre receives water from the Crocodile River. The water is pumped, treated and distributed from the Matsulu WTW, which is operated and maintained under concession by Sembcorp Silulumanzi under the jurisdiction of the Mbombela Local Municipality.

9.1 STATUS QUO ASSESSMENT

Most of the Demand Centre is largely formal with formal infrastructure, which enables metering, billing and cost recovery systems to be adequately implemented, however there is a relatively small area with informal infrastructure. The status quo for Matsulu is summarised in**Table 9.1** below:

Table 9.1 Mastulu Status Quo

Institutional	Financial
• The WSP managing the area is well structured and has capacity to implement WC/WDM activities; • All vacancies are filled in the WSP's technical department; • No enforcement of municipal bylaws; • There are vehicles and support structures available for operation and maintenance.	• The current metering and cost recovery systems are generally adequate but can improve; • Non-revenue water in the area is estimated above 50%; • Reading of meter is outsourced; • There is a high level of non-payment of services in the area, estimated to be above 60%; • Water tariff structure is cost reflective; • Rising block tariffs promote WC/WDM; • There is informative billing within the Demand Centre.
Social	**Technical**
• The relationship between the WSP and community is generally positive; • There is political support and involvement in promoting water efficiency and awareness; • Excessive garden watering is a common phenomenon in summer; • Water is paid for but not valued very highly by community; • The WSP has an effective 24 hour customer call centre and promotes reporting and fixing of leaks; • The illegal connections and non-payment of services is prevalent in rural (informal) areas. • The consumer profile is one of a high level of low income earners and indigents; • Vandalism of infrastructure is a major concern.	• There are WC/WDM activities taking place such as bulk metering, pressure management, sectorisation and leak repair; • Intermittent supply in some parts of the Demand Centre; • There is sectorisation and zone metering taking place; • Sufficient macro management information is available to perform a proper assessment of the water losses and potential savings in the Demand Centre; • An active telemetry system is in place to improve monitoring of reservoirs; • There is existing water loss equipment such as loggers and leak detectors; • No consumer meter replacement programme is taking place.

9.1.1 Key Performance Indicators

The key performance indicators for Matsulu are summarised below:

Table 9.2: Matsulu KPI's

Indicator	Current Value	Realistic Target value 15% Reduction	Optimistic Target Value 30% Reduction
System Input volume (million m^3/a)	5.3	4.51	3.71
System Input volume (Mℓ / day)	14.5	12.3	10.2
Billed Authorised Consumption (million m^3/a)	1.06	1.80	2.23
Unbilled Authorised Consumption (million m^3/a)	2.12	1.35	0.74
Water Losses (million m^3/a)	2.12	1.35	0.74
Non-revenue Water (million m^3/a)	4.24	2.70	1.48
% Non-revenue water	80%	60%	40%
% Water Losses	40%	30%	20%
Input Volume (litres / capita / day)	292	248	205
Input Volume (m^3 / household / month)	36	30	25
Authorised Consumption (litres / capita / day)	175	174	164
Authorised Consumption (m^3 / household / month)	21	21	20

Based on the unit consumption of Matsulu it is clear that WC/WDM should be implemented as a matter of priority. The current consumption is 50% more than the national average of 235ℓ/c/d. Realistic and optimistic target reductions of 15 and 30% respectively have been set, although further reductions could be achieved in time.

9.2 STRATEGY

The strategy for Matsulu Demand Centre is summarised below:

- The Demand Centre should focus on improving the level of service to address the water supply challenges ;
- Employ local plumbers to repair all visible leaks to private property. leaks as well as indigent households; same comment as previous Demand Centre.
- Improve micro management information through proper sectorisation to obtain a better understanding of problem areas;
- Implement a consumer meter replacement programme where possible, starting with the top consumers;
- Undertake Councillor training programme on water business and WC/WDM;
- Review current bylaws to include promotion of WC/WDM and implement enforcement thereof;
- Undertake community awareness programme that emphasises the fixing of internal plumbing leaks;
- Embark on schools awareness programme promoting reporting of leaks and water wise practices;
- Implement a pressure management programme where possible and focus on maintenance and monitoring.

9.3 SUMMARY AND CONCLUSIONS

There is scope for WC/WDM in the Matsulu area which will result in both reduction of non-revenue water and the total system input volume. There is limited institutional capacity and skills available to embark on such a programme which should be resolved before focusing on the following interventions:

- Improve service delivery which will minimise illegal connections in the area;
- Improve political support through a Councillor awareness programme focusing on the water business;
- Promote payment for services through community awareness
- Improve micro management information.
- Embark on a community awareness programme that promotes the value of water and water wise gardening;
- Maintain the satisfactory operating pressure and install PRVs in areas experiencing high pressure and ensure that operating pressures never exceeds the DWA regulatory standard of 9 bar;
- Train meter readers and perform monthly audits to eliminate estimates and other inaccuracies;
- Perform meter audit and cleaning to improve meter reading and accessibility.

10 GENERAL OBSERVATIONS

10.1 REGULATORY PERFORMANCE MEASUREMENT SYSTEM

The Department of Water Affairs is measuring and monitoring the overall performance of Water Services Authorities through the Regulatory Performance Measurement System (RPMS). The RPMS is a tool to assist the DWA to consistently, transparently, and objectively measure performance in the sector.

KPIs 7 to 11 of the RPMS have a direct impact on WC/WDM and therefore have been analysed as part of this study. KPI 8 – Institutional Effectiveness and KPI 9 – Financial Performance are critical to implement effective WC/WDM and must be addressed as a matter of priority. KPI 11 highlights the lack of information with regards to management information. The results from the 2011/12 RPMS are summarised in **Table 10.1.**

Table 10.1: RPMS results for Mbombela Municipality

Key Performance Indicators	Achieved KPI Score	Required score	Performance assessment
KPI 1: Access to water supply	2.833	3	Concern
KPI 2: Access to sanitation	3.086	3	Adequate
KPI 3: Access to Free Basic Water	3.686	3	Excellent
KPI 4: Access to Free Basic Sanitation	0	3	Crisis
KPI 5: Drinking Water Quality management	4	3	Excellent
KPI 6: Wastewater quality management	4	3	Excellent
KPI 7: Customer service quality	5	3	Excellent
KPI 8: Institutional effectiveness	3.568	3.5	Adequate
KPI 9: Financial performance	2.064	4	Concern
KPI 10: Strategic asset management	4.319	3	Excellent
KPI 11: Water use efficiency	No data	3	No data

The municipality has done very well with KPI 7 – Customer service quality and KPI 10 – Strategic Asset Management.

10.2 BLUE DROP ASSESSMENT

Ensuring efficient and continuous supply to an area is a prerequisite for implementing effective WC/WDM. This cannot be promoted and implemented in areas characterised by intermittent supply and poor level of service.

The Blue Drop assessment process is an effort by the Department of Water Affairs to raise the drinking water quality and reliability of supply to all consumers. The incentive-based regulatory approach acts as a positive stimulus to facilitate improved performance and public accountability, whilst establishing essential systems and processes to sustain and measure gradual improvement. The results from the Blue Drop assessment are an indication of the efficiency and sustainability of supply to an area, which impacts directly on WC/WDM.

The Blue Drop regulatory impression is quoted as follows “Mbombela Local Municipality performed

extremely well in some water supply systems, while the performance in particularly Dwaleni, Legogote Mganduzweni, Nsikazi North, Nyongane and Phola Mshadza need to urgently improve. On a very positive note, the Department wishes to applaud the Municipality for the shared team effort with Silulumanzi to achieve Blue Drop certification status in the Matsulu and Nelspruit systems."

10.3 WC/WDM QUANTITATIVE SCORECARD

The WC/WDM quantitative scorecard provides an indication of the WC/WDM activities the municipality is undertaking against international best practice. The purpose is that municipalities evaluate themselves on an annual basis and attempt to improve their score.

The results for Mbombela are shown in **Figure 10.1**.

