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Water Requirements Report

Water Reconciliation Strategy for
Richards Bay and Surrounding Towns

Department of Water and Sanitation

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REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF WATER AND SANITATION

Directorate: National Water Resources Planning

Water Reconciliation Strategy for Richards Bay and Surrounding Towns

WATER REQUIREMENTS REPORT

Final: September 2014

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Department of Water and Sanitation
Directorate: National Water Resource Planning

WATER RECONCILIATION STRATEGY FOR RICHARDS BAY AND SURROUNDING TOWNS

APPROVAL

Title	:	Water Requirements Report
DWS Report no.	:	DWS Report No P WMA 06/W100/00/3114/1
Consultants	:	Aurecon South Africa (Pty) Ltd
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Report Name	DWS Report Number	Aurecon Report No
Inception	No report No	9167
Water Requirements	**P WMA 06/W100/00/3114/1**	**9168**
Water Balance	P WMA 06/W100/00/3114/2	9169
Screening of Options	P WMA 06/W100/00/3114/3	9174
Scenarios Evaluation	P WMA 06/W100/00/3114/4	9170
Reconciliation Strategy	P WMA 06/W100/00/3114/5	9171

Executive summary

Background

Richards Bay is the economic centre of the uMhlathuze Local Municipality which further comprises Empangeni, Ngwelezane, Nseleni, eSikhaleni and a number of rural villages. Richards Bay is one of the strategic economic hubs of the country. Though the water resources available to the uMhlathuze Municipality are currently sufficient to cater for the existing requirements, should anticipated growth and industrial development materialise the current water sources are likely to come under stress.

The objective of the study is to develop a strategy to ensure adequate and sustainable reconciliation of future water requirements within the uMhlathuze Local Municipality with potential supply up to 2040, especially that of Richards Bay / Empangeni, their significant industries, as well as the smaller towns and potential external users that may be supplied with water from the system in future.

The purpose of this report is to describe the various water requirement sectors and significant users in the study area, along with their historical water requirements, identify potential future water users and associated uses and develop a set of future water requirements scenarios for Richards Bay and its surrounding areas.

The Strategy Water Supply System is shown in Figure E1.

Current Water Use

The water supply sectors in the study area consist mainly of bulk industrial, urban (residential, commercial and light industrial), irrigated agriculture and indirect water uses such as dryland agriculture, invasive alien plants and commercial forestry. Bulk industrial water use is the most significant use in this strategy area.

Large industrial users in the vicinity of the Richards Bay include Mondi Richards Bay, Foskor, Hillside and Bayside Aluminium and the Richards Bay Coal Terminal (RBCT). RBM is located outside Richards Bay. Tronox mines the Hillendale and Fairbreeze mines. Other significant industrial water users include the Tongaat-Hulett sugar mill and Mpact (previously known as Mondi Felixton), both in Felixton.

The main urban centres in this area are Richards Bay and Empangeni. These account for more than half of the non-industrial use of potable water. The remaining potable water supply is distributed to the smaller towns and rural areas. The former include eSikhaleni, Nseleni, Felixton and Ngwelezane, while the latter mostly consist of tribal areas and farming communities.

In addition to the industrial development in the area there is large-scale agricultural activity. This consists principally of citrus and sugar cane, both irrigated and dryland, and commercial forestry, owned mostly by Sappi and Mondi.

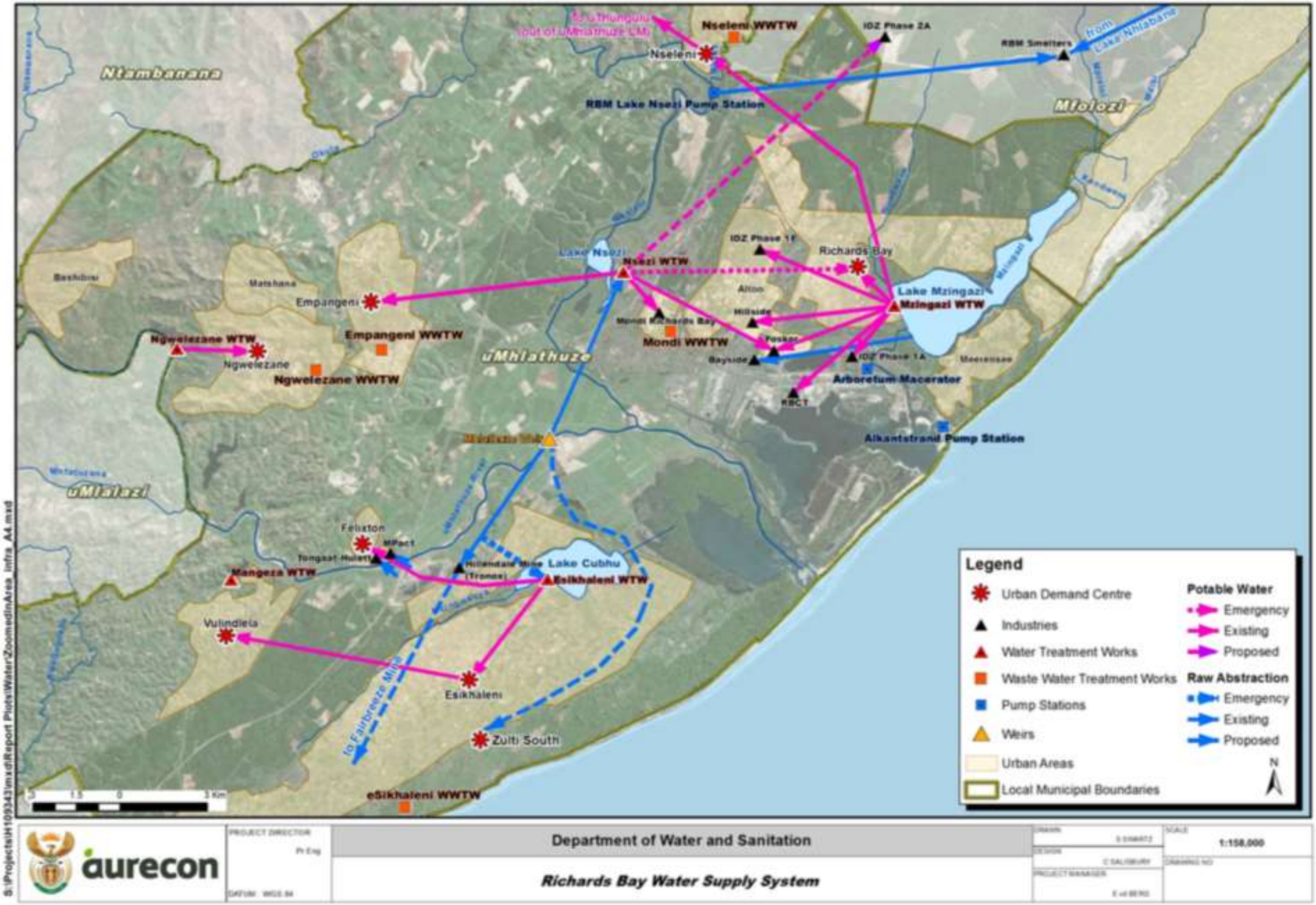

Figure E1: **Strategy Water Supply System**

Table E1 shows the current daily water requirement for industrial and urban water users, as well as the water allocations.

Table E1: Summary of 2013 Water Uses and Allocations

		Current Usage		Allocation	
Supply Sector	***User***	***Annual (M³/a)***	***Daily (Ml/d)***	***Annual (M³/a)***	***Daily (Ml/d)***
Industry	Mondi Richards Bay	23.61	64.70	32.85	90.00
	RBM - Total	**15.34**	**42.02**	**30.00**	**82.19**
	RBM - Nhlabane	*12.95*	*35.49*	*23.00*	*63.00*
	RBM - uMfolozi	*0.00*	*0.01*	*20.99*	*57.50*
	RBM - Nsezi	*2.38*	*6.53*	*16.43*	*45.00*
	Tronox - Total	**5.30**	**14.52**	**11.48**	**31.46**
	Tronox - Hillendale	*3.75*	*10.28*	*11.48*	*31.46*
	Tronox - potable	*1.55*	*4.24*	*0.00*	*0.00*
	Foskor - Total	**7.09**	**20.04**	**10.44**	**28.60**
	Foskor - clarified	*4.12*	*11.28*	*6.21*	*17.00*
	Foskor - potable	*2.97*	*8.76*	*4.96*	*13.60*
	Mpact	2.22	6.07	2.48	6.79
	Tongaat Hulett	0.71	1.95	1.89	5.17
	Bayside - Total	**0.52**	**1.44**	**0.34**	**0.94**
	Bayside - raw	*0.34*	*0.94*	*0.34*	*0.94*
	Bayside - potable	*0.18*	*0.50*	*0.00*	*0.00*
	Hillside	0.72	1.97	0.75	2.05
	RBCT	0.43	1.19	0.00	0.00
	Total	**55.94**	**153.27**	**91.30**	**249.21**
Urban	Empangeni	9.34	25.58	13.51	37.00
	Richards Bay	14.24	39.02	9.13	25.00
	eSikhaleni	11.16	30.56	11.32	31.00
	Nseleni	4.28	11.71	0.00	0.00
	Ngwelezane	2.54	6.95	2.92	8.00
	Total	**40.00**	**109.58**	**36.87**	**101.00**
	GRAND TOTAL	**95.94**	**262.86**	**128.17**	**350.21**

Figure E2 shows the relative 2013 water sector usages.

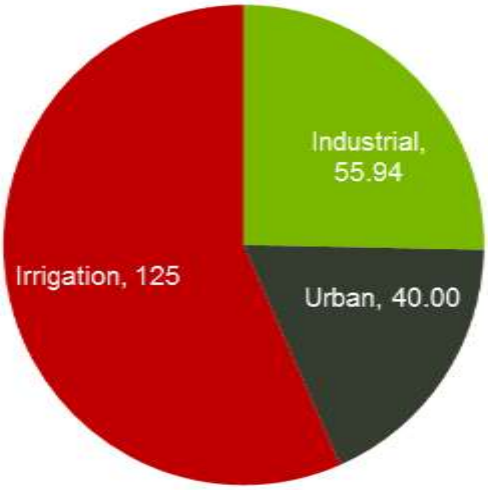

Figure E2: Mhlathuze 2013 Sector Usage (million m^3/a)

Figure E3 and Figure E4 show the relative 2013 usages for urban and industrial users.

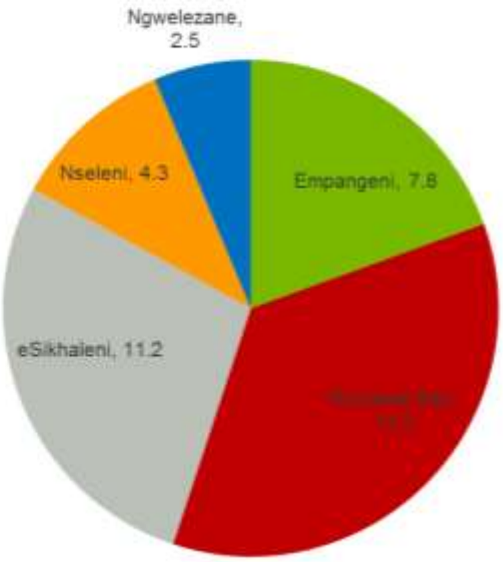

Figure E3: Current Urban Usage (million m^3/a)

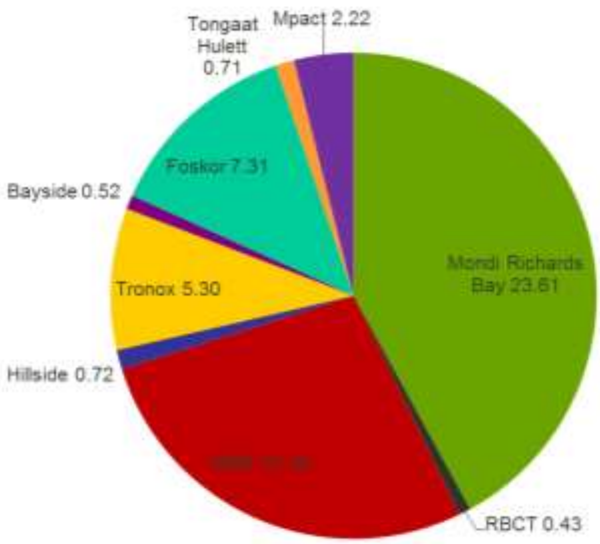

Figure E4: Current Industrial Usage (million m^3/a)

Historical Water Use

Historical water use is shown in Figure E5. The figure shows a decrease in consumption by industrial users in recent years: this is the result of WC/WDM measures being implemented and corresponding savings. As a result of this, the scope for WC/WDM in the industrial sector is reduced, although there are still opportunities for improvement.

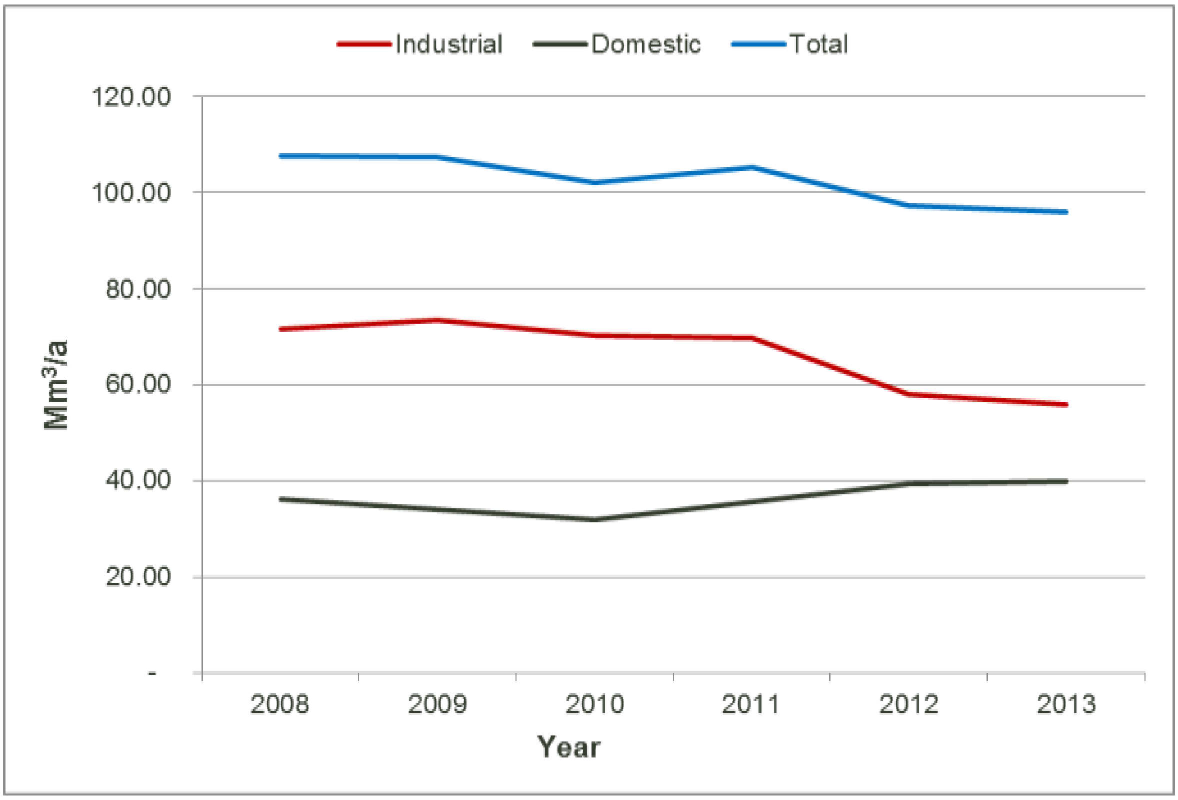

Figure E5: **Historical Water use**

Future Water Requirements Scenarios

Richards Bay is (alongside Rustenburg), South Africa's fastest developing city. It is a fast growing industrial centre. The uMhlathuze Local Municipality has experienced an estimated population growth rate of about 1, 5% per annum between 2001 and 2011, and has a current population of about 350 000. The future demography will also largely be influenced by economic opportunities and potential. Moderate population growth in the uMhlathuze area is probable, influenced by migration from rural areas into Richards Bay in search of employment opportunities.

Due to a small local consumer base together with limited integration of industrial activities in the area (with limited supporting industries), it is expected that future industrial growth will, over the medium term, mainly be driven by further development of large export-orientated industrial developments, rather than through generic growth as would be possible in a more integrated industrial environment.

Future urban water requirements have been assumed to be composed of the following, for the various Future Water Requirements Scenarios:

a. Increased use by existing users from existing WTW in the current strategy area;
b. Increased supply to other urban water users located in the Mhlatuze catchment or located outside the Mhlatuze catchment, but supplied from it;
c. Significant new municipal and urban WSS outside the municipal boundary to the north referred to as the ‘Mtubatuba Scheme’.
d. Potential efficiency saving in urban water requirements, relevant to current urban water use.

The following future water requirements scenarios have been compiled, for the various water use sectors and their components:

1) **Allocations** for existing and potential future heavy industries and irrigation (latest estimate), and estimated future urban water use.
2) **Best-estimate** future water requirements for existing and potential future heavy industrial future urban water use, and irrigation allocations (latest estimate).

Table E2: Future water requirement scenarios

Scenario	Water requirement component								
	Current industries (fixed & variable)	**New identified IDZ industries** (% additional growth)	**Jindal Mine**	**Further new industries** (cumulative growth on previous year's total)	**Municipal Urban/ domestic** (% growth)	**Increased domestic supply in Mhlatuze catchment** (% growth)	**Increased domestic supply: 'Mtubatuba' Scheme** (No/Low/High)	**Irrigation**	**WC/WDM** (% saving on current use; phased in over 10 yrs.)
Sc 1: Low growth	✓	25%	✓	0%	1%	1%	No	✓	0%
Sc 2: Low-Medium growth	✓	50%	✓	0.25%	1.5%	2%	No	✓	0%
Sc 3: Medium growth	✓	75%	✓	0.5%	2%	3%	Low	✓	0%
Sc 4: High growth	✓	100%	✓	1%	3.0%	4%	High	✓	0%
Sc 5: Water Efficient Medium growth	✓	75%	✓	0.5%	2%	3%	Low	✓	Urban: 15%, Industrial 10%

The baseline for projections is the 2013 water use.

The future water requirements for the “Allocations” scenarios are as shown in Figure E6 and that of the “Best-estimate” scenarios in Figure E7. The expected sharp increases in future water requirements from 2016 to 2018 for the various scenarios is as a result of the Fairbreeze and Jindal mines going into production. The sharp increases in 2022 and 2032 are the result of the IDZ expansion.

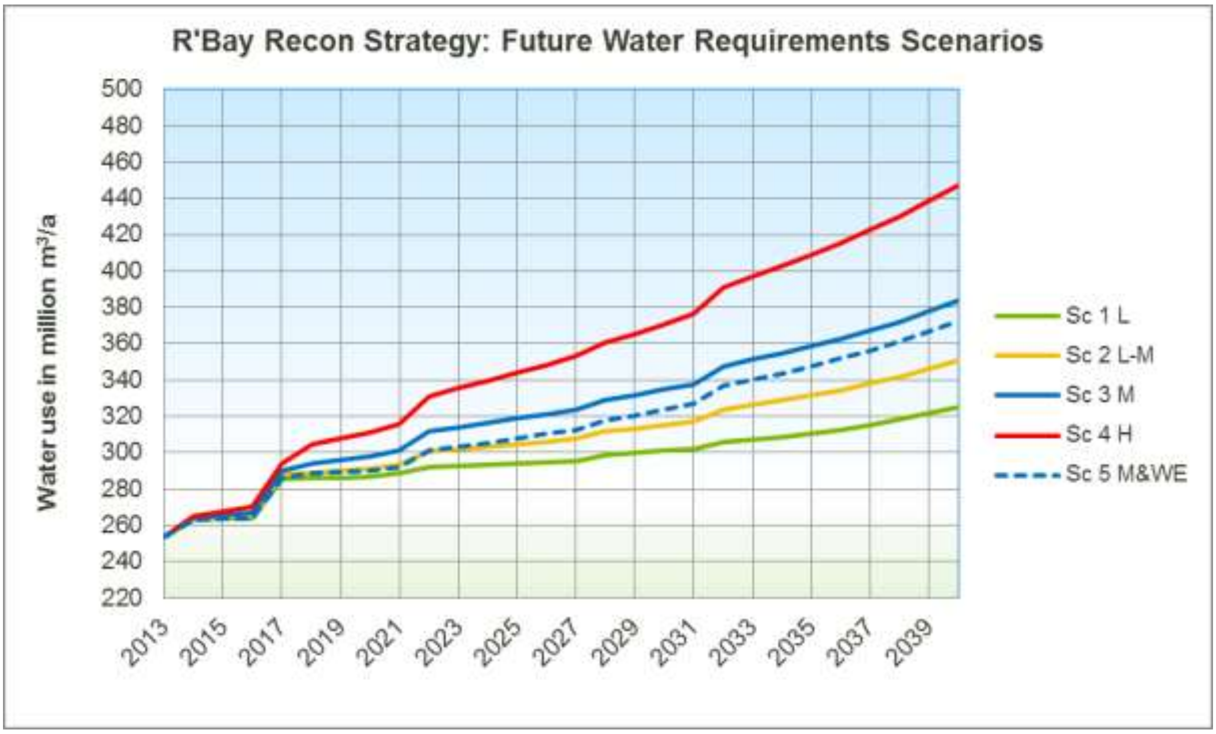

Figure E6: **Future water requirements ‘Allocation’ scenarios**

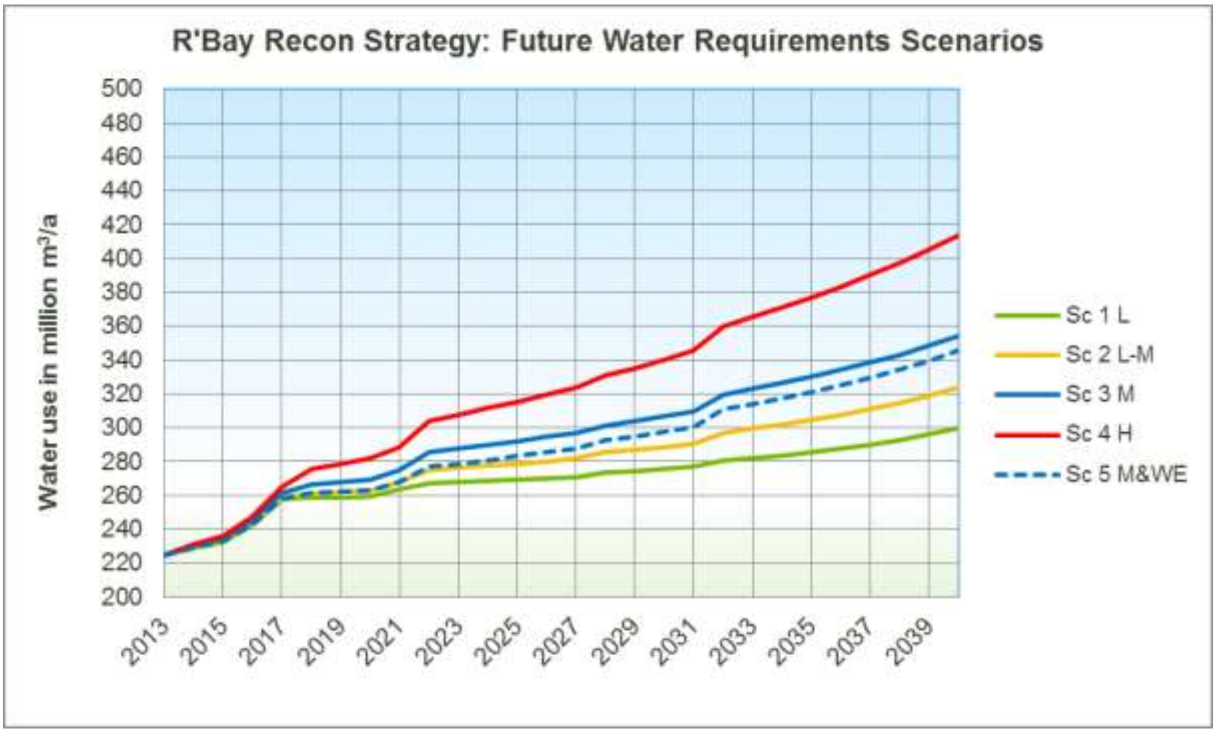

Figure E7: **Future water requirements ‘Best-Estimate’ scenarios**

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Acronyms

DEA	Department of Environment Affairs
DWS	Department of Water & Sanitation
EFR	Estuarine Flow Requirement
ESIA	Environmental and Social Impact Assessment
EWR	Ecological Water Requirement
GDP	Gross Domestic Product
IDZ	Industrial Development Zone
IFR	Instream Flow Requirements
MAP	Mean Annual Precipitation
NGO	Non-Government Organisation
NRW	Non Revenue Water
RBCT	Richards Bay Coal Terminal
RBM	Richards Bay Minerals
SFRA	Streamflow Reduction Activities
WAAS	Water Availability Assessment Study
WC/WDM	Water Conservation and Water Demand Management
WSS	Water Supply System
WSSA	Water and Sanitation Services South Africa
WTW	Water Treatment Works
WWTW	Wastewater Treatment Works

1 Introduction

1.1 Background

Richards Bay is the economic centre of the uMhlathuze Local Municipality which further comprises Empangeni, Ngwelezane, Nseleni, eSikhaleni and a number of rural villages. Richards Bay is one of the strategic economic hubs of the country. Though the water resources available to the uMhlathuze Municipality are currently sufficient to cater for the existing requirements, should anticipated growth and industrial development materialise the current water sources are likely to come under stress.

1.2 Objectives of the Reconciliation Strategy

The objective of the study is to develop a strategy to ensure adequate and sustainable reconciliation of future water requirements within the uMhlathuze Local Municipality with potential supply up to 2040, especially that of Richards Bay / Empangeni, their significant industries, as well as the smaller towns and potential external users that may be supplied with water from the system in future.

1.3 Strategy area

Richards Bay is an established city with well-developed industries, commercial areas and business centres. Significant industries include Mondi Richards Bay, Richards Bay Minerals (RBM), Tronox, Foskor, Hillside and Bayside Aluminium (BHP Billiton), Tongaat Hulett Sugar Mill, Mpact, (previously Mondi Packaging, South Africa) and the Richards Bay coal terminal and port.

Significant development is currently taking place in the town, particularly in the industrial development zone (IDZ), adjacent to the Richards Bay harbour. The study area includes the Mhlatuze catchment, but focuses on the uMhlathuze Local Municipality water supply area, and potential future supply areas that are located outside the uMhlathuze Local Municipality area or possibly even outside the Mhlatuze catchment.

In the study area, water is sourced from the Mhlatuze River, various natural lakes in the catchment, and is augmented by transfers from the Thukela River (via the Middledrift transfer scheme), and the Mfolozi River. Significant growth in water requirements has been experienced in recent years, and this trend is expected to continue, driven primarily by growth in industrial development, but also by growth in domestic water use.

The study area is shown on the following page (Figure 1-1).

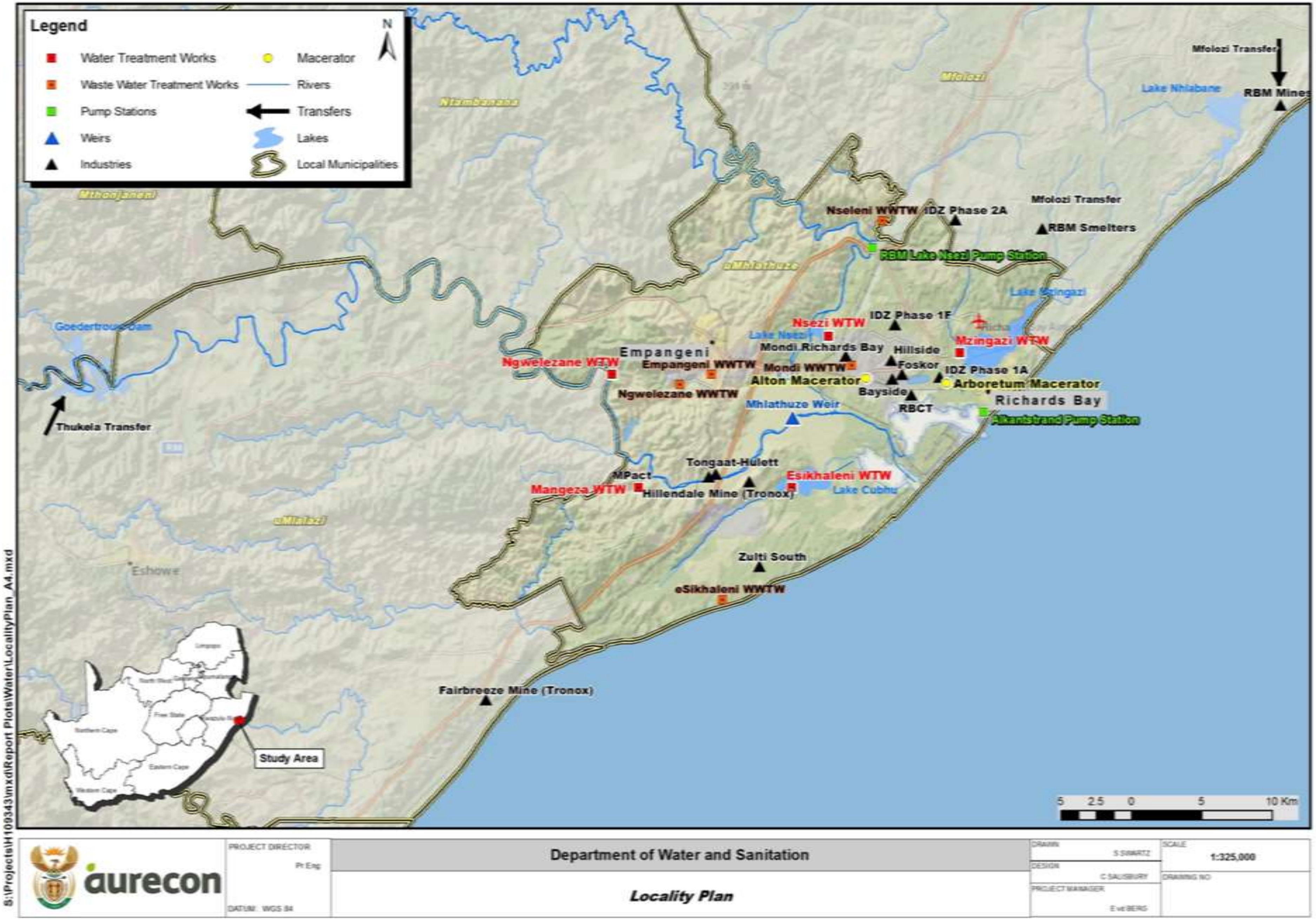

Figure 1-1 | Locality Map of the uMhlathuze Local Municipality

1.4 Purpose and scope of this Report

The purpose of this report is to describe the various water requirement sectors and significant users in the study area, along with their historical water requirements, identify potential future water users and associated uses and develop a set of future water requirements scenarios for Richards Bay and its surrounding areas. The focus of this evaluation will be on the water requirements of the major industries which utilise significantly more than the urban water requirements of the strategy area.

1.5 Approach and methodology

Good forecasts are scenario based, and seek to understand the key drivers of demand, and the factors that will affect changes in these drivers over time.

Within an urban context, the most important base drivers of demand are two-fold, namely:

- Economic activity
- Population growth

These two factors are interlinked to some extent, as high levels of growth in economic activity will increase the levels of immigration into the area, whereas depressed economic activity may result in migration away from the area to other centres with perceived higher economic activity, growth and employment opportunities.

Other factors which will affect water requirements include:

- Water use efficiency and technology change
- Pricing
- Management effectiveness
- Ecological requirements (the Reserve)
- Climate change

It is therefore useful to have some understanding of the dynamics affecting each of these, and on the basis of this understanding, to develop a range of scenarios of future water requirements.