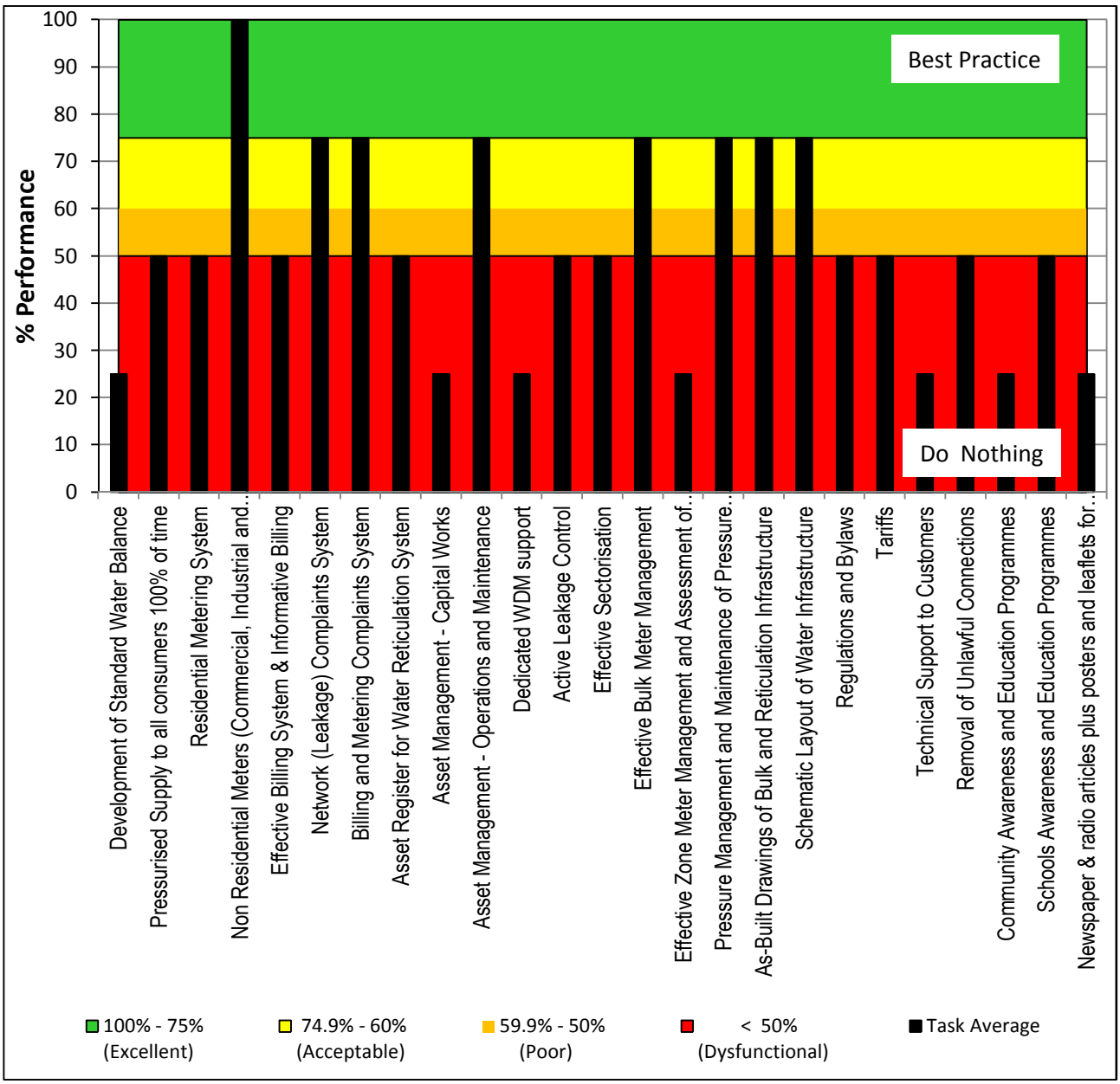

Figure 10.1: Mbombela quantitative scorecard

10.4 FINANCIAL STATEMENT ASSESSMENT

The water services revenue and expenditure are summarised in **Table 10.2**.

Table 10.2: Water Services Revenue and Expenditure

Financial Year	2008/09 Audit outcome	2009/10 Audit outcome	2010/11 Audit outcome	2011/12 Pre Audit outcome	2012/13 Forecast	2013/14 Forecast	2014/15 Forecast
Revenue / Expenditure							
Revenue	31.085	85.059	65.351	34.339	37.086	42.538	45.984
Expenditure	1.079	99.910	170.385	133.758	140.446	151.681	163.816
Surplus/Deficit	30.006	-14.851	-105.034	-99.419	-103.36	-109.143	-117.832
Water tariff increases							
Water	8.0%	7.0%	8.0%	9.75%	8.0%	8.0%	8.0%
Sembcorp /Silulumanzi	10.99%	14.42%	9.74%	10.42%			
Capital expenditure							
Water supply (million)					147. 24	171.22	244.12

Source: Mbombela LM - Draft 2013/2014 – 2015/2016 Annual Budget and Medium Term Revenue and Expenditure Framework

The municipality highlights the huge deficit and indicates and have already identified six key turn around strategies to improve the situation. This include:

- Revenue enhancement strategy – It entails implementation of mechanisms that will address and perfect the bottlenecks and weaknesses on the revenue management value chain in order to enhance revenue collection.
- Cost management strategy – It entails implementation of processes and systems to identify, allocate, control and manage key cost drivers linked to primary activities (water, sanitation, electricity, waste management, roads and stormwater, and parks and recreational facilities). And ensure all tariffs and fees for services charge (water, sanitation, electricity and waste management) are cost-reflective.

The municipality will be spending 25% or R 562.58million of their capital budget on water supply infrastructure which is encouraging.

The 2012/13 water tariffs for Mbombela and the concession area are summarised in **Table 10.3.** There is a huge disparity between the Concessionaire and Mbombela and the water tariffs area generally considered cheap considering the area is water stressed and the very high unit consumption in most areas.

It is recommended that the water tariffs are reviewed to promote WC/WDM and should be brought in line with metropolitan water tariffs which are above R15.00 per kilolitre in the top consumption block.

Revising the declining block tariff in the Mbombela supply area to an increasing block tariff will certainly assist to address the high levels of leakage and inefficiency in the White River and Hazyview areas

Table 10.3: 2012/13 Water tariffs

Concession Area	Residential	Concession Area	Business	Municipal Area	White River	Kabo-kweni	Hazy-view
Fixed charge	40.83	Fixed charge	61.26	Basic charge	56.55	0	109.75
0 to 6	0	< 50	10.20	0 to 6	0	0	0
6 to 12	Fixed charge	50 to 100	12.23	6 to 30	10.98	6.71	8.02
12 to 20	8.97	100 to 300	13.27	30 to 100	9.78	6.92	5.28
20 to 40	9.41	300 to 500	12.34	> 100	9.06	8.68	5.28
40 to 150	10.58	> 500	11.64	Business	8.95	8.95	5.22
> 150	11.79						

11 BUSINESS PLAN

11.1 ASSUMPTIONS

The business plan is based on the following assumptions:

- The business plan budget allows for international best practice such as replacement of consumer water meters every 10 years and continuous monitoring.
- The cost benefit ratio is an average of all interventions but it should be noted that some interventions will have a much better cost benefit ratio than others.
- Some of the budget items are probably already included in other CAPEX or OPEX budgets but have been included here for sake of completeness.
- The success of the strategy and business plan also depends on issues such as :
  - Appointment suitably qualified staff to perform and maintain the programme;
  - Allocation of required budgets;
  - Expediting procurement processes to ensure consultant and / or contractors are appointed;
  - Proper baseline assessment and measurement of savings to show results;
  - Raising WC/WDM awareness within the whole organisation and collaboration between all stakeholders;

11.2 TARGETS

The realistic and optimistic targets for the total study area are summarised in **Table 11.1.** The optimistic target seeks to reduce the input volume, non-revenue water and water loss all by about 10%. The optimistic target seeks to reduce the input volume, non-revenue water and water loss all by about 20%. The optimistic target will also achieve the Presidential target of halving water losses by 2014.

Table 11.1: Summary of total target

Indicator	Current Value	Realistic Target value 10% Reduction	Optimistic Target Value 20% Reduction
System Input volume (million m^3/a)	54.71	48.87	43.03
System Input volume (Mℓ / day)	149.79	133.80	117.80
Billed Authorised Consumption (million m^3/a)	26.73	28.62	29.07
Unbilled Authorised Consumption (million m^3/a)	8.90	8.27	6.47
Water Losses (million m^3/a)	19.08	11.98	7.49
Non-revenue Water (million m^3/a)	27.98	20.25	13.96
% Non-revenue water	51%	41%	32%
% Water Losses	35%	25%	17%
Input Volume (litres / capita / day)	277	247	218
Input Volume (m^3 / household / month)	32	29	26
Authorised Consumption (litres / capita / day)	180	187	180
Authorised Consumption (m^3 / household / month)	21	22	21

If the above targets could be achieved, the future realistic water balance for the municipality will look as shown in **Figure 11.1**.