With regard to economic activity, the pace at which the Richards Bay key industries and the IDZ grows, and the nature of the economic activities within the Richards Bay IDZ will have a very significant effect on future water demand. This is the key driver for future water use.

History is not linear and it is not ideal to extrapolate into the future based on an analysis of the past. Nevertheless, it is important to understand how water demand has grown in the past and what factors have contributed to this growth. What is learnt in the process of understanding water demand is more important than the scenario forecasts. These forecasts should in time be revised as events unfold.

1.6 Structure of this Report

This report is presented in four chapters. The contents of these chapters are as follows:

Chapter 1: Introduction which introduces the reader to the background to and purpose of the Reconciliation Strategy and the Mhlathuze Water Supply System (WSS).

Chapter 2: Historical Water Use describes historical and current water use by urban, industrial, irrigation and other water users.

Chapter 3: Future Water Requirements Scenarios describes the background to and development of future water requirement scenarios.

Chapter 4: Conclusions provides a summary of the report findings.

2 Historical Water Use

2.1 Background

2.1.1 Introduction

It is anticipated that water requirements in the Richards Bay area will increase in the future, principally driven by the need to meet the improving levels of water and sanitation services, and associated urban development in the town, due to industrial and commercial growth.

2.1.2 Water supply sectors

The water supply sectors in the study area consist mainly of bulk industrial, urban (residential and light industrial), irrigated agriculture and. Other indirect uses in the Mhlatuze catchment that will be taken into account in the catchment system modelling to determine an updated WSS yield but will not be focussed on in this report include environmental flows (the Reserve), dryland agriculture, invasive alien plants and commercial forestry.

2.1.2.1 Bulk Industry

Bulk industrial water use is the most significant use in this strategy area. Large industrial users in the vicinity of the Richards Bay include Mondi Richards Bay, Foskor, Hillside and Bayside Aluminium and the Richards Bay Coal Terminal (RBCT). RBM is located outside Richards Bay. Tronox mines the Hillendale and Fairbreeze mines. Other significant industrial water users include the Tongaat-Hulett sugar mill and Mpact, both in Felixton.

2.1.2.2 Urban

The main urban centres in this area are Richards Bay and Empangeni. These account for more than half of the non-industrial use of potable water. The remaining potable water supply is distributed to the smaller towns and rural areas. The former include eSikhaleni, Nseleni, Felixton and Ngwelezane, while the latter mostly consist of tribal areas and farming communities. A small transfer takes place out of the uMhlathuze Municipality, from the Nseleni treatment works to Ntambanana, but otherwise the water treated in the municipality is consumed within it. Urban water use includes water supply for commercial uses and light industry in Richards Bay and Empangeni.

2.1.2.3 Irrigation

In addition to the industrial development in the area there is large-scale agricultural activity. This consists principally of citrus and sugar cane, both irrigated and dryland, and commercial forestry, owned mostly by Sappi and Mondi. Forestry and dryland agriculture do not require irrigation volumes, so are not direct water users, but they do intercept rainfall and reduce runoff. Forestry is the only defined streamflow reduction activity (SFRA) in terms of the National Water Act.

Irrigation use has received significant attention in the past, with regard to the determination of allocation and legal water uses. It will not be examined in detail here; the most accurate values that have been determined to date have been used.

2.1.2.4 Environmental flows

Ecological water requirements (EWR) is the generic term to describe the flows required to maintain a healthy riverine ecosystem .The concept of the Ecological Reserve, embodied in the National Water Act, 1998, represents the South African version of environmental water requirements. This is the portion of the streamflow that must always be present in the rivers or other water bodies for healthy functioning of aquatic ecosystems. The Ecological Reserve can be a legal requirement and is given second highest priority, after the Basic Human Needs Reserve component.

2.1.2.5 Water Management

The water resources in this area are managed mostly by the uMhlathuze Local Municipality and Mhlathuze Water. The uMhlathuze Municipality controls the Lake Mzingazi and Lake Cubhu supply schemes, as well as abstractions from the Mhlatuze River, except those at the Mhlatuze Weir, which are the responsibility of Mhlathuze Water, as is the Lake Nsezi supply. Until recently, Water and Sanitation Services South Africa (WSSA) operated the municipal water treatment works (WTW) and wastewater treatment works (WWTW) on behalf of the municipality. Operation of these works has now been taken over by Mhlathuze Water.

The Municipality owns and operates two macerators and Mhlathuze Water owns and operates a sea outfall pump station and pipelines, as well as the Mhlatuze weir[24].

The Middledrift Transfer Scheme from the Thukela River and the 301 million m^3 Goedertrouw Dam is owned and operated by the Department of Water and Sanitation (DWS).

Some of the bulk industries own and manage some of their own water supply and treatment infrastructure, notably Mondi Richards Bay, RBM, Tongaat Hulett and Bayside Aluminium. Bayside owns and operates its own infrastructure for abstraction of raw water from Lake Mzingazi[2].

2.1.2.6 Water Treatment Works

WTW in the strategy area include Mzingazi, Ngwelezane and eSikhaleni treatment works, owned by the municipality and operated by WSSA. Felixton, Mangeza and Nseleni treatment works are municipal-owned but are no longer functional. Nsezi treatment works is owned and operated by Mhlathuze Water. Nsezi WTW abstracts from Lake Nsezi and from the Mhlatuze Weir. Following Compulsory Licensing, DWS' intention is to license Mhlathuze Water for the abstraction of 94.4766 million m^3/a from the weir for the WTW. The water-users supplied by Mhlathuze Water are allotted volumes from this allocation. Mhlathuze Water's allocation is not fully utilised as the full supply is not currently required by the water users.

Figure 2-1 | Nsezi WTW

An emergency pipeline exists between the Mhlatuze weir and the eSikhaleni WTW for use during times when the Lake Cubhu water level is too low for abstraction. The lake is generally preferred as a water source for the municipality, since the river water requires pumping, which has cost implications.

RBM abstracts and treats its own water, as it is relatively distant from any other treatment works. Other industries including Bayside Aluminium and Tongaat-Hulett abstract raw water for use in their processes. The other bulk industrial users (Mondi, Hillside Aluminium, Foskor and the RBCT) are supplied with potable water (as well as clarified water in Foskor's case) for industrial processes and domestic use.

Table 2-1 | WTW Abstraction Volumes

Annual Abstraction (million m^3)						
Treatment Works	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
eSikhaleni	10.15	9.98	10.34	11.37	11.36	11.16
Ngwelezane	3.20	3.27	3.04	2.79	2.99	2.54
Mzingazi	21.26	22.00	16.10	11.92	18.33	22.40
Nsezi	40.82	44.77	48.25	45.94	43.36	39.67
Total	**75.44**	**80.03**	**77.72**	**72.02**	**76.04**	**75.76**

Table 2-2 | WTW Production Volumes

Annual Water Production (million m^3)						
Treatment Works	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
eSikhaleni	9.16	9.95	8.14	9.96	10.76	10.50
Ngwelezane	2.84	2.86	2.41	2.64	2.35	2.07
Mzingazi	20.50	21.03	14.52	11.01	17.93	21.77
Nsezi	36.58	37.01	38.07	46.93	41.14	38.13
Total	**69.09**	**70.86**	**63.14**	**70.55**	**72.18**	**72.47**
Nsezi (potable)	32.19	33.06	33.78	41.03	36.59	34.01
Nsezi (clarified)	4.40	3.95	4.30	5.90	4.55	4.12

Table 2-3 | WTW Design Capacity

Treatment Works	Design Capacity		Abstraction Source
	(Mm^3/a)	(Ml/d)	
eSikhaleni	13.14	36	Lake Cubhu
Ngwelezane	2.92	8	Mhlatuze River
Mzingazi	23.73	65	Lake Mzingazi
Nsezi	74.83	205	Lake Nsezi

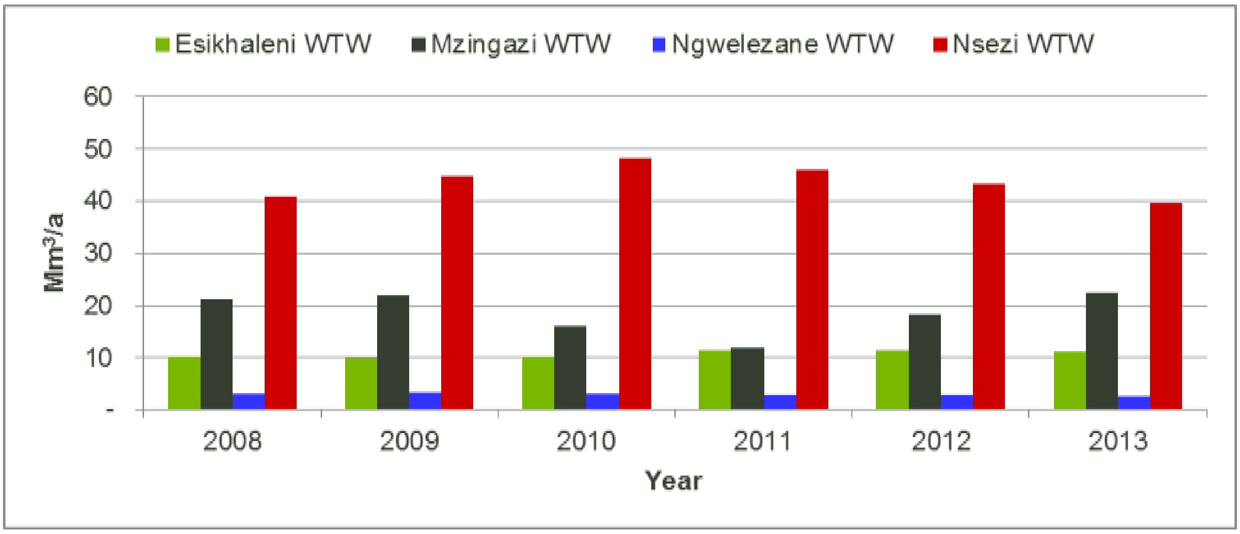

Figure 2-2 | WTW Annual Abstraction Volumes

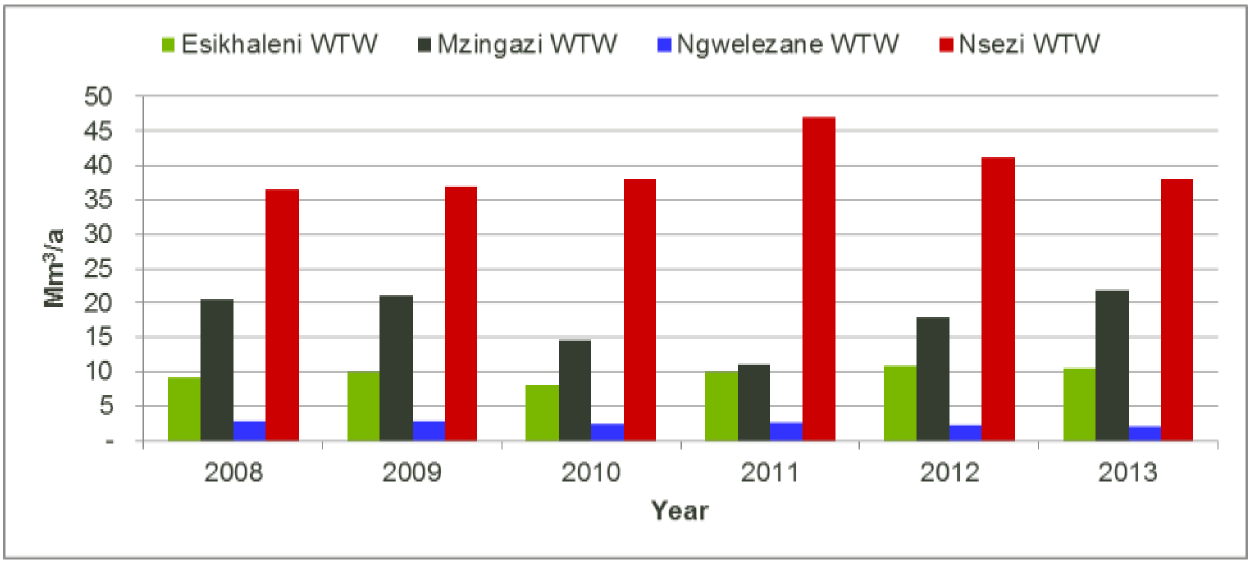

Figure 2-3 | **WTW Annual Production Volumes**

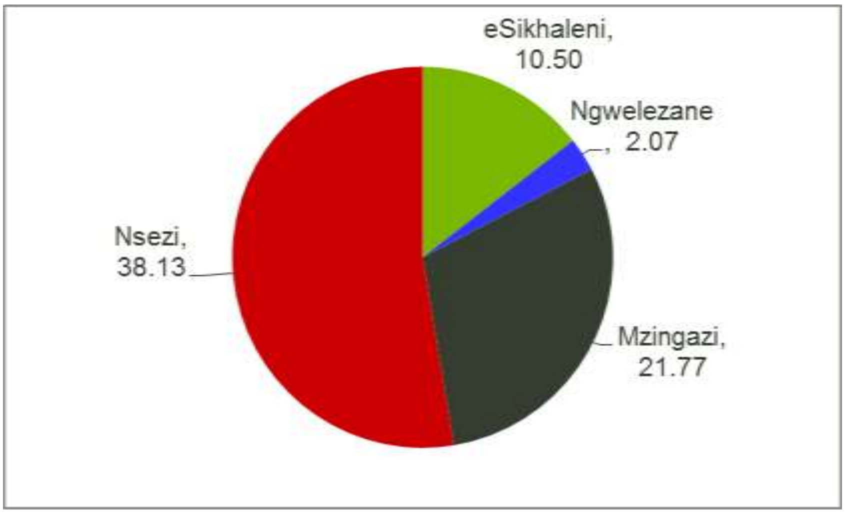

Figure 2-4 | **Annual WTW Production (million m³/a) for 2013**

2.1.2.7 Wastewater Treatment Works

There is no municipal WWTW in Richards Bay. Empangeni has a WWTW, previously operated by WSSA, and now uMhlathuze Water, with a design capacity of 5.48 million m^3/a (15 Ml/d), which operates between 3.65 million m^3/a and 4.02 million m^3/a (10-11 Ml/d). There are WWTW in eSikhaleni, Ngwelezane and Nseleni, shown in Figure 2-6.

Mondi has its own treatment works on-site.

All industrial and domestic effluent from Richards Bay is pumped via Alkantstrand pump station (owned and operated by Mhlathuze Water) out to sea. Some elementary screening takes place beforehand at the Alton and Arboretum macerators (owned and operated by the municipality), but there is no further treatment beyond screening. At Alkantstrand the effluent is diluted with seawater, and pumped out through the sea outfall pipelines.

Figure 2-5 | Alkantstrand Pump Station

There are three sea-outfall pipelines from Alkantstrand, which extend more than 4km out to sea, at which point the effluent is discharged though diffusers under pressure. Pipeline A carries the buoyant effluent from domestic and industrial users (excluding Foskor). Pipelines B and C carry the dense effluent from Foskor (containing gypsum) which is pumped out into the sea at a higher pressure to compensate for the greater density. The outfall discharge is approximately 140 Ml/d or 51 million m^3/a.

In a 2009 report by Bigen[34] the possibility of centralising and rationalising the effluent treatment infrastructure was explored. Several scenarios were considered, and a recommendation was made to increase the capacity of the Empangeni WWTW and transfer effluent from eSikhaleni WWTW there.

Figure 2-6 presents the key surface water abstraction points for the urban and industrial sectors within the study area, as well as the supply to users, inclusive of WTW and WWTW.

2.1.3 Concerns relating to abstraction from lakes

Three lakes are sources for abstraction in this strategy area: Lake Mzingazi, which supplies Bayside Aluminium and the Mzingazi WTW, Lake Nsezi, which supplies the Nsezi WTW and supplements RBM's supply from other sources, and Lake Cubhu, which supplies the eSikhaleni WTW.

The historic firm yields of the lakes are given below in Table 2-4[18]. These results will change should lake – groundwater interaction be taken into consideration.

Table 2-4 | Lake Firm Yields

Lake	Historic Firm Yield (million m^3/a)	
	DWA MORFP Study (2001)	DWA WAAS Study (2009)
Nsezi	13.9	5.7
Mzingazi	10.8	8.2
Cubhu	5.3	0.3
Nhlabane	30.7	32.7

There is concern that the abstraction from Lake Mzingazi is *significantly* in excess of its sustainable yield (22.3 million m^3/a vs. 8.2 million m^3/a), and this is an important issue to be addressed. This does however also raise some concerns about the accuracy of the determined Lake Mzingazi firm yield.

Some contamination issues have been noted at Lake Nsezi (high ATP from runoff from cultivated areas, high turbidity, pollution from poorly-serviced areas upstream growth of waterweeds etc.).

The Lake Nhlabane Water Availability Assessment Study (WAAS) yield evaluation included support in supplying RBM water requirements through inter-catchment transfers from the Mfolozi River. This determined yield is therefore significantly in excess of what would be expected from a yield assessment involving the lake on its own. This may need to be revisited.

RBM has concerns about the sustainability of abstraction from Lake Nhlabane, from which they draw water for their mining ponds. Diffuse water demands within the lake's catchment can have a marked impact on available inflow to lakes and any changes in their magnitude will affect the lake yield. RBM suggests that the increase in plantations in the catchment, reduces runoff, has an adverse effect on the lake's water-level and reduces groundwater augmentation potential. The mining ponds cannot use salt water, as this corrodes the equipment, but raw water can be used, provided there is not too much sediment. There have however been suggestions (as the result of investigations by Bruce Kelbe and Ricky Taylor) that as the demand on the lake increases, the groundwater recharge increases.

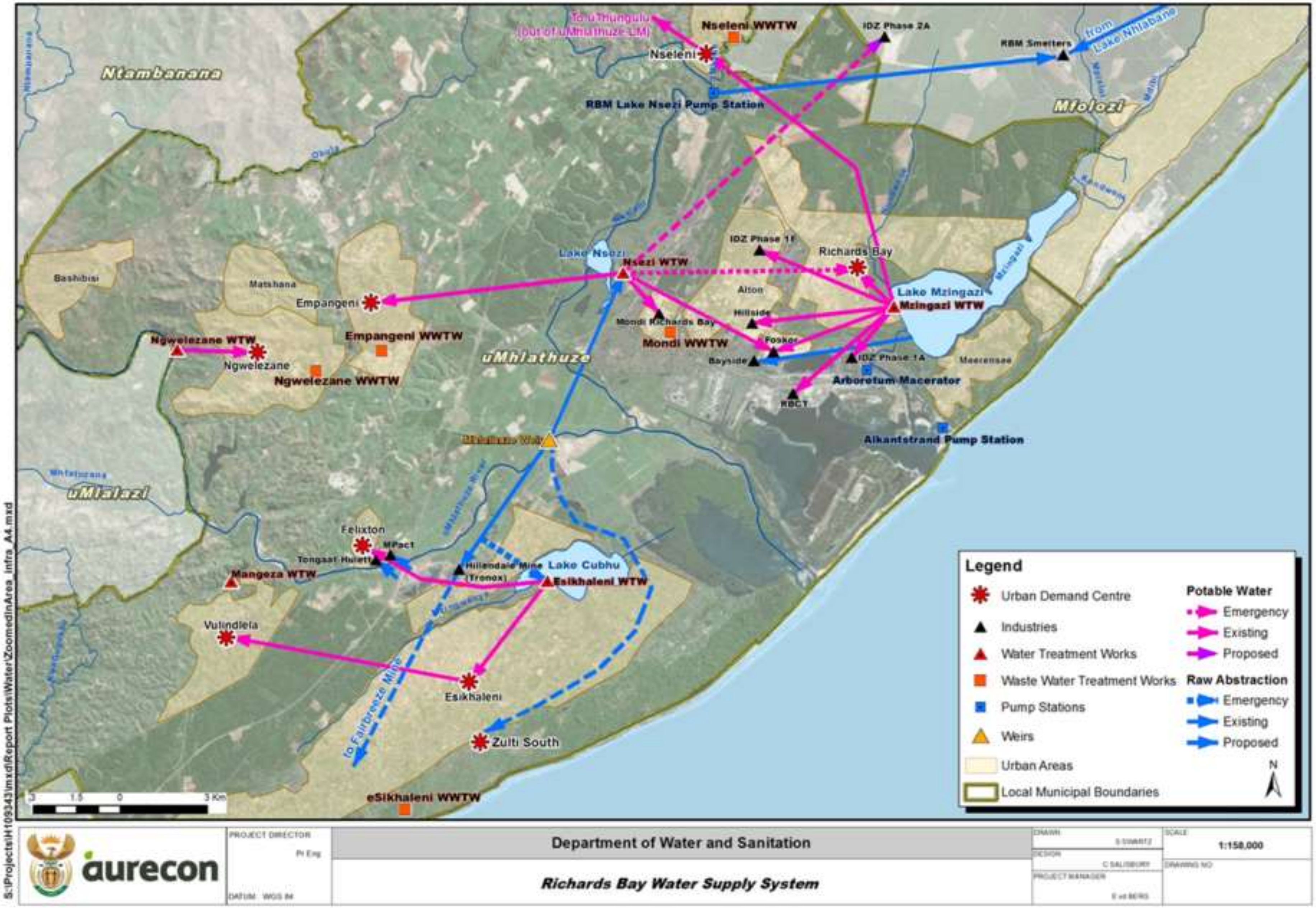

Figure 2-6 | Strategy Water Supply System

2.1.4 Strategy area delimitation

Although the main focus of this study is the uMhlathuze Local Municipality WSS, some areas outside of it are relevant to the strategy area as well.

As described in Sections 2.1.2.1 and 2.1.2.2, RBM's current operations in the Mfolozi Local Municipality falls outside the uMhlathuze Local Municipality area but forms part of its WSS.

The Fairbreeze Mine, owned by Tronox, is situated in the uMlalazi Local Municipality but is scheduled to be supplied from the Mhlatuze weir.

Potable water is also supplied from the Nseleni WTW to a rural area, Mbonambi, beyond the municipal boundary (in Ntambanana Local Municipality).

Therefore, although the study area is intended to cover the uMhlathuze Local Municipality, it is necessary to consider water requirements from some of the surrounding municipalities as well and their intended use of water resources that will impact on this strategy area.

In addition, the WSS is influenced by activities upstream in the Mhlatuze Catchment. This will be taken into account when yield estimates of future water supply options are modelled and include potential mining development and increased domestic/rural water supply.

As water is imported from both the Thukela and Mfolozi Rivers into the WSS, significant changes in land uses or other activities in the catchments of these rivers may impact on the water situation in the strategy area.

2.1.5 Water efficiency perspective

2.1.5.1 uMhlathuze Local Municipality

A preliminary assessment of the level of water use efficiency and the level of non-revenue water (NRW) in the uMhlathuze WSS, indicated that the total system losses are high. It was estimated that the total system losses in the WSS is approximately 31% of the treated water production. This translates to approximately 5.3 million m^3/a (14.7 Ml/d).

The uMhlathuze Municipality has implemented some water conservation and water demand management measures (WC/WDM) in Richards Bay. Some municipal personnel are dedicated to water loss management, although it has not been formally institutionalised. The current measures include measuring of NRW as well as passive leakage detection based on responding to consumers reporting any leaks. Some of the supply zones also have pressure reducing valves (PRVs) which have fixed outlets with constant head on the downstream of the valves.

Their 5-year Strategic Management Plan for the implementation of WC/WDM is in place and has identified that a target of about 19% NRW is the minimum practical achievable goal, as it would become prohibitively expensive to better that target.

The eSikhaleni Water Supply System Report (2013) identifies the inadequacies in the metering, billing and revenue collection system, and that rectification of these problems, will benefit both the Municipality and its customers. These opportunities include:

- Implementing metered zones and bulk meter monitoring to support water balance determinations;
- Undertaking a review of consumer meters in place and billing processes;

- Calibration of new consumer water meters;
- Ensuring correct sizing of water meters to be installed;
- Undertaking routine meter readings as part of a monitoring program;
- Implementing active leakage control and expediting repairs;
- Structuring by-laws to promote use of water efficient fittings in new developments;
- Building public awareness on the importance of efficient water use;
- Ensuring adequate budget and resources to support all of the above.

2.1.5.2 Foskor

Storm water dams are utilised by Foskor to collect the majority of storm water run-off from their manufacturing site. That water is reused in their two phosphoric acid plants at a monthly average of about 1800m^3. They also have an agreement with BHP Billiton (Hillside Aluminium), to recycle their storm water as a replacement for municipal raw water uptake. Foskor is developing its own water reduction and efficiency plan for implementation.

2.1.5.3 Mondi

Mondi developed and began implementation of their RB720 programme in 2005 to improve their environmental performance through the treatment of waste water, minimising air pollution, SO_2 and odours and to decrease their fresh water consumption by approximately 15,000 m^3 per day.

A Mondi Water Reduction Task Team was formed towards the end of 2012. The team consists of members of all the main water consuming business units within the Mill. Each business unit has a specific water consumption specification, determined by the respective area's design specifications. Whenever these water use targets are exceeded, it is raised in the bi-weekly meetings, together with water consumption optimisation exercises and new ideas of further minimising water use within the mill. Viable ideas are developed and scoped and could eventually be implemented, depending on capital expenditure approval. Mondi also has an overall fresh water intake design specification (measured in m^3/day) and if exceeded, the water reduction task team will investigate and remedy where possible.

2.1.5.4 Richards Bay Coal Terminal

The coal terminal's Environmental Systems Upgrade Project (ESUP) to harness all process water, to prevent pollution of the harbour, and to recycle water was commissioned in 2009. Storm water and water collected from the coal stockpiles is channelled into settling ponds, where contaminants are separated from the water before it can be pumped into the ESUP dam. RBCT uses this recycled water for suppression of dust. This has reduced their overall consumption of potable water over the past 3 years by more than 75%. Potable water is now only used for domestic purposes.

2.1.5.5 Mhlathuze Water

Mhlathuze Water has a Water Resources Management Unit which raises awareness and undertakes education campaigns on water conservation. This was done as part of a Forum consisting of different stakeholders (government, private sector and non-government organisations (NGOs)) within the uThungulu District Municipality.

Mhlathuze Water has been implementing the Working for Water Programme for DWA since 2003. The programme now falls under the Department of Environmental Affairs (DEA) and aims to increase runoff in catchments through the removal of alien invasive plants, with job creation as a positive spin-off. A total area of about 6 030 hectares was cleared during the 2012/13 financial (95% of the expected target).

2.1.5.6 Richards Bay Minerals

RBM were awarded first place by the DWA at the WC/WDM Sector Awards 2013. Their commitment to reducing freshwater abstraction and improving both water recycling and efficiency of use in their daily operations is paying off. Their Water Management Plan identifies the following initiatives:

- Improvement of storm and process water capturing;
- Expansion of the water treatment plant; and
- Addressing the water efficiency of tails stacking operations at the mining plants.

Process water from smelting and processing activities is re-used at the mine. Both process water and storm-water runoff is captured on site at Lake Evans at the processing plant, and used in processing.

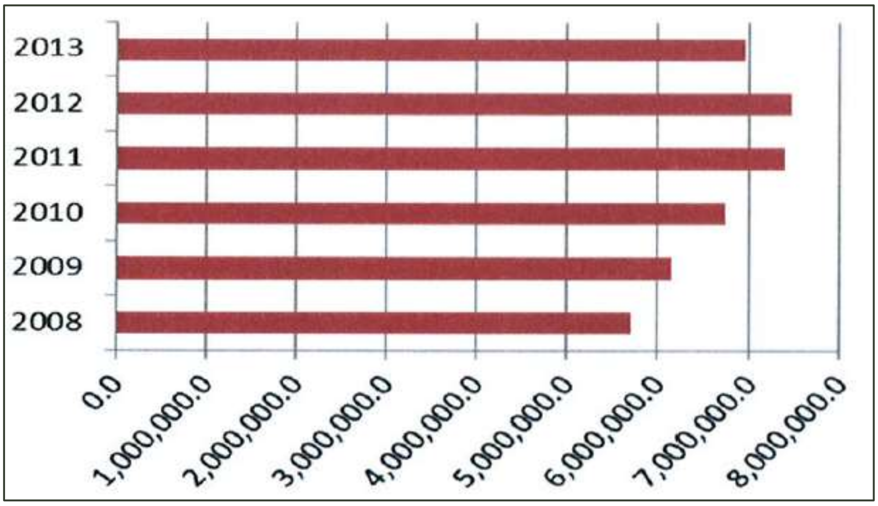

Figure 2-7 | Storm water and Process Water Reused

2.1.5.7 Industrial Development Zone

The Environmental Management Framework for the port expansion and the IDZ recognises the need to ensure that appropriate demand-side management measures are implemented during the development of the IDZ. It also targets protection of water quality through:

- Ensuring that development complies with appropriate design measures;
- Preventing illegal dumping of waste into water features and stormwater gutters;
- Discouraging stockpiling activities; and
- Discouraging industries that have a high potential risk of water contamination such as chemical storage facilities.

2.1.6 Outstanding Information

In a number of the following sections there is information that has not yet been received or verified. In cases where water use figures could not be verified, the best estimate is presented and justification is provided.

Where there was more than one data source for water use amounts, the order of the discrepancy was considered and a conservative decision reached.

The lawful use for Mondi as recorded in the 2012 document 'Mhlatuze Catchment – Modelling Support for Licensing Scenarios Study' by WRP[16] is 54.75 million m^3/a, as opposed to the 36.5 million m^3/a given by Mhlathuze Water and DWA and 32.85 million m^3/a given by Mondi. The value provided by Mondi was used in further calculations because it can be regarded as a reliable upper limit of use.

Values for the supply of raw water from Lake Nsezi to RBM by Mhlathuze Water were provided by both RBM and Mhlathuze Water – RBM's values were higher and were therefore adopted.

Historical usage statistics were not available for Bayside Aluminium, RBCT and Mpact. Assumptions were made for the historical use.

2.2 Major industries

Descriptions of the water profiles of the individual bulk industries are given in Appendix A, along with historical water use and allocations.

Mondi and RBM are by far the largest water users, with Tronox and Foskor being significant water users. The 2013 bulk industrial water use was 56.17 million m^3/a.

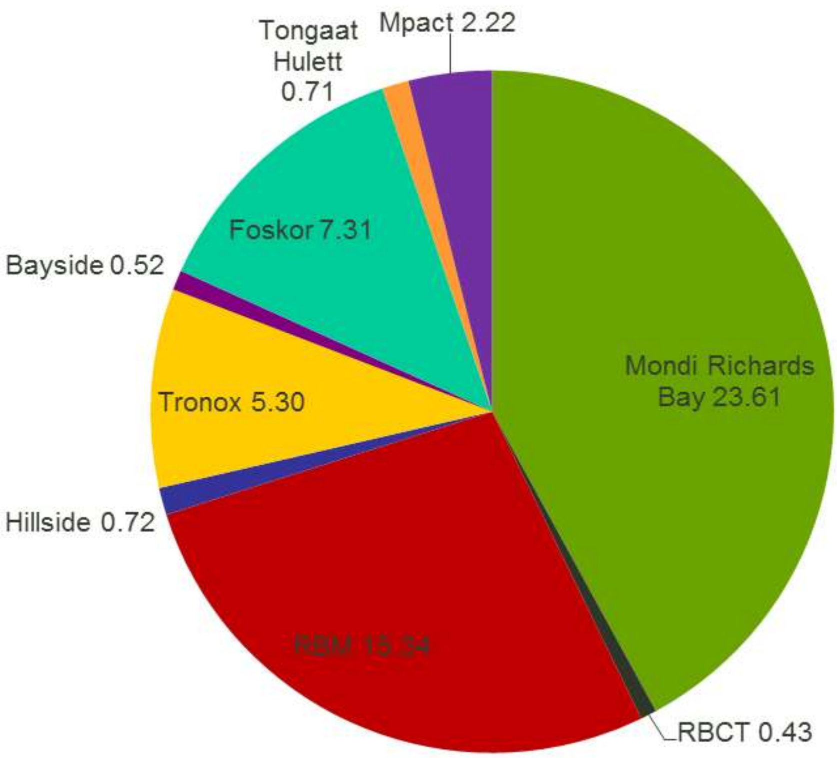

Figure 2-8 | Current Industrial Water Use (million m^3/a)

2.3 Urban and domestic water use

2.3.1 Richards Bay

The industrial area within the city of Richards Bay includes the Alton area, where Mondi, Hillside and Bayside Aluminium and Foskor are located. The residential suburbs include Meerensee, Arboretum and Veld en Vlei and the commercial/ light-industrial centre. The heavy industrial users are supplied as discussed above in Section 2.2 and in Appendix A. The remaining parts of the city, both residential and commercial/ light-industrial, are primarily supplied from the Mzingazi treatment works, and supplemented when necessary from the Nsezi treatment works. The allocation from Nsezi WTW is 25 Ml/d, but more than 2.5 Ml/d is seldom required from there. Mzingazi WTW provides water to a large portion of the users in Richards Bay: a portion is supplied to Hillside and Bayside Aluminium, Foskor and RBCT, some is transferred to the Nseleni WTW for further distribution, and the remainder is supplied to the urban users, including domestic and light industrial/ commercial.