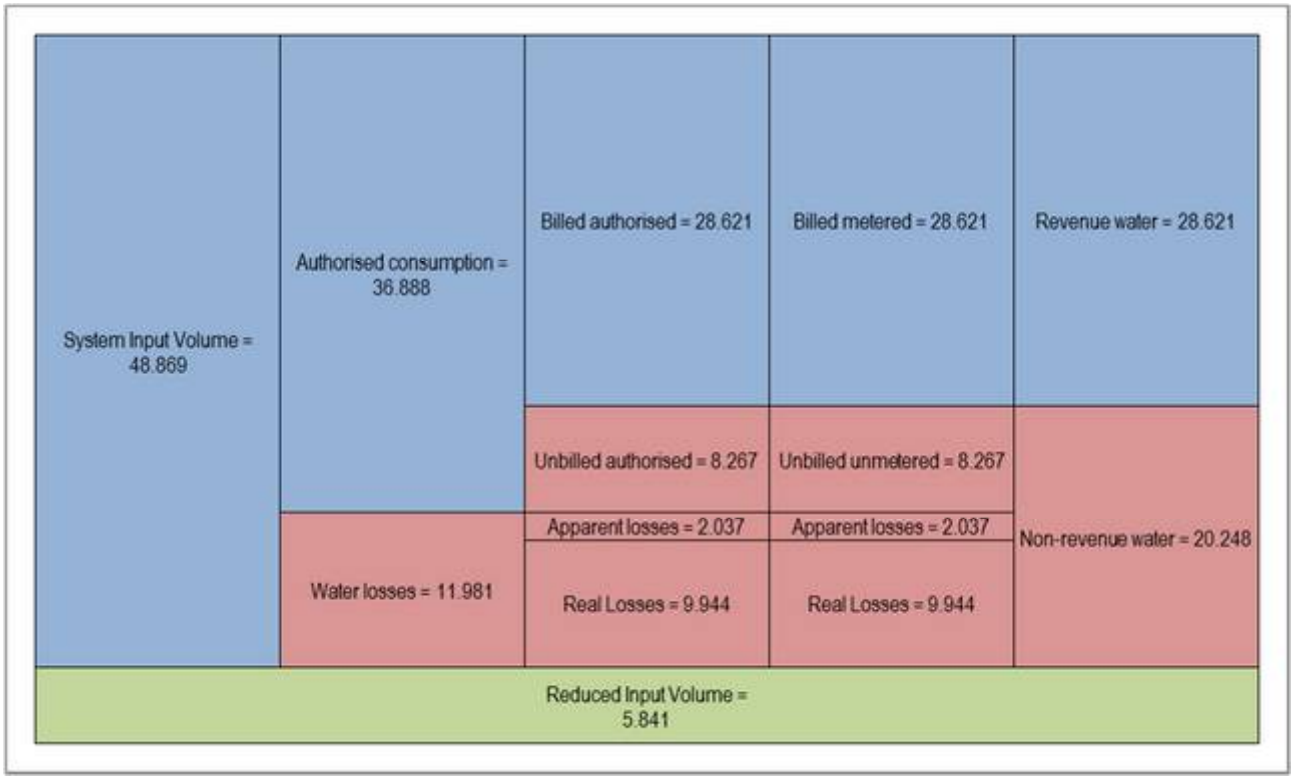

Figure 11.1: Target realistic water balance

The target water balance will reduce non-revenue water to 41% and total consumption by approximately 10%.

The non-revenue, water loss and efficiency targets for each demand centre are summarised in **Table 11.2.**

Table 11.2: NRW / Water loss / Efficiency target summary

Demand centre	NRW		Losses		l/c/d	
	Current	Target	Current	Target	Current	Target
Nelspruit	27%	20%	22%	15%	723	614
White River	37%	30%	32%	25%	470	423
Karino	15%	15%	10%	10%	137	137
Matsulu	80%	60%	40%	30%	292	248
Hazyview	55%	40%	48%	30%	485	413
Nsikazi North	60%	50%	33%	25%	179	170
Nsikazi South	60%	50%	45%	30%	235	211
Total	**51%**	**41%**	**35%**	**25%**	**277**	**247**

11.3 FIVE YEAR BUDGET REQUIREMENTS

The budget requirements for implementing WC/WDM in Mbombela municipality are shown in **Table 11.3.**

Table 11.3: WC/WDM budget summary

Component	Type	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Institutional	CAPEX	R 80 000	R 110 000	R 10 000	R 0	R 0	R 200 000
	OPEX	R 1 025 000	R 1 025 000	R 1 025 000	R 1 025 000	R 1 025 000	R 5 125 000
	TOTAL	**R 1 105 000**	**R 1 135 000**	**R 1 035 000**	**R 1 025 000**	**R 1 025 000**	**R 5 325 000**
Financial	CAPEX	R 180 000	R 140 000	R 40 000	R 0	R 0	R 360 000
	OPEX	R 26 880 100	R 26 880 100	R 26 880 100	R 26 880 100	R 26 880 100	R 134 400 500
	TOTAL	**R 27 060 100**	**R 27 020 100**	**R 26 920 100**	**R 26 880 100**	**R 26 880 100**	**R 134 760 500**
Social	CAPEX	R 3 924 032	R 3 899 032	R 3 164 032	R 3 139 032	R 3 139 032	R 17 265 160
	OPEX	R 8 459 580	R 8 459 580	R 8 459 580	R 8 459 580	R 8 459 580	R 42 297 900
	TOTAL	**R 12 383 612**	**R 12 358 612**	**R 11 623 612**	**R 11 598 612**	**R 11 598 612**	**R 59 563 060**
Technical	CAPEX	R 25 375 732	R 29 533 132	R 23 996 132	R 23 118 632	R 23 118 632	R 125 142 260
	OPEX	R 15 102 950	R 15 102 950	R 15 102 950	R 15 102 950	R 15 102 950	R 75 514 750
	TOTAL	**R 40 478 682**	**R 44 636 082**	**R 39 099 082**	**R 38 221 582**	**R 38 221 582**	**R 200 657 010**
Total	CAPEX	R 29 559 764	R 33 682 164	R 27 210 164	R 26 257 664	R 26 257 664	R 142 967 420
	OPEX	R 51 467 630	R 51 467 630	R 51 467 630	R 51 467 630	R 51 467 630	R 257 338 150
	TOTAL	**R 81 027 394**	**R 85 149 794**	**R 78 677 794**	**R 77 725 294**	**R 77 725 294**	**R 400 305 570**

The budget shows that approximately R80million per annum is required over the next 5 years to address WC/WDM. The budget details are summarised in **Appendix B**.

Table 11.4 shows that if the municipality can achieve the realistic saving scenario, the project should be paying for itself within 3.1 years. This is based on the assumption that the municipality improves their water tariff structure to become more cost reflective and promote WC/WDM.

Table 11.4: Realistic Scenario Cost benefit ratio

Item	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Reduced input volume							
Volume	m^3/annum	1 168 400	2 336 800	3 505 200	4 673 600	5 842 000	17 526 000
Amount	R / annum	5 842 000	11 684 000	17 526 000	23 368 000	29 210 000	87 630 000
Increased revenue water							
Volume	m^3/annum	377 400	754 800	1 132 200	1 509 600	1 887 000	5 661 000
Amount	R / annum	2 858 800	5 717 600	8 576 400	11 435 200	14 294 000	42 882 000
Total							
Volume	**m^3/annum**	**1 545 800**	**3 091 600**	**4 637 400**	**6 183 200**	**7 729 000**	**23 187 000**
Amount	**R / annum**	**8 700 800**	**17 401 600**	**26 102 400**	**34 803 200**	**43 504 000**	**130 512 000**

Payback period - years	**3.1**

Table 11.5 shows that if the municipality can achieve the optimistic saving scenario, the project should be paying for itself within 1.8 years. This is based on the assumption that the municipality improves their water tariff structure to become more cost reflective and promote WC/WDM.