An estimate for the urban use for Richards Bay (including the light-industrial and commercial users, since there is no means of distinguishing between them), is given below in Table 2-5 and Figure 2-9. First, the supplies from the WTW are given; from these the known volumes supplied to various users/ sectors are subtracted, and the remainder is deduced to be the urban use for the city.

Table 2-5 | Richards Bay Urban Water Use (million m^3/a)

	Use component	2008	2009	2010	2011	2012	2013
Inflows	Nsezi WTW	0.03	0.12	3.32	8.12	2.04	1.06
	Mzingazi WTW	20.50	21.03	15.03	11.01	18.00	21.77
Outflows	*Transfer to Nseleni supply area*	2.77	3.88	4.06	4.13	4.29	4.28
	Hillside - approximate	0.72	0.72	0.78	0.78	0.78	0.72
	RBCT	0.84	0.79	0.67	0.21	0.30	0.43
	Foskor (potable)	5.24	5.24	5.24	3.43	2.01	2.97
	Bayside (potable) - approximate	0.18	0.18	0.18	0.18	0.18	0.18
Remainder	**Urban Richards Bay**	**10.77**	**10.33**	**7.47**	**10.46**	**12.53**	**14.24**
	Daily (Ml)	***29.52***	***28.30***	***20.46***	***28.65***	***34.34***	***39.02***

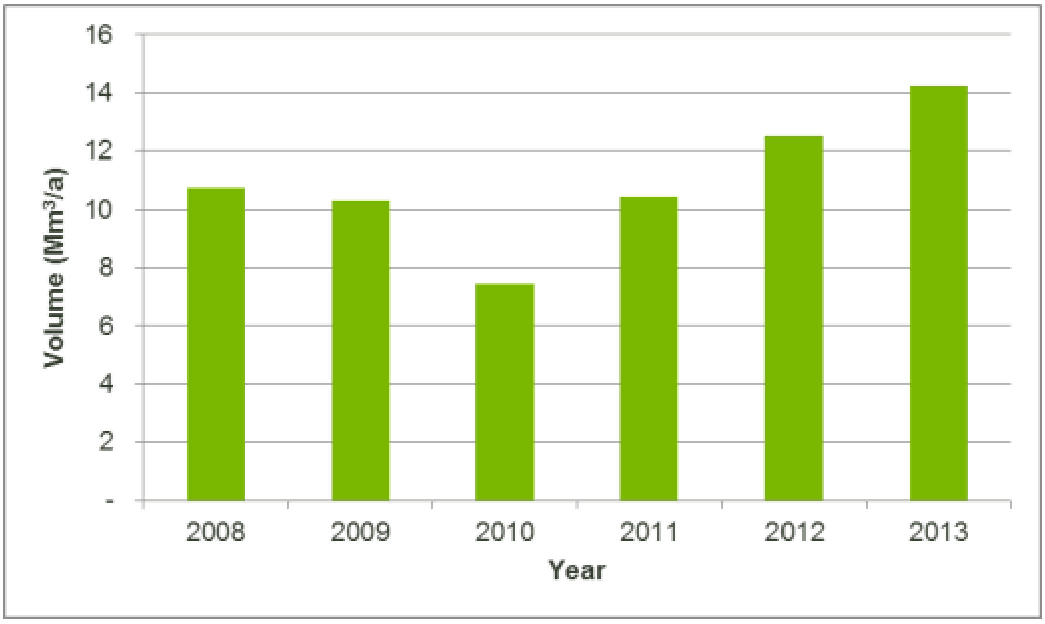

Figure 2-9 | **Richards Bay Urban Water use 2010-2012**

2.3.2 Empangeni

Empangeni is an urban centre that contains a large light-industrial and commercial sector, in addition to residential users. There was previously a WTW on the western shores of Lake Nsezi that serviced Empangeni exclusively, but this was decommissioned and the supply was replaced by Nsezi WTW. The allocation is 37 Ml/d which, as can be seen in Table 2-6, is not fully utilised.

Table 2-6 | **Empangeni Water Use**

Year	Annual (Mm^3)	Daily (Ml)
2008	7.24	19.84
2009	7.53	20.64
2010	8.24	22.58
2011	7.77	21.30
2012	9.15	25.08
2013	9.34	25.58

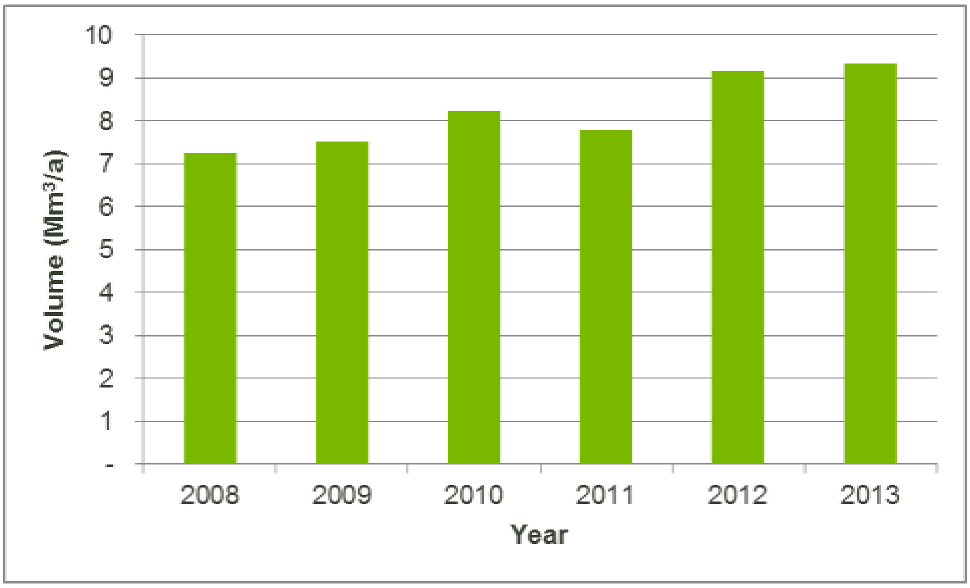

Figure 2-10 | Empangeni Water use

2.3.3 Small Towns

The smaller towns that are supplied by WTW in this area are eSikhaleni, Ngwelezane, Nseleni, Vulindlela and Felixton, eSikhaleni and Ngwelezane have their own treatment works, abstracting from Lake Cubhu and the Mhlatuze River respectively. Nseleni and Felixton's WTW are not functional. Vulindlela and Felixton are supplied with treated water from eSikhaleni's WTW, and Nseleni is supplied from Mzingazi's WTW. Some villages or rural areas are also supplied from these works, including KwaMbonambi, Ntambanana, Khosa, Dube, Mkhwanazi north and south etc. Combining these urban uses by WTW, the values in Table 2-7 and Figure 2-11 have been estimated (source WSSA).

As mentioned above in section 2.3.1, a certain portion of the treated water from the Mzingazi WTW is pumped to the Nseleni WTW, which now serves only as a pump station to distribute treated water to the surrounding areas.

Table 2-7 | Small Towns Water Use

Year	eSikhaleni WTW		Ngwelezane WTW		Nseleni WTW	
	Annual (Mm^3)	Daily (Ml/d)	Annual (Mm^3)	Daily (Ml/d)	Annual (Mm^3)	Daily (Ml/d)
2006	9.32	25.55	2.13	5.84	2.10	5.76
2007	9.45	25.88	2.86	7.83	2.54	6.95
2008	11.97	32.80	2.99	8.20	4.10	11.23
2009	9.98	27.35	3.27	8.96	3.88	10.62
2010	9.98	27.35	3.27	8.96	3.88	10.62
2011	11.37	31.15	2.79	7.64	4.13	11.31
2012	11.36	31.11	2.99	8.18	4.29	11.75
2013	11.16	30.56	2.54	6.95	4.28	11.71

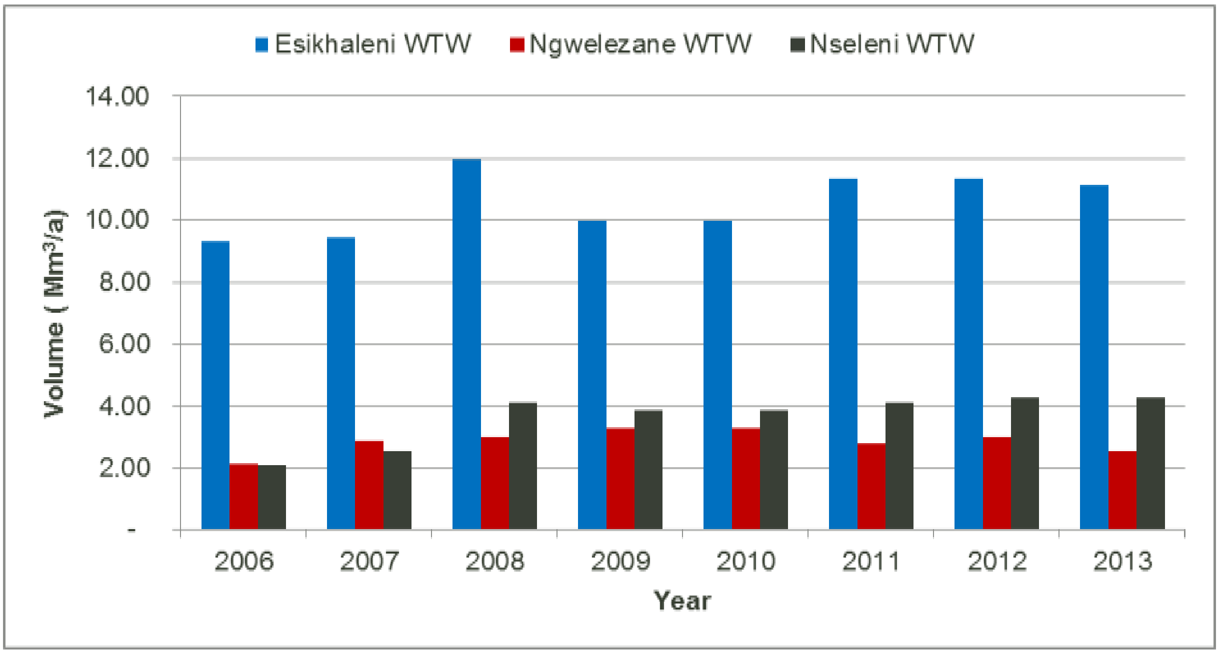

Figure 2-11 | Small Towns Water use 2006-2013

2.4 Irrigation

2.5.1 Background

The Mhlatuze River has a long history of irrigation, with the Nkwaleni Irrigation District being established in 1926, the Mfuli Irrigation District in 1935 and the Heatonville Irrigation District later, in 1971. These Districts were proclaimed and administered by Irrigation Boards in terms of the 1956 Water Act.

In the early days, the Nkwaleni Irrigation District was supplied with irrigation water by means of unlined earth canals fed by a diversion weir and the Mfuli District by means of a canal from the Mfule River, later supplemented from the Mhlatuze River. In the Heatonville District only riparian farmers had access to water, prior to the construction of the Tongaat Hulett pump station and canal scheme in 1993.

Originally the main crop at Nkwaleni was cotton, but by 1961 this had been overtaken by sugar. Citrus is also grown.

2.5.2 The Goedertrouw Dam

The Goedertrouw Dam was built by the Department of Water Affairs as a Government Water Scheme and completed in 1983. The purpose, according to White Paper W.P.Q-73 and the First Supplementary White Paper, W.P.O-79, was *"in order to make available a reliable water supply for urban and industrial use at Eshowe and in the Richards Bay – Empangeni complex and for irrigation".*

The White Papers make the following provision for irrigation:

Table 2-8 | White Paper Provision for Irrigation

Locality	Area (ha)	Quota (m^3/ha/a)	Volume (Mm^3/a)
Nkwaleni	6 475	12 560	91.2
Heatonville	5 231	11 830	67.8
KwaZulu	2 000	11 830	26.0
Total			**185.0**

The values in the right hand column are quoted in the Supplementary White Paper as an average duty required from the Dam, totalling 185.0 million m^3/annum, allowing for losses.

The Goedertrouw Dam structure covered the Nkwaleni Irrigation Board's diversion weir and the canal is now fed directly from the Dam.

With the construction of the Goedertrouw Dam, the Mhlatuze River was proclaimed a Government Water Control Area in 1977. In order to allow irrigation to continue, a Government Notice was published in 1979, allowing existing lawful irrigation to continue and enabling riparian irrigators who had not developed fully, to irrigate up to 80% of their irrigable potential between the limits of 2 km horizontally and 60 m vertically from the river. This included the above-mentioned area in then KwaZulu. Permits were required from the then DWA Circle Office for new pumps.

In 1994, the irrigation which had developed lawfully was scheduled in terms of section 63 of the 1956 Water Act. This increased the irrigators' assurance of supply, as their supply was now no longer from run of river, but officially from the Government Water Scheme.

The areas scheduled were as follows:

Table 2-9 | Government Water Scheme Irrigation Areas

Locality	Area (ha)	Quota (m^3/ha/a)	Volume (Mm^3/a)
Nkwaleni	6 738	12 600	84.9
Mfule	794	11 800	9.4
Heatonville	5 260	11 800	62.1
Lower Irrigators	1 582	9 000	14.2
Total			**170.6**

2.5.3 The Heatonville Scheme

Tongaat Hulett embarked on the construction of the Heatonville irrigation scheme which was completed in 1993. This scheme pumps water from the Mhlatuze River via a 1.0 m diameter pipeline into a system of 12.8 km of concrete-lined canals and balancing dams. There are 4 booster pump stations and a total area of some 4 200 ha is commanded by the scheme.

In terms of the National Water Act, 1998, the Irrigation Boards have been transformed into Water User Associations, Nkwaleni in 2007 and Heatonville, Mfule, the Tongaat Hulett Scheme, the emerging Biyela and Mzimela farmers, becoming the Central Mhlatuze Water User Association in 2010.

2.5.4 Compulsory Licensing

In 2006, the Department commenced with a Validation and Verification exercise in the Mhlatuze catchment, to lay the foundations for Compulsory Licensing. This first step was to ascertain the lawfulness of the irrigation (and other) water use in the catchment. Much additional groundwork was done and in August 2010 a notice was published, requiring that all users taking water, storing water, or engaging in a stream flow reduction activity (afforestation) were to apply for licences for the purpose of Compulsory Licensing. This process is now nearing completion. One of the aims was to free up allocated, but unutilised water.

After considerable consultation and negotiation with the irrigators, consensus was reached and the Department has agreed to allocate the irrigators 66% of their quotas on scheduled land or on actual irrigated land, provided certain conditions have been met.

This means that in Nkwaleni, the quota of 12 600 m^3/ha/a has been reduced to 8 316 m^3/ha/a, and in Heatonville, the quota of 11 800 m^3/ha/a, has been reduced to 7 788 m^3/ha/a.

The Department is currently recalculating the final schedules for irrigation use, and indications are that the irrigation allocation towards the end of compulsory licensing will be in the order of 121.1 million m^3 per annum.

Once this phase of the Licensing process is complete, there will be a volume of water set aside for future small irrigation development. When this volume has been allocated, it is doubted whether any additional water will be available for commercial irrigation. It is anticipated that small volumes may still be allocated to resource-poor farmers (likely sugar cane irrigation and community forestry) in future. The precise volume set aside for future small irrigation development is not certain, but it is expected that it may be up to approximately 5 million m^3/a.

The value used for the final allocation volume for irrigation, including the volume set aside for future small irrigation development is 125 million m^3/a. This allows for small changes in allocations of existing irrigation, should it become necessary, as well as for some allocation to resource-poor farmers.

2.5 Other significant catchment water uses

2.5.1 Ecological Flow Requirements (Reserve)

The Reserve consists of an ecological component (EWR) and a basic human needs component. An EWR is a non-consumptive demand, the requirement of which is determined from and dependant on the natural flow in the river at the point of the EWR. The EWR is the portion of the streamflow that must always be present in the rivers for healthy functioning of aquatic ecosystems. As a result, the EWR differs substantially over the record period, with low flows during times of naturally low flows, and high flows during high flow times. These figures are subject to improvement as better insights are gained through monitoring, studies and improved assessment methodologies.

DWS RDM produced a new set of River Quantity EWRs in 2012 which superseded all previous EWRs that had been used. This preliminary Reserve has been approved by DWS and therefore has a legal status.

Table 2-10 presents an extract summary from the EWR document.

Table 2-10 | Table Preliminary determination of the Reserve for Water Quantity in terms of section 17(1) (a)

Quatenary Catchment	Water resource	Ecological Reserve (%) NMAR	Ecological Reserve Volume (Mm^3)	Basic Human Needs (%NAMR)	*Total Reserve (%)	NMAR (Mm^3)
W12A	***Mhlatuze River: Estimated from IFR site 1	38.1	24.7	0.40	38.5	64.8
W12B	**Mhlatuze River: IFR site 1	30.5	54.3	0.06	30.6	156.7
W12C	***Mhlatuze River: Estimated from IFR site 2	26.3	13.4	0.16	26.4	50.8
W12D	**Mhlatuze River: IFR site 3	26.3	70.8	0.14	26.4	195.2
W12D	**Mhlatuze River: IFR site 2	26.6	81.8	0.10	26.7	265.8
W12E	**Mhlatuze River: IFR site 4	11.4	40.3	0.11	11.5	278.1
W12F	**Mhlatuze River: IFR site 4	11.4	40.3	0.23	11.6	332.4
W12G	***Nseleni River: Estimated from IFR site 1	38.0	10.2	0.34	38.3	26.8
W12H	***Nseleni River: Estimated from IFR site 4	26.1	22.7	0.63	26.7	87.2

**This amount is the sum of ecological reserve and basic human needs.*

***Indicates the Original 2001 IFR Sites.*

****New Hydrological Nodes to which IFR results estimated to.*

The WRYM for the Mhlatuze catchment has been configured such that all EWRs are satisfied as a priority. The ecological component of the Reserve is given the second-highest priority, after the Basic Human Needs Reserve component, which is estimated as 25l/capita/day for all inhabitants of the catchment[18].

During final modelling undertaken to support compulsory licensing, some cases were found where the revised river EWRs required more water than was naturally available. These cases were adjusted such that the requirement was decreased to be equal to the natural flow.

The 2012 River Reserve followed on the *Mhlathuze Catchment Ecological Reserve and Monitoring Programme*[12], 2003 which entailed a comprehensive Reserve undertaken for the quantity component for the Mhlathuze River downstream of Goedertrouw Dam, the Mhlathuze Estuary, as well as the lakes (including Lakes Mzingazi, Cubhu, Nsezi and Nhlabane) in the area.

Several other values for the ecological Reserve in this area are given in other reports, for some of the lakes, wetlands and the groundwater in the area. The *Water Quality Planning Studies in Support of Water Quality Planning in the Mhlathuze WMA* report[27] contains a further list of documents containing Reserves determined in the past.

The MWAAS study[2], 2009 further includes estimates for the estuarine (EFR) flow requirements for the quaternary catchments within the Mhlathuze River Catchment, obtained from the *Mhlathuze Operating Rules and Future Phasing* study[19], 2001.

Figures for the ecological Reserve for the lakes are given as follows:

Lake	Ecological requirement (million m^3/annum)
Lake Nsezi	2.9
Lake Mzingazi	4.5
Lake Cubhu	1.5
Lake Nhlabane	14.3
TOTAL	**23.2**

Figure 2-12 | Ecological Reserves for lakes

It is noted that the figure for Lake Nhlabane is misleading, because the transfer from the Mfolozi River is included in the system modelling in support of the Reserve determination, as noted in the discussion of scenarios. Some of these Lake Reserve are larger than the latest estimated sustainable yields of these lakes, and must be treated with caution.

2.5.2 Forestry

There is extensive commercial afforestation in this area. According to the Mhlathuze Water Availability Assessment Study (MWAAS)[2] there is 677km^2 afforested area in the Mhlatuze catchment, about 34km^2 of which is in the municipality, a further 146km^2 to the north in the Mbonambi Municipality, and another 97km^2 along the Mhlatuze River between Goedertrouw Dam and Richards Bay[2]. Forestry is always located in the high MAP regions and as such results in reduced stream-flow, which leads to decreased yields downstream. For this reason the growth in forestry activities in this area is strictly regulated by the DWA, and it is not intended that significant expansion in this sector be allowed. Concerns have already been raised regarding the reduction in the yield of Lake Nhlabane as a result of stream-flow reduction activities such as forestry, which is prevalent in that catchment area.

The total commercially afforested area in the headwaters of the Mhlatuze catchment is about 60 000 hectares. Roughly 40 000 hectares are under pine, 16 000 under gum and the balance is wattle. At present most of the plantations are under the control of large commercial companies supplemented by a number of small growers with small woodlots. Most of the wood is either delivered to the Mondi factory at Richards Bay or is exported[15].

2.5.3 Alien Vegetation

According to the ‘Overview of Water Resources Availability and Utilisation’ report by BKS[11], there are large areas of alien vegetation in the Mhlatuze catchment, which cause a substantial reduction in runoff. MWAAS[2] gives a value of 44.29km^2 in the catchment. This is a water use that should be reduced, and the DWA is addressing this issue with collaboration with stakeholders through projects such as the Working for Water. If strategies for eradicating alien vegetation are successful, and such additional low flows are not intercepted by users before the Mhlatuze weir, more water will become available downstream.

2.5.4 Dry land sugar cane

There is an area of approximately 262km^2 of dryland sugarcane found in the Mhlatuze catchment, some 90km^2 of which is near the coast and therefore in the study area for this project[10]. This does not impact directly on the water use, but, like forestry and alien vegetation, it reduces runoff and hence stream-flow. As mentioned previously, some sugar-cane farmers are converting to dryland farming, as factors such as a lack of reliability in the electricity supply for pumping and theft of pumping equipment and cables makes irrigating problematic. Furthermore the rising price of electricity is a deterrent.

The impact on water availability of this land-use is difficult to estimate accurately, but in the MWAAS[2], the catchment was modelled and runoff reduction values were determined.

2.6 Summary of Current (2013) Water Use

Table 2-11 below shows the current daily water requirement for industrial and urban water users, as well as the legal water allocations. Table 2-12 summarises these users in terms of water source, quality required, supplier etc. Notably bulk industrial users utilise only a portion of the water allocations.

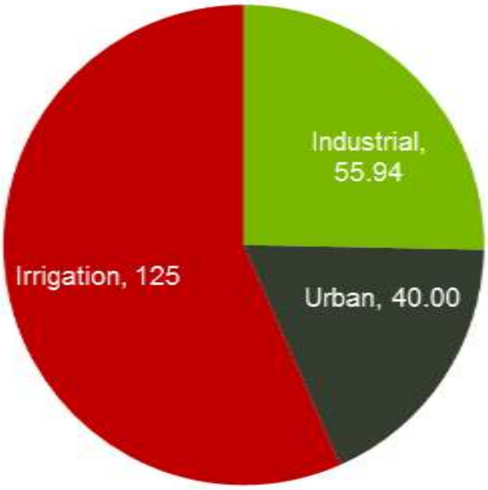

Figure 2-13 and Figure 2-14 show the breakdown of the water-usage by sector.

Figure 2-15 and Figure 2-16 show the relative 2013 usages for urban and industrial users.

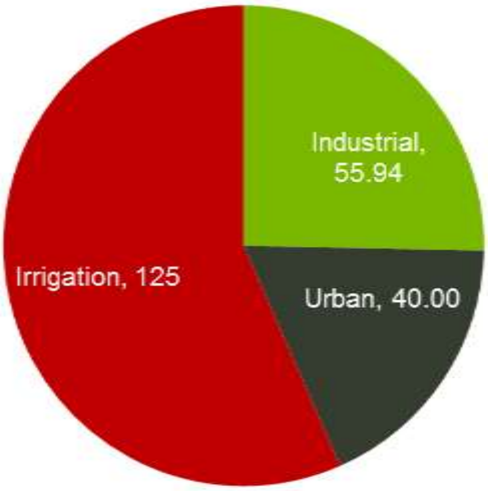

Figure 2-13 | Mhlathuze Sector Usage (million m^3/a)

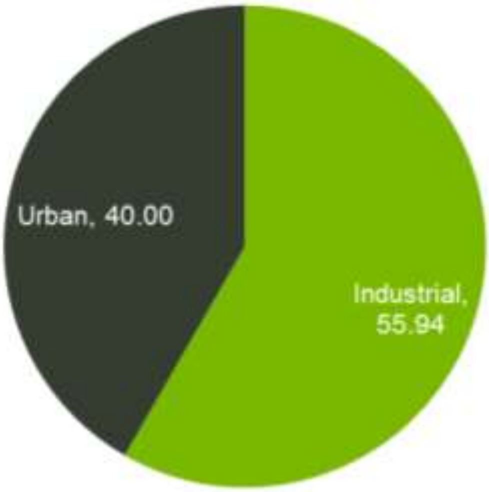

Figure 2-14 | Mhlathuze Sector Usage (million m³/a)

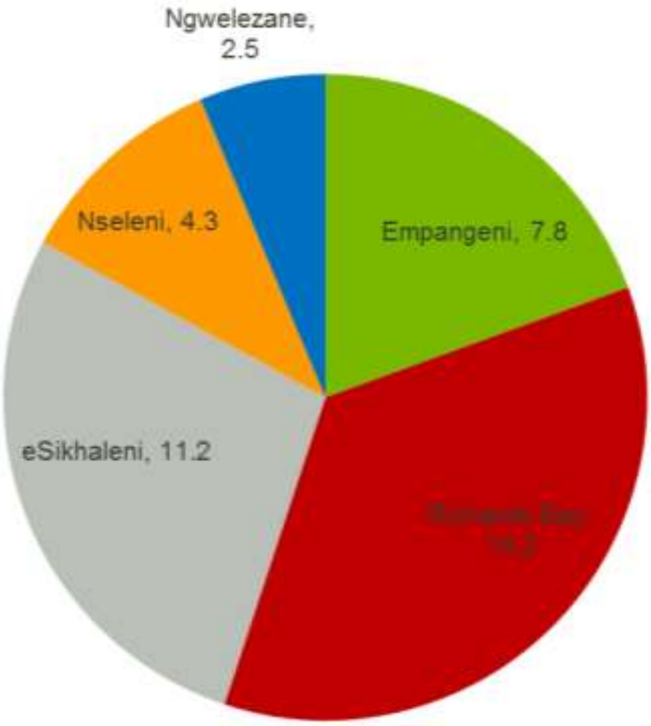

Figure 2-15 | Current Urban Usage (million m³/a)

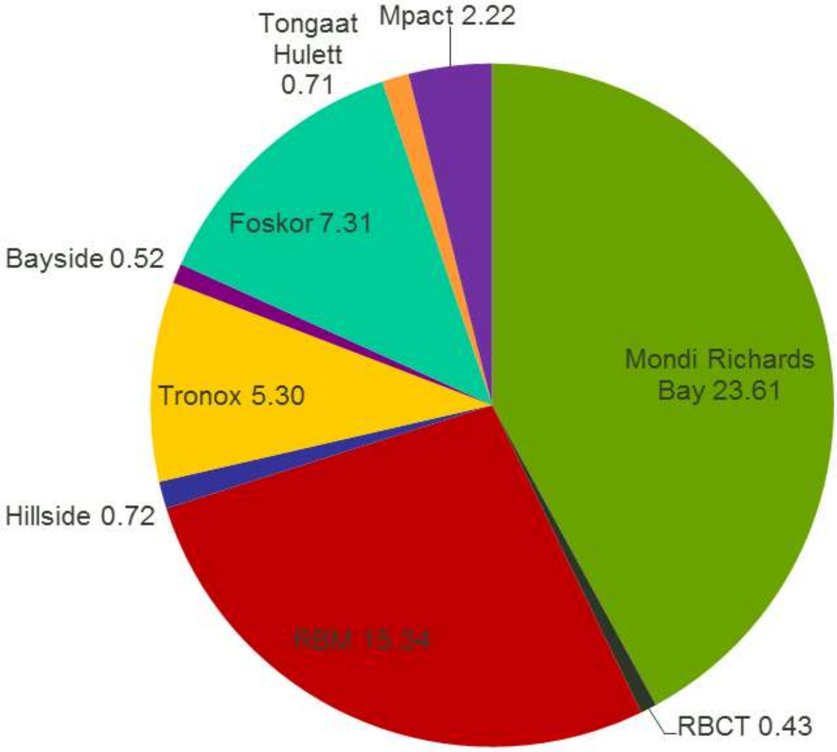

Figure 2-16 | Current Industrial Usage (million m³/a)

Table 2-11 | Summary of 2013 Water Uses and Allocations

		Current Usage		Allocation	
Supply Sector	***User***	***Annual (M³/a)***	***Daily (Ml/d)***	***Annual (M³/a)***	***Daily (Ml/d)***
Industry	Mondi Richards Bay	23.61	64.70	32.85	90.00
	RBM - Total	**15.34**	**42.02**	**30.00**	**82.19**
	RBM - Nhlabane	*12.95*	*35.49*	*23.00*	*63.00*
	RBM - uMfolozi	*0.00*	*0.01*	*20.99*	*57.50*
	RBM - Nsezi	*2.38*	*6.53*	*16.43*	*45.00*
	Tronox - Total	**5.30**	**14.52**	**11.48**	**31.46**
	Tronox - Hillendale	*3.75*	*10.28*	*11.48*	*31.46*
	Tronox - potable	*1.55*	*4.24*	*0.00*	*0.00*
	Foskor - Total	**7.09**	**20.04**	**10.44**	**28.60**
	Foskor - clarified	*4.12*	*11.28*	*6.21*	*17.00*
	Foskor - potable	*2.97*	*8.76*	*4.96*	*13.60*
	Mpact	2.22	6.07	2.48	6.79
	Tongaat Hulett	0.71	1.95	1.89	5.17
	Bayside - Total	**0.52**	**1.44**	**0.34**	**0.94**
	Bayside - raw	*0.34*	*0.94*	*0.34*	*0.94*
	Bayside - potable	*0.18*	*0.50*	*0.00*	*0.00*
	Hillside	0.72	1.97	0.75	2.05
	RBCT	0.43	1.19	0.00	0.00
	Total	**55.94**	**153.27**	**91.30**	**249.21**
Urban	Empangeni	9.34	25.58	13.51	37.00
	Richards Bay	14.24	39.02	9.13	25.00
	eSikhaleni	11.16	30.56	11.32	31.00
	Nseleni	4.28	11.71	0.00	0.00
	Ngwelezane	2.54	6.95	2.92	8.00
	Total	**40.00**	**109.58**	**36.87**	**101.00**
	GRAND TOTAL	**95.94**	**262.86**	**128.17**	**350.21**