Table 11.5: Optimistic Scenario Cost benefit ratio

Item	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Reduced input volume							
Volume	m^3/annum	2 336 400	4 672 800	7 009 200	9 345 600	11 682 000	35 046 000
Amount	R / annum	11 682 000	23 364 000	35 046 000	46 728 000	58 410 000	175 230 000
Increased revenue water							
Volume	m^3/annum	498 800	997 600	1 496 400	1 995 200	2 494 000	7 482 000
Amount	R / annum	3 379 600	6 759 200	10 138 800	13 518 400	16 898 000	50 694 000
Total							
Volume	**m^3/annum**	**2 835 200**	**5 670 400**	**8 505 600**	**11 340 800**	**14 176 000**	**42 528 000**
Amount	**R / annum**	**15 061 600**	**30 123 200**	**45 184 800**	**60 246 400**	**75 308 000**	**225 924 000**

Payback period - years	**1.8**

11.4 UNIT REFERENCE VALUES

The unit reference values for the demand centres are summarised in **Table 11.6.** The unit reference values have been discounted over 20 years at 6, 8 and 10% with details provided in **Appendix C.** The unit reference values compare well with the augmentation options.

Table 11.6: Summary of Unit Reference Values

Demand Centre	Scenario	6%	8%	10%
Nsikazi North	Realistic	R 20.15	R 20.65	R 21.17
	Optimistic	R 10.50	R 10.76	R 11.03
Nsikazi South	Realistic	R 13.86	R 14.20	R 14.55
	Optimistic	R 7.43	R 7.60	R 7.79
Nelspruit	Realistic	R 7.99	R 8.18	R 8.39
	Optimistic	R 1.84	R 1.88	R 1.93
White River	Realistic	R 18.35	R 18.82	R 19.31
	Optimistic	R 7.98	R 8.19	R 8.40
Matsulu	Realistic	R 4.90	R 5.03	R 5.16
	Optimistic	R 2.73	R 2.80	R 2.88
Hazyview	Realistic	R 14.70	R 15.09	R 15.50
	Optimistic	R 8.19	R 8.41	R 8.64
Total	Realistic	R 12.29	R 12.59	R 12.91
	Optimistic	R 5.29	R 5.42	R 5.55

12 SUMMARY AND CONCLUSIONS

Results from the study are summarised as follows :

- There is a large part of the study area which has formal infrastructure which enables effective metering and billing.
- The average consumption in the urban areas is very high and there is scope for reduction which is expected to reduce the total demand and non-revenue water.
- The rural areas are characterised by intermittent supply with limited cost recovery and consumers revert to illegal connections on the bulk supply to obtain water.
- The average consumption in the rural areas is within the acceptable range, but there is huge inequality of supply. Any reduction will be redistributed with limited or no reduction in the total demand;
- The water tariffs in areas outside the concession area are not cost reflective and not promoting water conservation and water demand management
- The municipality lack funding to implement WC/WDM;
- The municipality and Sembcorp Silulumanzi require additional staff to address and implement WC/WDM.
- Asset management is lacking in some areas, which impacts on the assurance of supply;

Based on the above the following key strategic focus areas are recommended :

- Raise WC/WDM awareness within the organisation by setting-up a WC/WDM task team, chaired by senior officials to meet on monthly basis to address WC/WDM issues;
- Fill vacant positions and provide training and capacity building
- Improve metering, reading, billing and cost recovery;
- Review the water tariff structure to be most cost reflective and promote WC/WDM;
- Improved tariff structures and the cost recovery will increase revenue for the municipality which can be used to address the backlog in maintenance and improve service delivery;
- Implementing metering and cost recovery in the rural areas does present several challenges and fixing internal plumbing leak using local plumbers is recommended until such time as the system has stabilised and service delivery has improved;
- Implement awareness campaigns across all consumers to use water efficiently; and
- Improve management information through proper monthly reporting and records keeping. These reports should be discussed at the monthly EXCO meeting.

PART B: IRRIGATION SECTOR

1 INTRODUCTION

While irrigation is not the main focus of this study, one of the reconciliation options is to reduce inefficiencies in irrigation use (if any) so as to make more water available for domestic and industrial purposed. This Part B of this report specifically with Water Conservation and Water Demand Management Options for the Irrigation sector.

2 APPROAH

The approach to this task involved the review of reports which address the issue of irrigation and water conservation and water demand management and to hold meetings with all the Irrigation Boards and Water Authorities operating within the study area or influencing irrigation water use in the study area.

The water authorities visited included:

- Sabie Irrigation Board
- Sand River Irrigation Board
- White River Irrigation Board (incorporating the minor Boards:
    - White river estates
    - Curlew IB
    - Manchester IB
    - Karino IB
    - Goedehoop IB
    - Prinsloo IB
- Crocodile Irrigation Board (Main Boards).

The following questions and issues were raised with all the Irrigation Boards and Water Authorities in the study area:

- Source of irrigation water (e.g. direct abstraction from river or dam and canal etc)
- Bulk water reticulation to and within irrigation area (e.g. canal or pipeline;
- Number of member irrigators
- Total area under registered irrigation
- Water allocation (m^3/ha/a)
- Allocation management and measurement
- Main crops irrigated
- Main irrigation systems used by farmers
- Challenges facing the IB/WUA such as:
    - Water shortages (% of years where deduction in allocations had to be applied.
    - Illegal water use
    - Land claims
    - Condition of infrastructure

- Theft of infrastructure
- Existing initiatives to optimize water use efficiency

3 FINDINGS

3.1 SABIE IRRIGATION BOARD

3.1.1 Features

The Sabie Irrigation Board serves 55 member farmers with irrigation water diverted from a weir on the Sabie River and reticulated along an 18.8km earth canal. About 1,5 km of the canal has been converted to closed pipeline to reduce leakage and related water-logging below the canal.

The farms served by this canal are situated in mountainous terrain where the main crops under irrigation are banana, litchi, mango, macadamia nut and vegetables.

The farmers are fully responsible for the canal and carry all the costs of maintenance and repair. Sections of the canal adjacent to farms are allocated to the farmers for maintenance. The Irrigation Board therefore does not employ staff for canal maintenance.

There is an allocation of water for domestic use in Hazeyveiw. Water is pumped from the canal to a filtration plant and reticulated by pipeline.

There are increasing demands on this water resource for domestic/primary use (which now makes up about 60% of the canal's capacity) and for emerging irrigation farmers.

An important feature of this Scheme is that 60% to 70% of the flow through the canal returns to the Sabie River at the end of the canal.

No restrictions have had to be applied to irrigation water allocations since the establishment of the Scheme.

3.1.2 Challenges affecting irrigators and irrigation efficiency

3.1.2.1 Farm dam storage

The topography of this farming area makes it difficult for farmers to build farm dams for storage of irrigation water allocations from the canal. This is a major constraint to efficient irrigation management and to efficient irrigation water use, as the farms rely on direct flow from the canal into the irrigation systems.

3.1.2.2 Farm subdivisions

Subdivision of the original farms has been an on-going process for many years. This has placed a heavy administrative burden on the Irrigation Board and has led to some unauthorised water extraction.

3.1.2.3 Earth canal

The open earth canal is very inefficient with substantial leakage losses. The conversion of 1,5km of the canal to a closed pipeline to reduce water losses is indicative of the challenge.

3.1.2.4 Pumping directly from canal

Farmers are increasingly using land above the canal for irrigation of orchard crops. Pumping directly from the canal increases the cost of irrigation water and requires metering which is not

installed in some cases. The pumping head to these lands above the canal is as much as 130m in places.

3.1.2.5 Land claims

The prospect of land claims in the area has impacted significantly on the morale of farmers and on their willingness to make capital investment in their farms, to use their own resources and time to maintain the canal and to focus on improving irrigation efficiency.

3.1.2.6 Orchard crop irrigation

The reluctance to spend capital on upgrading the farms has resulted in a relatively small proportion of the farmers being equipped with efficient micro-jet and drip irrigation systems.

3.1.2.7 Water User Association

A Water User Association (WUA) has not yet been formed and the control of water allocation and infrastructure maintenance remains with the Sabie Irrigation Board. The need to form a WUA is recognised by the farmers.

3.1.3 Opportunities to improve irrigation efficiency

The opportunities for improving water use efficiency in this irrigation area are outlined below.

3.1.3.1 Establishment of WUA

The establishment of a Water User Association would provide the institutional structure to draw up and implement a Water Management Plan with the focus on the gradual improvement in Irrigation efficiency and related water savings.