Table 2-12 | Water Users Summary

Type of Use	User	Water Quality	Treatment Works	Source[1]	Supplier
Industrial	**Mondi**	Potable	Nsezi WTW	Lake Nsezi and Mhlatuze weir	Mhlathuze Water
	RBM	Raw	-	Lake Nsezi	Mhlathuze Water
		Raw	-	Mfolozi River	RBM
		Raw	-	Lake Nhlabane	RBM
	Tronox	Raw	-	Mhlatuze Weir	Mhlathuze Water
		Potable	Nsezi TW	Lake Nsezi and Mhlatuze weir	Mhlathuze Water
	Foskor	Clarified	Nsezi WTW	Lake Nsezi and Mhlatuze weir	Mhlathuze Water
		Potable	Mzingazi WTW	Lake Mzingazi	
	Mpact **Tongaat-Hulett**	Potable Raw	Tongaat Hulett WTW	Lake Cubhu Mhlatuze River	uMhlathuze Local Municipality
	Bayside Aluminium	Raw	-	Lake Mzingazi	uMhlathuze Local Municipality
		Potable	Mzingazi WTW	Lake Mzingazi	uMhlathuze Local Municipality
	Hillside Aluminium	Potable	Mzingazi WTW	Lake Mzingazi	uMhlathuze Local Municipality
	RBCT	Potable	Mzingazi WTW	Lake Mzingazi	uMhlathuze Local Municipality
Urban	**Empangeni**	Potable	Nsezi TW	Lake Nsezi and Mhlatuze weir	Mhlathuze Water
	Richards Bay	Potable	Mzingazi TW	Lake Mzingazi	uMhlathuze Local Municipality
	Richards Bay (supplementary supply)	Potable	Nsezi TW	Lake Nsezi and Mhlatuze weir	Mhlathuze Water
	eSikhaleni, Felixton and Vulindlela	Potable	eSikhaleni TW	Lake Cubhu and Mhlatuze weir	uMhlathuze Local Municipality
	Nseleni	Potable	Mzingazi TW	Lake Mzingazi	uMhlathuze Local Municipality
	Ngwelezane	Potable	Ngwelezane TW	Mhlatuze River	uMhlathuze Local Municipality

[1] Users supplied from the Mzingazi WTW will be supplemented from the Nsezi WTW when Lake Mzingazi reaches the minimum allowable level

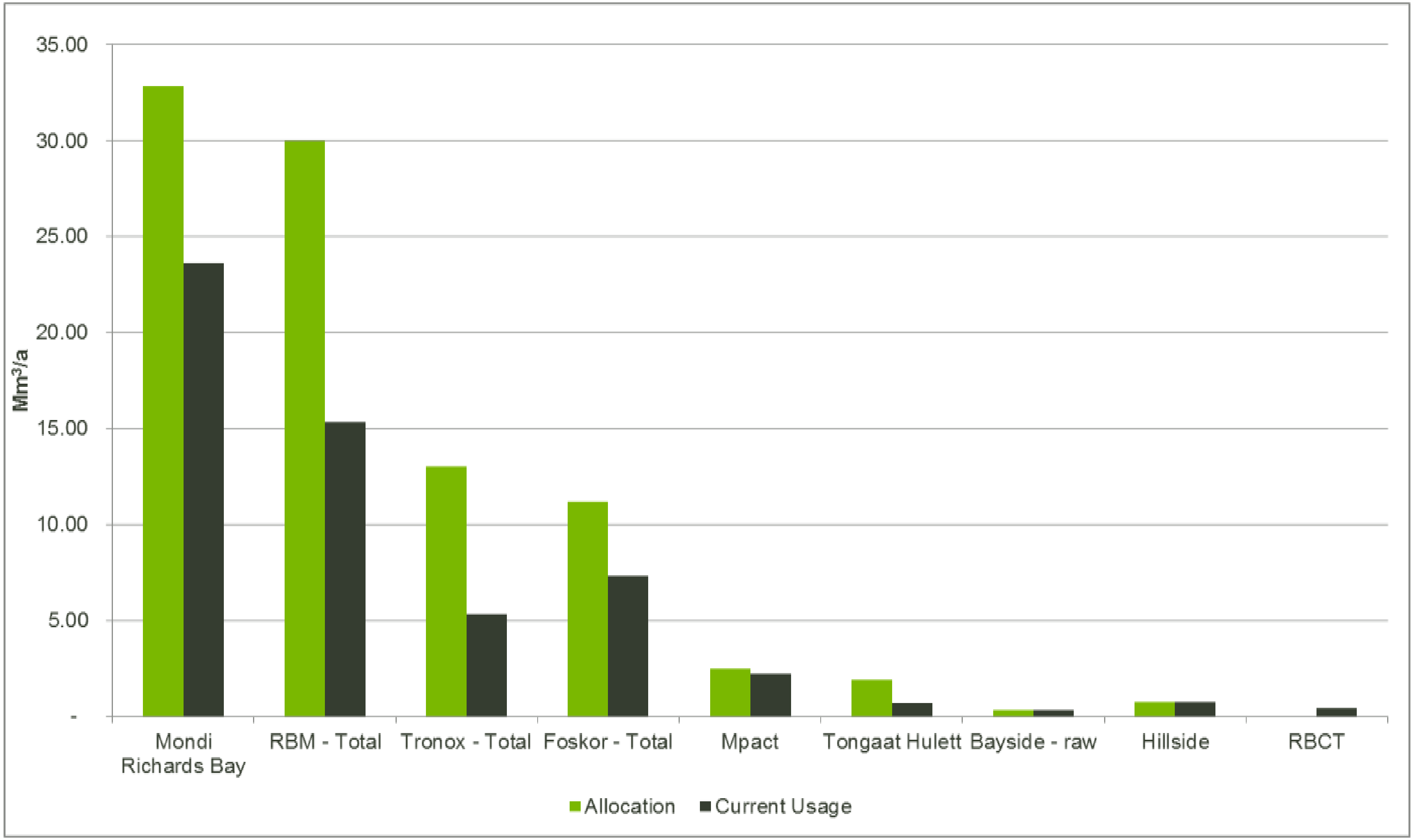

Figure 2-17 | **Current Industrial Allocation and Usage**

2.7 Summary of Historical Water Use

A summary of the historical water use from 2008 to 2013 for industrial and urban water users is given below in Table 2-13 and Figure 2-18.

Table 2-13 | Historical Water Use

Supply Sector	User	Annual Usage (Mm^3/year)					
		2008	**2009**	**2010**	**2011**	**2012**	**2013**
Industry	Mondi	24.91	25.41	25.02	25.14	25.40	23.61
	RBM	21.30	27.07	25.75	25.10	16.27	15.34
	Foskor - clarified	4.40	3.95	4.67	5.90	4.55	4.12
	Foskor - potable	5.24*	5.24*	5.24	3.43	2.01	2.97
	Tronox - raw	9.58	5.69	3.56	4.78	3.98	3.75
	Tronox - potable	1.04*	1.04*	1.04*	1.04*	1.04	1.55
	Hillside	0.72*	0.72*	0.72*	0.72*	0.72*	0.72
	Bayside - raw	0.34*	0.34*	0.34*	0.34*	0.34*	0.34
	Bayside -potable	0.18*	0.18*	0.18*	0.18*	0.18*	0.18
	Tongaat Hulett	1.01	0.91	0.91	0.71	0.96	0.71
	Mpact	2.22*	2.22*	2.22*	2.22*	2.22*	2.22
	RBCT	0.84	0.79	0.67	0.21	0.30	0.43
	TOTAL	**71.77**	**73.57**	**70.32**	**69.76**	**57.96**	**55.94**
Urban	Empangeni	6.20	6.49	7.20	6.73	8.11	7.79
	Richards Bay	10.77	10.33	7.47	10.46	12.53	14.24
	eSikhaleni, Felixton, Vulindlela	11.97	9.98	9.98	11.37	11.36	11.16
	Nseleni	4.10	3.88	3.88	4.13	4.29	4.28
	Ngwelezane	2.99	3.27	3.27	2.79	2.99	2.54
	TOTAL	**36.05**	**33.96**	**31.80**	**35.48**	**39.28**	**40.00**
	GRAND TOTAL	**107.82**	**107.53**	**102.13**	**105.25**	**97.24**	**95.94**

*Estimated values

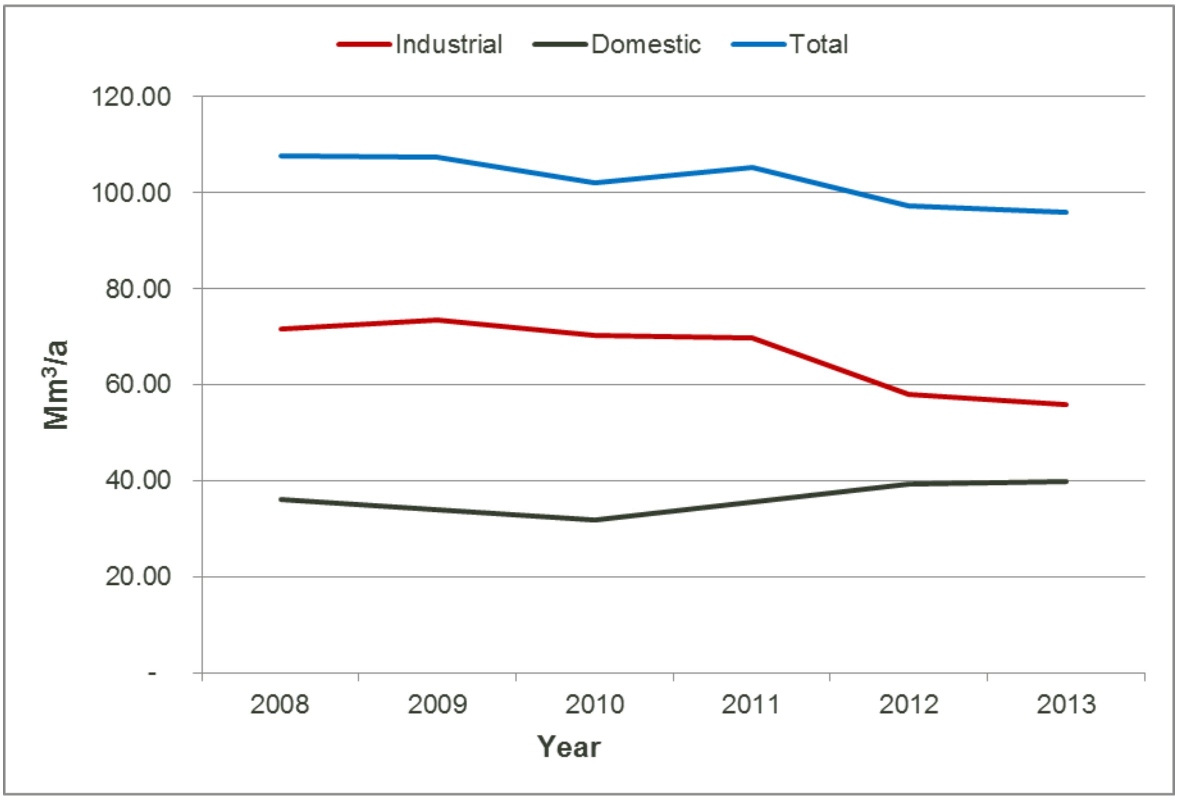

Figure 2-18 | Historical Water use

3 Future Water Requirements Scenarios

3.1 Drivers of water use

The primary infrastructure development which has transformed Richards Bay from a small harbour village into the largest coal export facility in the world was the conversion of the original Richards Bay harbour into a deep water port with railway and an oil/gas pipeline linking the port to Johannesburg. This laid the foundation for large-scale industrial investment and development in the region. The Richards Bay Coal Terminal is currently the largest coal export facility in the world. Richards Bay is one of South Africa's fastest developing cities. It is a fast growing industrial centre within which the major water users as described in previous chapters.

Apart from the mining industry, the tourism industry is a major part of the local economy, with Richards Bay seen as a gateway to the Zululand area which is popular with foreign tourists (game parks and wildlife diversity).

Commercial forestry and irrigation (primarily sugar cane) is practised in the study area. Although in a relatively favourable position compared to other parts of South Africa, no significant growth is foreseen for irrigation or for plantation forestry.

There is also a relatively high contribution from the transport sector which can be ascribed to the railways and harbour infrastructure, which support the export of coal, timber, metals, minerals and manufactured goods.

About 2% of the Gross Domestic Product (GDP) of South Africa originates from what was the Usutu to Mhlathuze Water Management Area, consisting of:

- Manufacturing 35,5%
- Agriculture 15,2%
- Transport 12,5%
- Government 9,7%

Of this about 50% occurs within the Richards Bay and Empangeni areas. The manufacturing sector employs the majority of the population.

3.1.1 Rainfall

Water requirements are also influenced by rainfall. Figure 3-1 below shows the historical variability in the nature of rainfall in the area, with a mean annual precipitation (MAP) of approximately 1200mm. A dry period is evident in the early 1990s. It was in this period that the emergency Thukela transfer scheme from the Middledrift weir was implemented. This is now used at times to augment the supply from Goedertrouw Dam.

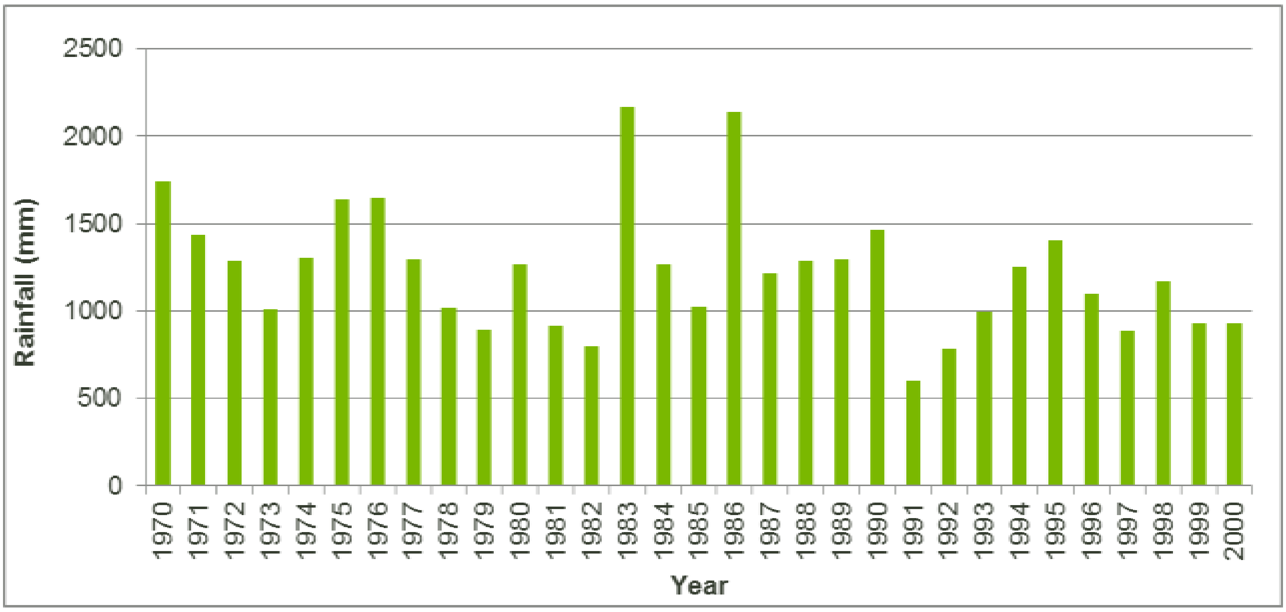

Figure 3-1 | Annual Rainfall 1970-2000

3.1.2 Population growth

Urban centres include Richards Bay and Empangeni with the inclusion of former KwaZulu government townships of eSikhaleni, Ngwelezane, Vulindela and Nseleni. Another settlement of note is Felixton, situated to the north of eSikhaleni (south east of Empangeni). Development at Felixton includes the industrial premises of Tongaat-Hulett and Mpact, employee residential area, schools and recreational facilities. Rural areas include five Traditional Authority areas within the uMhlathuze Local Municipality, 21 rural settlements and 61 farms[5].

The uMhlathuze Local Municipality has an estimated population growth rate of about 1, 5% per annum. Table 3-1 below shows the historical population growth between 2001 and 2011, in which the uMhlathuze Municipality shows an increase of just over 45 000 people during that period.