3.1.3.2 Infrastructure upgrade

The most effective way of improving irrigation water use efficiency in the Sabie Irrigation Board would be to convert the open earth main canal to a closed pipeline. About 1,5km of the 18,8km canal have already been piped for this purpose. To complete the conversion would be a very expensive exercise and would be unaffordable for the farmers themselves. Government support would therefore be required. A pipeline would eliminate leakage losses which are estimated at about 12% of gross water use due to evaporation and leakage.

A pipeline would allow efficient metering of irrigation water allocations at all farm outlets.

The possibility of DWA funding (or partly funding) this development for part of the water savings for primary use could be a win-win scenario worthy of consideration.

3.1.3.3 Hydro- power generation from pipeline

If the main earth canal were to be replaced by a closed pipeline, it would provide the opportunity for the installation of a hydro-power turbine which would either provide power for pumping or generate income for the Irrigation Board from the sale of electricity.

3.1.3.4 Irrigation systems

There are opportunities for increasing the proportion of micro-jet and drip irrigation systems on the farms. At present about 60% of irrigated lands are furrow and flood irrigated. However farmers are reluctant to invest in such infrastructure upgrade while the prospect of possible land claims remains a reality.

3.1.4 Conclusions

Irrigation in the Sabie Irrigation Board area is based on an open canal system where farmers extract there irrigation water allocations directly from the canal. The canal overflow returns to the Sabie River below the Scheme. About 60% of the canal flow is already extracted for primary use in Mbombela. Although there are opportunities for improving irrigation efficiencies on the Scheme, these improvements would not contribute significantly to improving the availability of water for primary use in Mbombela. The conversion of the open canal to a closed pipeline would be the most effective way of optimising the water resources of the system.

3.2 SAND RIVER IRRIGATION BOARD

3.2.1 Features

The Sand River Irrigation Board has 90 members and commands 1400ha of irrigation. The source or irrigation water is a 15km lined canal from the Witklip dam. Releases from the dam are controlled and measured by the Department of Water Affairs (DWA). The irrigators pay a fee to the DWA for their 6000m^3/ha/a allocation. The canal is owned and maintained by the Irrigation Board. The canal is also used for reticulation of water for primary use in Mbombela.

The Scheme was originally designed for flood irrigation with irrigated lands situated below the canal. Irrigation now also takes place above the canal. Water is pumped from the canal into unlined farm storage dams.

The licensed allocation is 6000m^3/ha/a with a total demand of 8,4million m^3/annum.

The main crops grown are macadamia nut, avocado, guava, row crops such as tobacco and maize and vegetable crops such as butternut and cabbage.

The orchard crops are mostly irrigated with micro-jet systems and the field crops with dragline sprinkler irrigation. Because of the relatively high rainfall of the area, the crops are largely supplementary irrigated.

3.2.2 Challenges affecting irrigators and irrigation efficiency

3.2.2.1 Water releases from Witklip dam

At present water releases from Witklip dam are managed by DWA and include releases for primary use in Mbombela. The management of the releases for irrigators is inefficient and problematic at present. The Sand River Irrigation Board would like to be able to take over the management of releases and have submitted a proposal to DWA in this regard. If the Irrigation Board were constituted as a WUA, it would be most appropriate for them to manage releases from the dam.

3.2.2.2 Water User Association establishment

The Sand River Irrigation Board recognises the importance of forming and being part of a WUA. An application has been lodged with the DWA. However a major constraint to the registration of the WUA is the issue of the ownership of infrastructure belonging to (and funded) by the Irrigation Board. When this issue is resolved a WUA can be registered. In terms of the WUA constitution, a Water Management Plan will be drawn up which will provide a vehicle for the gradual and rational improvement in irrigation water management and irrigation water use efficiency on the Scheme.

3.2.2.3 Off -take metering

At present off-take from the canal by irrigators is not metered. The common system used is the “V notch” sluice gate system. Metering is fundamental to efficient water use. “You cannot manage what you don’t measure”.

3.2.2.4 Lining of farm dams

Unlined farm dams are a significant source of irrigation water loss through seepage which can have the additional negative effect of creating water logged conditions in irrigated lands below the dams. The lining of dams is a priority recommendation of the Sand River Irrigation Board.

3.2.2.5 Pumping (electricity) cost

Electricity costs for pumping irrigation water to lands above the canal have become a major component of crop production costs. This reality has in itself become an incentive to improve irrigation efficiency in the cropping areas above the canal.

3.2.2.6 Irrigation water allocation restrictions

The releases of water for irrigation from the Witklip dam are not at a high assurance of supply. The irrigators have had to apply restrictions themselves in about two years in ten. The restrictions applied are often up to 20% of the 6000 m^3/ha/a.This level of restriction is very risky for orchard crops where the loss of production and even the loss of trees seriously impact on enterprise and farm viability.

3.2.2.7 Unauthorised water use

Unauthorised water use is a reality in the area. However the problem stems from land subdivisions without irrigation licences and not from the farmers themselves. It was not possible to quantify this “loss” for this study, but it is an issue that requires investigation. The present validation study should assist in this regard.

3.2.2.8 Irrigation systems

The field crops such as butternut, maize, tobacco and cabbage are mostly irrigated with dragline sprinkler irrigation systems. This is a relatively inefficient system and there are opportunities for converting to more efficient systems such as Centre Pivots and roll-out dripper systems.

3.2.3 Opportunities to improve irrigation efficiency

3.2.3.1 Establishment of WUA

The establishment of a Water User Association (WUA) would provide the institutional structure to draw up and implement a Water Management Plan with the focus on the gradual improvement in Irrigation efficiency and related water savings.

The WUA would also have the authority to take over the management of water releases from Witklip dam. This would ensure a significant improvement in irrigation water use efficiency and improved crop production.

3.2.3.2 Replace canal with pipeline

A comprehensive feasibility study has been commissioned on the conversion of the open canal to a pressurised pipeline from Witklip dam. The Irrigation Board would raise capital for this major infrastructure development.

A pipeline would ensure a saving of at least 13% of gross water requirements - the estimated present losses from the canal due to evaporation and leakage.

The possibility of DWA funding (or partly funding) this development for part of the water savings for primary use could be a win-win scenario worthy of consideration.

A pipeline would also allow the installation of electronic metering devices at each farm off-take point which would, in turn, allow the WUA to charge for actual water usage rather than a blanket allocation charge.

The feasibility study also includes the installation of a hydropower turbine to generate electricity which could be used to offset pumping costs on the Scheme and provide a means of capital loan repayment.

3.2.3.3 Construction and lining of farm dams

Farm dams are an essential component of effective and efficient irrigation on the Scheme. A number of farms still require farm dams. The existing farm dams are all unlined and are a significant source of irrigation water losses. A priority infrastructure improvement strategy of the irrigation Board is therefore to encourage the establishment of farm dams where required and the lining of all existing dams. The Irrigation Board will seek financial assistance with this initiative.

3.2.3.4 Investigating unauthorised water use

It appears that significant volumes of irrigation water are being extracted from the system by unauthorised users. This relates mainly to land subdivisions. It is recommended that this phenomenon be investigated by the authorities.

3.2.3.5 Convert dragline irrigation systems.

Dragline irrigation, which is the most common form of irrigation for the annual field crops such as butternut, maize, tobacco and cabbage on the Scheme, is a relatively inefficient system. The Irrigation Board is encouraging farmers to convert to more efficient systems such as Centre Pivots and roll-out dripper systems.

3.2.4 Conclusions

The Sand River Irrigation Board is an effective and visionary institution which faces many challenges in its efforts to ensure a sustainable and efficient irrigation Scheme. The main areas of focus for the Board are the formation of a WUA, the lining of farm dams, the replacement of the open canal with a pressurised pipeline and hydropower turbine and the installation of water meters at all farm outlet points.

The possibility of DWA funding (or partly funding) the pipeline for part of the water savings for primary use could be a win-win scenario worthy of consideration.

3.3 WHITE RIVER VALLEY CONSERVATION BOARD (MAIN BOARD)

3.3.1 Features

The White River Conservation Board consists of a complex system of open canals incorporating four minor boards. The boards with their areas under irrigation and irrigation water allocations are shown in Table 1.

Table 1: White River Valley Conservation Boards – areas under irrigation and registered volumes of irrigation water

IRRIGATION BOARD	IRRIGATION AREA (ha)	REGISTERED VOLUME (m^3/annum)
White River Estates IB	973	2 676 000
Curlews IB	685	1 884 000
Ranch Karino IB	1 028	2 827 000
Upper Owners and Folly farm	373	1 026 000
Manchester Nordwyk IB	743	2 415 000
Lower Owners	379	1 232 000
Good Hope	246	748 000
Total irrigation	4427	**12 806 209**
Municipal/Urban/Industrial allocation	-	**1 332 000**
Total		**14 138 000**

The irrigation allocations for the area are 2 750 m^3/ha/a above Primkop Dam (three boards) and 3 250 m^3/ha/a for Manchester below Primkop Dam.

The system is supported by four dams, Klipkopje, Longmere, Primkop and Manchester dams.

The main enterprises are macadamia nut, citrus, vegetables and dairying.

The system has data loggers installed at inlets to all the canals.

With the gradual peri-urbanisation of the area, irrigated land-use has decreased over time and the allocation of raw water to the municipality has increased. Consequently a number of the minor boards are defunct and irrigated agriculture is under severe threat in the area. Nevertheless this remains a high potential area for sub-tropical fruit and nuts and vegetables and agriculture plays a significant role in the economy of the region.

3.3.2 Challenges affecting irrigators and irrigation efficiency

3.3.2.1 Open canal bulk reticulation

All bulk water reticulation under the control of the White River Valley Irrigation Board is in open canal with the related inefficiencies of direct evaporation and leakage. However, despite some canals having small sections of pipelines, it is not considered practical or affordable at this point in time to consider converting to a piped system.

3.3.2.2 Unauthorised water use

There are two main sources of unauthorised water use. Firstly, a major concern is the unlicensed use of water for irrigation in the tributaries of the White River. Secondly there is a growing use of water for irrigation on subdivided farms without water allocations. It is understood that this unauthorised use of water is presently being quantified in a validation study and should be an area of focus for significant water saving.

3.3.2.3 Lining of farm dams

Not all the 110 (estimate) farm dams are lined and significant seepage losses are occuring. However with the growing pressure on agricultural land use and decreasing assurance of supply of irrigation water, farmers are reluctant o invest in upgrading infrastructure.

3.3.2.4 Urban/peri-urban expansion

Urban and peri-urban expansion, mainly in the form of tourism accommodation and domestic housing expansion, is a growing threat to irrigated agriculture. Although this trend is likely to continue it is important to ensure that the integrity of the remaining farming areas and their related irrigation water allocations are not compromised to the point where they are unable to operate as viable enterprises.

3.3.2.5 Water trading

The trading of water allocations is emerging in this region. The process is sound and provides a good opportunity to access water for primary use. However, it is essential that certain key principles are adhered to in this process. Firstly, if trading takes place within an Irrigation Board or WUA, trading should only take place from lower areas to higher areas on a canal because of the limitations of canal capacity. Secondly if the water transfer is off the Scheme, then the buyer should be contractually bound to pay the water-use levees of the source Irrigation Board. Without this security the source Scheme is at risk of becoming financially unviable and the viability of all the other irrigators is threatened.

Another type of water trading that is emerging is the conversion of timber estates to water use licences based on the principle that the water normally extracted by evapotranspiration from a commercial timber plantation becomes available for alternative (mainly domestic) users if the plantation is felled and discontinued. This has become a serious challenge to the Irrigation Boards as it has been inadequately researched and appears to be impacting on the surety of supply of water to existing licensed water users.

3.3.2.6 Declining water quality

There is a significant decline in irrigation water quality in the area which is of great concern to the agricultural industry. Water quality is impacting on (a) the marketability of fresh produce, particularly for export quality fruit (in some cases farmers are having to treat water at their own cost to meet minimum standards), (b) pumps become blocked with algae and (c) there have been some instances reported of livestock becoming ill as a result of the quality of drinking water.

3.3.2.7 Irrigation water surety of supply

Irrigation water surety of supply is now consistently below target. Reduction in irrigation water allocations can have devastating effects on farm viability, particularly orchard crops. Reduction in standard allocations, has occurred in two years out of the last ten years.

3.3.2.8 Establishment of a WUA

A Water User Association (WUA) has not yet been formed and the control of water allocation and infrastructure maintenance remains with the White River Valley Irrigation Board. The need to form a WUA is recognised by the Board and the member farmers. However a major constraint to the registration of the WUA is the issue of the ownership of infrastructure presently belonging to (and funded) by the Irrigation Boards.

3.3.3 Opportunities to improve irrigation efficiency

3.3.3.1 Establishment of WUA

The establishment of a Water User Association (WUA), with related Water Management Plan implementation is an essential step in stabilising the extremely volatile situation that exists in the area in terms of water management and water use efficiency. The introduction of a Water Management Plan (a statutory requirement of WUA's) and its systematic implementation is the most practical and effective mechanism for the equitable allocation and sharing of water and the consequent improvement in water use efficiency.

3.3.3.2 Lining of farm dams

The lining of farm dams is a specific action that would significantly reduce water losses in the system and provide farmers with greater net volumes for irrigation. However with the growing pressure on agricultural land use and decreasing assurance of supply of irrigation water, farmers are reluctant o invest in upgrading infrastructure.

3.3.3.3 Investigating unauthorised water use

It appears that significant volumes of irrigation water are being extracted from the system by unauthorised users. This relates mainly to land subdivisions. It is recommended that this phenomenon be investigated by the authorities.

The two main sources of unauthorised water use are the unlicensed use of water for irrigation in the tributaries of the White River, and the use of water for irrigation on subdivided farms without water allocations. Once this unauthorised use of water is quantified in the validation study the authorities should take the necessary action to minimise these losses. This "saved' water is not necessarily all available for primary use as the priority for "re-use" should be to secure the surety of supply for existing licensed users.

The installation of water meters at registered extraction points would be a major benefit in this regard.

3.3.4 Conclusions

The White River Valley Conservation Board and it's minor Boards find themselves in a highly complex water-use environment due to rapid urbanisation of their area of jurisdiction. The establishment of a WUA, which would be represented by all the sectors using or requiring water, would be an important step in the process of equitable allocation of water and the maximisation of water use efficiency in the irrigation sector.

Although the trend of urbanisation is likely to continue it is important to ensure that the integrity of the remaining farming areas and their related irrigation water allocations are not compromised to

the point where they are unable to operate as viable enterprises.

It also the view of the Irrigation industry that Environmental Impact Assessments (EIA's) undertaken for development projects in the area are not taking adequate cognisance of the impact of the additional water requirements of that development on the area as a whole, particularly with respect to existing licensed water users.

Immediate areas of focus to improve irrigation water use efficiency is the lining of farm dams and the "policing' of unauthorised irrigation water use in the tributaries of the White River and on subdivided irrigation land without irrigation water allocations

3.4 WHITE WATER IRRIGATION BOARD (MAIN BOARD) - SAND TO SABIE RIVER.

3.4.1 Features

The White Water Irrigation Board incorporates the stretch of irrigation along the Sand River, from the Da Gama dam to the confluence with the Sabie River and includes the three minor boards:

- White Water IB
- De Rust IB
- Burgershall IB.

The irrigation water allocation is 5 300m^3/ha/a in a high potential sub-tropical fruit producing area. The area has been involved in substantial transfer of land from commercial farmers to land claimants in terms of the Land Claims programme.

The primary crops in the area are bananas and macadamia nuts and the standards of production on the commercial farms are very high. Irrigation systems are almost elusively micro-jet and drip systems with generally high levels of water-use efficiency.

These Irrigation Boards include irrigation water allocations which are not at present being utilised. They include 262ha (1,2 million m^3/annum of Department of Agriculture land and 87ha (0,46millionm^3/annum) from the De Rust Irrigation Board.

3.4.2 Challenges affecting irrigators and irrigation efficiency

3.4.2.1 Unauthorised water use

Unlicensed water use on the tributaries of the Sabie River is making a significant impact on the ability of the system to meet the surety of supply to licensed irrigation water users. Restrictions occur in two years out of ten. This is of particular concern for the orchard crops with very high capital investment.

3.4.2.2 Land Reform programme

The Land Claims programme in this area has resulted in the transfer of ownership of 600ha of fully established commercial banana farms to communal beneficiaries within the Burgershall Irrigation Board. The process was not successful and the banana orchards have become moribund due to lack of irrigation. This resulted in dramatic reduction in water use in the system of about 3.1million m^3/annum and the consequent impact on the viability of the Burgerhall Irrigation Board. It is understood that after various attempts to resuscitate the project, a joint venture with a commercial farmer has been established. It is anticipated that the full allocation of licensed irrigation water will

be utilised on this project in the future.

3.4.2.3 WUA not yet established

A Water User Association (WUA) has not yet been formed and the control of water allocation and infrastructure maintenance remains with the White Water Irrigation Board and it's three minor boards. The need to form a WUA is recognised by the Board and the member farmers.

3.4.3 Opportunities to improve irrigation efficiency

3.4.3.1 Establishment of WUA

The establishment of a Water User Association (WUA), with related Water Management Plan implementation is an essential step in stabilising the volatile situation that exists in the area in terms of water management and water use efficiency. The introduction of a Water Management Plan (a statutory requirement of WUA's) and its systematic implementation is the most practical and effective mechanism for the equitable allocation and sharing of water and the improvement in water use efficiency.

3.4.3.2 Investigating unauthorised water use

It appears that significant volumes of irrigation water are being extracted from the tributaries of the Sand River by unauthorised irrigators. It is recommended that this phenomenon be investigated by the authorities.

3.4.3.3 Availability of unutilised allocations

There are 349ha (1,66 million m3/annum) irrigation water rights not utilised at present. This provides a possible source of water for primary use. However cognisance must be taken of the fact that licensed users are experiencing reductions in their allocations in two years out of ten because of the shortage of water in the Da Gama dam. The utilisation of this "spare" water will exacerbate the problem.

3.4.4 Conclusions

Present licensed irrigation water use by commercial farmers is mainly being applied through efficient micro-jet and drip irrigation systems. There is little scope of improving this efficiency in order to make water available for alternative (primary) use.

The inability of the system to meet the required surety of supply on an on-going basis is indicative of the level of "stress" the system is already under. The re-establishment of the 600ha of banana orchards under the land claims transaction will add to the demands on the system.

Attention should be given to the following key issues to improve irrigation water-use efficiency:

(a) The establishment of a WUA, representing all the sectors using or requiring water, would be an important step in the process of equitable allocation of water and the maximisation of water-use efficiency in the irrigation sector. However the ownership-of-assets issue must first be addressed by the DWA before their will be progress in this regard.

(b) The "policing' of unauthorised irrigation water use in the tributaries of the Sand River and

(c) Consideration be given to the reallocation of the 349ha (1,66million m3/annum) irrigation water

rights not utilised at present, provided cognisance is taken of the fact that licensed users are experiencing reductions in their allocations in two years out of ten because of the shortage of water in the Da Gama dam.

3.5 CROCODILE IRRIGATION BOARD

3.5.1 Features

Within the context of the Mbombela Municipal area, the Crocodile River is a major source of water for all sectors, particularly the irrigation sector.The irrigation industry, which is the backbone of the regional economy, is in turn the major user of water and is seen as potentially the main source of water for the growing demand for domestic and industrial use. However this vitally important industry is facing serious challenges to its long-term viability. This is particularly relevant to the Crocodile River Irrigation Board and its related minor boards.

Water allocations for irrigation are 8 000m^3/ha from Kwena to the Crocodile Gorge and 12 000m^3/ha/a below the Crocodile Gorge.

The main crops grown in the area are orchard crops (sub-tropical fruit and nut crops such as banana, papaya, citrus, macadamia nut and mango) sugarcane and vegetable crops.

Irrigation efficiencies in the area are generally high because of the high percentage of micro-jet and drip system on orchard crops, the growing restrictions on water supply and the escalating energy costs as discussed below.

About 60% of all irrigated land in the area, under the jurisdiction of the Crocodile Irrigation Board, has been transferred to beneficiaries of the Land Claims process.

The irrigation Board has been proactive in installing a network of irrigation water metering devices and a sophisticated water distribution management and monitoring system which has contributed greatly to efficiency of irrigation water use. However there are still areas where metering is inadequate and it is in these areas that there is evidence of unauthorised water use.

3.5.2 Challenges affecting farmers and irrigation efficiency

3.5.2.1 Water restrictions

Irrigation water restrictions are being applied to the industry every year. The *de facto* assurance of supply has been reduced down to 60% from 80%. This is mainly due to the growing oversubscription of water in other sectors.

This level of reduction is of concern for all crops, but particularly for orchard crops with their high capital cost of establishment and capital intensive crop handling and processing facilities.

3.5.2.2 Pumping (electricity) cost

Recent rapid escalation in electricity costs has impacted significantly on irrigation water pumping cost which has, in turn, now become a major component of crop production costs. These escalations and the reduced assurance of supply has resulted in improved water storage and in-field irrigation efficiency.

3.5.2.3 Declining water quality

There is a significant decline in irrigation water quality in the area which is of great concern to the

agricultural industry. Water quality is impacting on the marketability of fresh produce, particularly for export quality fruit (in some cases farmers are having to treat water at their own cost to meet minimum standards), and pumps become blocked with algae.

3.5.2.4 WUA establishment

A Water User Association (WUA) has not yet been formed and the control of water allocation and infrastructure maintenance remains with the Irrigation Boards. The need to form a WUA is recognised by the Board and the member farmers and an application has been submitted. However a major constraint to the registration of the WUA is the issue of the ownership of infrastructure presently belonging to (and funded) by the Irrigation Boards and their member farmers.

3.5.2.5 Land Claims

The land claims process applies to individually owned farms and irrigation estates owned by companies or other institutions. In many instances the new owners, which consist of multi-beneficiary Trusts or cooperative-like structures, have retained the services of the previous farmers or managers as managing agents for the on-going commercial management of the transferred properties. Generally the process has progressed successfully with limited disruption to irrigation efficiency. However there are areas within the catchment where the process has led to deterioration of farming standards and irrigation practices. In these cases water-use efficiency may be affected, due mainly to the new owners' limited capital for the implementation of initiatives to improve water-use efficiency.

3.5.2.6 Unauthorised water use

Unauthorised water use, in unmetered areas of the Crocodile Irrigation Board's jurisdiction, impacts further on the system's ability to meet the irrigation allocations at the licensed assurance of supply. It is hoped that the validation process will be able to identify the transgressors and the necessary action taken.

3.5.3 Opportunities for improved irrigation water use efficiency

3.5.3.1 Establishment of a WUA

The establishment of a Water User Association (WUA), with the related implementation of a Water Management Plan, is an essential step in stabilising the extremely volatile situation that exists in the area in terms of water management and water use efficiency. The introduction of a Water Management Plan (a statutory requirement of WUA's) and its systematic implementation is the most practical and effective mechanism for the equitable allocation and sharing of water and the consequent improvement in water use efficiency.

3.5.3.2 Metering of irrigation water allocations

The installation of irrigation water meters at farm outlets will be a positive step in controlling unauthorised water use.

4 OVERALL CONCLUSIONS

4.1 CHALLENGES IN THE IRRIGATION SECTOR

Irrigated agriculture in the Mbombela Municipal area is generally under serious threat due to a

number of key challenges outlined below:

- Except for the Sabie Irrigation Board, every other irrigation water distribution authority in the study area experiences increasing restriction on licensed irrigation water allocations to farmers. In the case of the Crocodile Irrigation Board for example, this has effectively resulted in a reduction of surety of supply from 80% to 60% in recent years.
- Rapid urban development is taking place in the study area. However the Environmental Impact Assessment process on these developments seldom takes cognisance of the impact of the increasing water demand on existing licensed water users.
- Rapid urbanisation (formal and informal) and industrial development within the study area is having a serious impact on the quality of agricultural produce which in turn can seriously compromise the marketing of the produce, particularly if it is for export.
- Rapidly escalating pumping (electricity) costs are affecting the viability of most cropping enterprises. Ironically however this escalating production cost does have the effect of honing in-field irrigation efficiency.
- The many challenges facing irrigation farmers have been responsible for a generally low morale in the industry which is affecting investment and productivity.
- None of the Irrigation Boards have yet been converted to Water User Associations (WUA) despite application having been lodged to DWA by most Boards. The main constraining factor appears to be the issue of the ownership of the fixed assets of the Irrigation Boards, most of which has been paid for by the irrigators themselves.

  The establishment of a WUA, with related implementation of a Water Management Planning process is an essential step in stabilising the extremely volatile situation that exists in the area in terms of water management and water use efficiency. The introduction of a Water Management Plan (a statutory requirement of WUA's) and its systematic implementation is the most practical and effective mechanism for the equitable allocation and sharing of water and the consequent improvement in water use efficiency.
- Unauthorised water use appears to be widespread in the study area. There are two main sources of unauthorised water use. Firstly, a major concern is the unlicensed use of water for irrigation mainly in the tributaries of the White River and the Sand River. Secondly there is a growing use of water for irrigation on subdivided farms without water allocations. It is understood that this unauthorised use of water is presently being quantified in a validation study and should be an area of focus for significant water saving.
- Bulk water reticulation in the study area is dominated by open canals some of which are unlined. The common inefficiencies of these systems, including direct evaporation and seepage, is responsible for an estimated 13% gross loss, which, in the context of the whole irrigation industry, is a very significant volume of water.

4.2 OPPORTUNITIES FOR IMPROVED WATER USE EFFICIENCY AND MAKING WATER AVAILABLE FOR ALTERNATIVE SECTORS

- **The unauthorised use of water** is presently being quantified in a validation study and should be an area of focus for significant water saving. The installation of water meters at registered extraction points would be a major benefit in this regard.
- **Reallocation of 1,66 million m^3/annum unutilized irrigation water in the White Waters Irrigation Board**. Before this step is implemented, however, the reality of regular restrictions (two years in ten) on the supply of irrigation water to licensed users in this area should be carefully reviewed.

- **The establishment of a Water User Association (WUA),** with related Water Management Plan implementation is an essential step in stabilising the extremely volatile situation that exists in the area in terms of water management and water use efficiency. The introduction of a Water Management Plan (a statutory requirement of WUA's) and its systematic implementation is the most practical and effective mechanism for the equitable allocation and sharing of water and the consequent improvement in water use efficiency.

- **The conversion of open canals to pressurised pipelines** in the Sabie and Sand River Irrigation Boards has been raised by both Boards and in the case of the Sand River Irrigation Board, a full feasibility study has been commissioned. This would be an expensive development but would have many advantages including (a) an estimated 13% saving of gross water volume reticulated for irrigation, (b) facilitating the introduction of electronic metering devices at farm outlets and the opportunity to generate electricity through hydro turbines irrigation water pumping to lands above the canal or could be sold into the regional electricity grid.

  The possibility of DWA funding (or partly funding) this development in exchange for part of the water savings for primary use could be a win-win scenario worthy considering.

- **The lining of farm dams** on Schemes where unlined dams exist such as the Sabie IB and White River Valley Conservation Board. Such savings would be to the direct benefit of the farmers themselves but nevertheless would improve overall water-use efficiency in the system.

- **The trading of water allocations** is emerging in this region. The process is sound and provides a good opportunity to access water for primary use. However, it is essential that a key principle is adhered to in this process. If the water transfer is off the Scheme, then the buyer should be contractually bound to pay the water-use levees of the source Irrigation Board. Without this security, the source Scheme is at risk of becoming financially unviable and the viability of all the other irrigators would be threatened.

If the above measures were able to "free up" water it would not necessarily all be available for primary use as one of the priorities for "re-use" should be to secure the surety of supply for existing licensed users.

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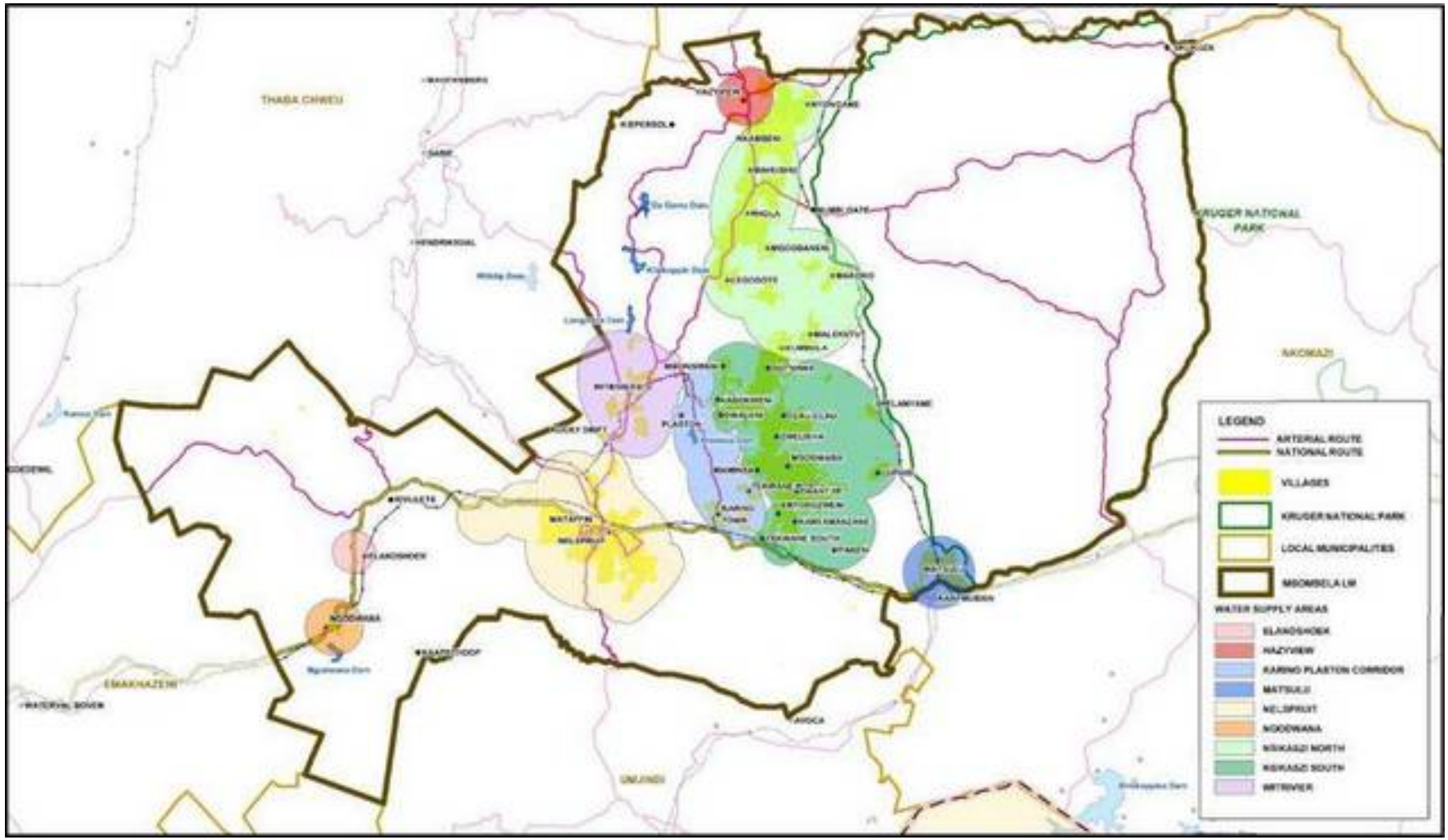
ANNEXURE A
STUDY AREA MAP


THABA CHWEU
KRUGER NATIONAL PARK
NKOMAZI
UMJINDI
LEGEND
ARTERIAL ROUTE
NATIONAL ROUTE
VILLAGES
KRUGER NATIONAL PARK
LOCAL MUNICIPALITIES
MBOMBELA LM
WATER SUPPLY AREAS
ELANDSHOEK
HAZYVIEW
KARINO PLASTON CORRIDOR
MATSULU
NELSPRUIT
NGODWANA
KWAGGZI NORTH
KWAGGZI SOUTH
WITRIVIER

ANNEXURE B

UNIT REFERENCE VALUES FOR DEMAND CENTRES

Summary of Unit Reference Values

Demand Centre	Scenario	6%	8%	10%
Nsikazi North	Realistic	R 20.15	R 20.65	R 21.17
	Optimistic	R 10.50	R 10.76	R 11.03
Nsikazi South	Realistic	R 13.86	R 14.20	R 14.55
	Optimistic	R 7.43	R 7.60	R 7.79
Nelspruit	Realistic	R 7.99	R 8.18	R 8.39
	Optimistic	R 1.84	R 1.88	R 1.93
White River	Realistic	R 18.35	R 18.82	R 19.31
	Optimistic	R 7.98	R 8.19	R 8.40
Matsulu	Realistic	R 4.90	R 5.03	R 5.16
	Optimistic	R 2.73	R 2.80	R 2.88
Hazyview	Realistic	R 14.70	R 15.09	R 15.50
	Optimistic	R 8.19	R 8.41	R 8.64
Total	Realistic	R 12.29	R 12.59	R 12.91
	Optimistic	R 5.29	R 5.42	R 5.55