Table 3-1 | Municipality Populations

	uMhlathuze Local Municipality
2011	334 459
2001	289 190
Population growth	15.65%
Per year	1.57%

The current population[5] is estimated at just under 350 000.

Similar to the national demographic trends and mainly attributable to the impacts of HIV/AIDS and of increasing urbanisation, little change and more probably a decline in population in the rural areas is expected. The future demography will also largely be influenced by economic opportunities and potential. Moderate population growth in the uMhlathuze area is probable, influenced by migration from rural areas into Richards Bay in search of employment opportunities.

Domestic per capita water consumption varies between the differing levels of water and sanitation services but is likely to increase in line with actual population growth and improvements in service levels. The current average per capita domestic water requirement is estimated to be 25l/c/d for rural users (this is the DWA minimum level of service for water supply) and 193l/c/d for urban users. This range is the result of the diverse nature and profile of communities in the area.

3.1.3 Socio-economic Considerations

Although about 5% of the national population reside in what was the Usutu to Mhlathuze Water Management area, less than 2% of the GDP originates from therein. It is therefore evident that socio-economic standards in the Water Management Area are well below the national average. This is attributed to the highly skewed distribution of wealth between the urban and rural areas and as such large differences in the standard of living prevail. Over 40% of the population are subject to living conditions associated with poverty.

Despite the rapid economic growth to date, there remain significant challenges regarding unemployment and poverty. The Municipality is making efforts through implementation of projects aimed at reducing poverty levels.

The unemployment rate in Richards Bay alone is estimated at about 19%, but this increases substantially (to more than 50%) in the surrounding rural areas. The percentage of people with a level of education less than Grade 12 is more than 50%.

It is of concern that the industrial growth witnessed in this region has not translated directly into entry-level job opportunities at an equivalent rate (the majority of the raw material extracted is for the export market). The limited development of integrated downstream business opportunities contributes substantially to this phenomenon.

3.1.4 Economic growth

Attributable to the harbour and transport infrastructure as well as the favourable climate, the economy of the area is relatively more competitive than the remainder of South Africa with respect to manufacturing, transport and agriculture. However due to a small local consumer base together with limited integration of industrial activities in the area (with limited supporting industries), it is expected that future industrial growth will, over the medium term, mainly be driven by further development of large export-orientated industrial developments, rather than through generic growth as would be possible in a more integrated industrial environment.

The projected uptake of subsequent Phases within the IDZ remains subject to market influences, electricity prices and a stable economic environment to encourage further investment.

3.2 Potential expansion of the study area

The study area as it is currently defined as explained in section 2.1.4 primarily consists of the uMhlathuze Local Municipality, rural areas supplied in the Ntambanana Local Municipality, RBM and the Fairbreeze mine operational areas, which fall outside the municipality but which are included in the WSS. However, just to the north of the Mfolozi River there are some towns, such as Mtubatuba and surrounding rural areas, which rely on abstractions from the Mfolozi River and which may need to be taken into account when considering other future abstractions. Water supply to distantly located areas however firstly requires the evaluation of all local water source options by such users, before expensive long-distance water supply is considered.

Furthermore, significant options for future water supply are transfers from the Thukela River, both the current Middledrift scheme and the possible Mandini scheme. The Thukela River is about 80km south of Richards Bay. When evaluating the available supply from that potential source, other uses such as irrigation, the current Lower Thukela Bulk Water Supply Scheme currently being implemented by Umgeni Water, as well as the Reserve, would need to be taken into account.

It can therefore be seen that the study area is not topographically definitively defined, and may need to be redefined to take into account other features when exploring water supply options from sources located outside the current WSS area and future water supply into areas located outside the current WSS area.

3.3 Future Water Requirements Scenarios

3.3.1 Discrepancy between water allocations and water use

Actual water use is generally lower than the allocated volumes. The reason for this is that allocations typically have allowed for future growth in actual use, or licence holders are simply using less than has been allocated to them. In the case of the Mhlatuze catchment, the allocation and actual use differ widely. In the case of irrigation, this situation has been corrected through the compulsory licensing process. It is evident though that for several bulk industrial users, actual use is much lower than allocations.

Determination of a strategy water balance and the planning of augmentation can therefore not be done according to water allocations (although such a perspective has to be considered), but such a determination has to consider best-estimate future water uses by existing and potential new users.

3.3.2 Heavy industrial water requirements

Future industrial water requirements have been assumed to be composed of the following, for the various Future Water Requirements Scenarios:

a. Use by existing heavy industries, which can either decrease, stay the same, increase or stop;
b. Future planning for heavy industries identified by the IDZ, not all located in the current strategy area;
c. Other new heavy industrial water users, some of which may be located outside the current strategy area;
d. Potential further efficiency savings, relative to current heavy industrial use.

It is expected that Richards Bay / Empangeni will remain significant in the national, provincial and districts spatial economy as a result of the bulk-handling facilities of the Richards Bay Harbour that allow for trade links with international economies, even considering the global economic sluggishness.

From a mineralogical viewpoint, numerous other mining lease areas have been identified along the coastal strip from Mhlatuze River Mouth towards Mtunzini. Of significance is the substantial demand for water, created by dune mining. It is therefore anticipated that industrial water requirements in the region will continue to increase.

For the future heavy industries identified by the IDZ, scenarios have been planned for increments of the full identified volumes. It has been assumed that Phase 1A would be implemented from 2014. Phase 1F would be implemented from 2017. Phase 1D would be implemented from 2022. Phase 2i would be implemented from 2022 and Phase 2ii from 2032.

Water requirements for the base-case of the potential future Jindal Mine, to be located just north of Goedertrouw Dam and its processing plant have been included. The mine water requirements are estimated to be 8 million m^3 per year if the pelletizing plant is located at the mine site. Should the alternate case be implemented, an additional 6 million m^3/a will be required for pumping pellet slurry to Richards Bay, which would also become available for re-use.

An upper bound of 1% growth (cumulative in relation to each previous year's heavy industrial use) has been set for any new future significant industries that have not yet been identified by the IDZ.

Current and future industrial water requirements have been updated based on interaction with industries, the IDZ and government officials. Limited updated information could not be obtained for a few industrial users, and other sources (internet references, previous reports) were used to obtain such information. Some estimates had to be made, which are indicated, although the confidence in the industrial water supply values can overall be regarded as good. Existing heavy industries have been supportive of the process and helpful in providing the required information pertaining to potential future water uses.

3.3.3 Urban water requirements

Future urban water requirements have been assumed to be composed of the following, for the various Future Water Requirements Scenarios:

e. Increased use by existing users from existing WTW in the current strategy area;
f. Increased supply to other urban water users located in the Mhlatuze catchment or located outside the Mhlatuze catchment, but supplied from it;
g. Significant new municipal and urban WSS outside the municipal boundary to the north referred to as the 'Mtubatuba Scheme'.
h. Potential efficiency saving in urban water requirements, relevant to current urban water use.

The municipal population has increased by, on average, about 1.5% per annum from 2001 to 2011. In 2011 the census indicated a population of 334 459, with 86 609 households. The 2014 population is estimated at 378 171. Access to water in June 2013 was 85%. The uMhlathuze municipal area is characterised by a shortage of suitably well-located land for housing development.

The current demand for housing is as follows:

Urban Areas:	8 248
Rural Areas:	6 622
TOTAL	**14 870 dwellings**

Increased urban water supply is needed to:

- Address the backlog of the households in the area below RDP supply standards
- Improve services provision and upgrade supply
- Provide connections to new households
- Potentially expand supply further beyond municipal boundaries

Future requirements could be calculated from the type and number of dwellings. However, even in instances where a uniform growth rate is applied to all standard dwelling types, there is always (great) uncertainty around such growth rates. Significant changes in urban water requirements can arise when there is a concerted effort to upgrade services in an area or a significant economic upturn (or downturn) is expected or both.

It was therefore decided to apply growth rates to the 2013 urban/domestic use instead, or introduce significant new supply areas as required. This is regarded as an acceptable way of forecasting urban water requirements in these circumstances, as forecasting is done for a long period of 27 years (up to 2040) and growth is not from a very low base, in which case it may not have been appropriate. Future raw water required at treatment plants is forecast.

For increased future water use by current urban water users, an upper bound of 3% growth has been set and a lower bound of 1% growth for future urban water requirements.

Potential new urban supply schemes outside the municipal area include the Nsezi Supply Scheme that could supply water to Mtubatuba and the Mpukunyoni Tribal Area, the Middledrift (including Vutshini and Nkandla) Supply Scheme and the Lake Phobane Scheme. Such approaches takes into account the Provincial Spatial Economic Development Strategy that addresses the water services backlog on a regional scale and the integration of existing and new distribution links.

For Increased supply to other urban water users located in the Mhlatuze catchment or located outside the Mhlatuze catchment, but supplied from it, an upper bound of 4% growth has been set and a lower bound of 1% growth for future urban water requirements.

For the "Mtubatuba Scheme", a Low Requirements option (5 million m^3/a) and a High Requirements option (15 million m^3/a) have been identified.

3.3.4 Irrigation

The revised allocations for irrigation, following compulsory licensing have been included in the scenarios. No growth in irrigation has been allowed for. While small allocations may in future be made to small resource-poor farmers, this is expected to have an almost negligible influence on the water balance.

3.3.5 Stream Flow Reduction Activities

No allowance has been made for increased stream flow reduction activities SFRAs, i.e. plantation forestry. While small allocations may in future be made to for community forestry, this is expected to have an almost negligible influence on the water balance.

3.3.6 Water Quality Differentiation

Scenarios for future water requirements have been differentiated between raw water requirements for heavy industries, potable water requirements for heavy industries and purified water for urban/domestic supply. Foskor requires clarified water as part of their supply and this has been indicated.

Table 3-2 shows the various uses according to supply sectors. This is shown in more detail in Table 3-3. It has been established that some heavy industrial users have a fixed water requirement over the strategy period, and some a variable supply. It is expected that the need for potable urban/domestic water requirements will increase.

Table 3-2 | Future water requirements by supply sector

Supply Sector	User	Notes on future water requirements
Current industries	• Mondi Richards Bay • Mpact • Hillside Aluminium • Bayside Aluminium	Fixed identified requirements over strategy period
	• RBM • Foskor • Tronox • Tongaat Hulett • RBCT and harbour	Variable identified requirements over strategy period
New industries	IDZ identified new industries	Future use according to IDZ planning Phases. Scenarios of 25%, 50%, 75% and 100% of IDZ planning
	Jindal Mine	Base case planned requirement without additional slurry pipe requirements
	Further new industries/mines	Scenarios of 0%, 0.25%, 0.5% and 1% cumulative annual growth, based on growth on previous year's full industrial demand
Urban (domestic / industrial)	Supply from WTWs in uMhlathuze LM	Scenarios of 1%, 2%, 3.5% annual growth
	Increased supply to other areas in or from Mhlatuze catchment	Growth of current supply areas and supply. Scenarios of 1%, 2%, 3% and 4% annual growth
	Significant expansion outside municipal boundary	Mtubatuba / Mpukunyoni Scheme from Nsezi WTW
Irrigation	Existing irrigation after compulsory licensing	Revised allocations over strategy period
	New irrigation	Increased irrigation not included in scenarios
SFRAs (forestry, alien plants, sugar cane)	Existing SFRAs	Increased plantation forestry not included in scenarios

Table 3-3 | Future water requirements by supply sectors and users

Supply Sector	User	Allocation (Mm^3/a)	Allocation (Ml/d)	Use 2013 (Mm^3/a)	Use 2013 (Ml/d)	Notes on future water requirements
Industrial *fixed requirements*	Mondi Richards Bay	32.85	90.00	23.61	64.70	Restrict to 90Ml use for entire period
	Mpact	2.48	6.79	2.22	6.07	Full allocation over period
	Hillside Aluminium	0.75	2.05	0.72	1.97	Current use continues over full period
	Bayside Aluminium potable	-	-	0.18	0.50	Allow full use over full period
	Bayside Aluminium raw	0.34	0.93	0.34	0.93	No use allowed for.
Industrial *variable requirements*	RBM – total *(Mfolozi, Nhlabane, Nsezi)*	30.00	82.19	15.34	42.02	Allow $30Mm^3/a$ for full period (from various sources) plus an additional $14.6Mm^3/a$ from 2017.
	Tongaat Hulett, Felixton	1.89	5.17	0.79	2.16	Full allocation over period – potential increased use of 1 million m^3/a – possibly effective from 2020
	Foskor - clarified	6.21	17.00	4.12	11.28	Increasing until 2018 then remaining constant
	Foskor - potable	4.96	13.60	2.97	8.76	Increasing until 2018 then remaining constant
	Tronox - Hillendale	11.48	31.46	3.75	10.28	Mine closing with rehabilitation being done – phase out over 3 yrs.
	Tronox - Fairbreeze	22.69	62.16	-	-	48.8 Ml/d from 2017 to 2027 for Fairbreeze. 55 Ml/d thereafter for Port Durnford planned mine
	RBCT and harbour	-	-	0.43	1.19	Current use continues until 2020 when it increases by 20%
New industrial	IDZ planning	-	-	-	-	According to IDZ Phases (incl. Pulp United as part of Phase 1D) Scenarios of 25%, 50%, 75% and 100% of IDZ planning
	Jindal Mine					
	Further new industrial	-	-	-	-	Scenarios of 0%, 1%, 2% additional growth
Urban *(domestic / commercial / light industrial)*	Supply from WTWs in uMhlathuze Local Municipality			38.45	105.34	Scenarios of 1%, 2%, 3.5% growth
	Increased supply to other areas located in or supplied from Mhlatuze catchment	5.02	13.75	5.5	15.07	Scenarios of 1%, 2%, 3% and 4% growth
	Significant expansion outside municipal boundary	-	-	-	-	Planning for Mtubatuba / Mpukunyoni Scheme from Nseleni WTW
Irrigation	Existing irrigation after compulsory licensing	125	342.5			Revised allocations over full period
	New irrigation		-	-	-	Increased irrigation not included in scenarios
SFRAs *(forestry, sugar cane)*	Existing SFRAs	-	-	-	-	Increased plantation forestry not included in scenarios

The following future water requirements scenarios have been compiled, for the various water use sectors and their components:

3) **Allocations** for existing and potential future heavy industries and irrigation (latest estimate), and estimated future urban water use.

4) **Best-estimate** future water requirements for existing and potential future heavy industrial future urban water use, and irrigation allocations (latest estimate).

For the Best-estimate scenarios, it was necessary to make some assumptions relating to expected actual use, which is typically lower than allocations. Where possible best-estimate values were obtained from water users. In cases where there was no indication of likely future usage, a conservative fraction of the allocation was used.

Table 3-4 | Future water requirement scenarios

	Water requirement component								
Scenario	**Current industries** (fixed & variable)	**New identified IDZ industries** (% additional growth)	**Jindal Mine**	**Further new industries** (cumulative growth on previous year's total)	**Municipal Urban/ domestic** (% growth)	**Increased domestic supply in Mhlatuze catchment** (% growth)	**Increased domestic supply: 'Mtubatuba' Scheme** (No/Low/High)	**Irrigation**	**WC/WDM** (% saving on current use; phased in over 10 yrs.)
Sc 1: Low growth	✓	25%	✓	0%	1%	1%	No	✓	0%
Sc 2: Low-Medium growth	✓	50%	✓	0.25%	1.5%	2%	No	✓	0%
Sc 3: Medium growth	✓	75%	✓	0.5%	2%	3%	Low	✓	0%
Sc 4: High growth	✓	100%	✓	1%	3.0%	4%	High	✓	0%
Sc 5: Water Efficient Medium growth	✓	75%	✓	0.5%	2%	3%	Low	✓	Urban: 15%, Industrial 10%

The baseline for projections is the 2013 water use.

3.3.7 Discussion of scenarios findings

The future water requirements for the “Allocations” scenarios are as shown in Figure 3-2 and that of the “Best-estimate” scenarios in Figure 3-3.

The expected sharp increases in future water requirements from 2016 to 2018 for the various scenarios is as a result of the Fairbreeze and Jindal mines going into production. The sharp increases in 2022 and 2032 are the result of the IDZ expansion.

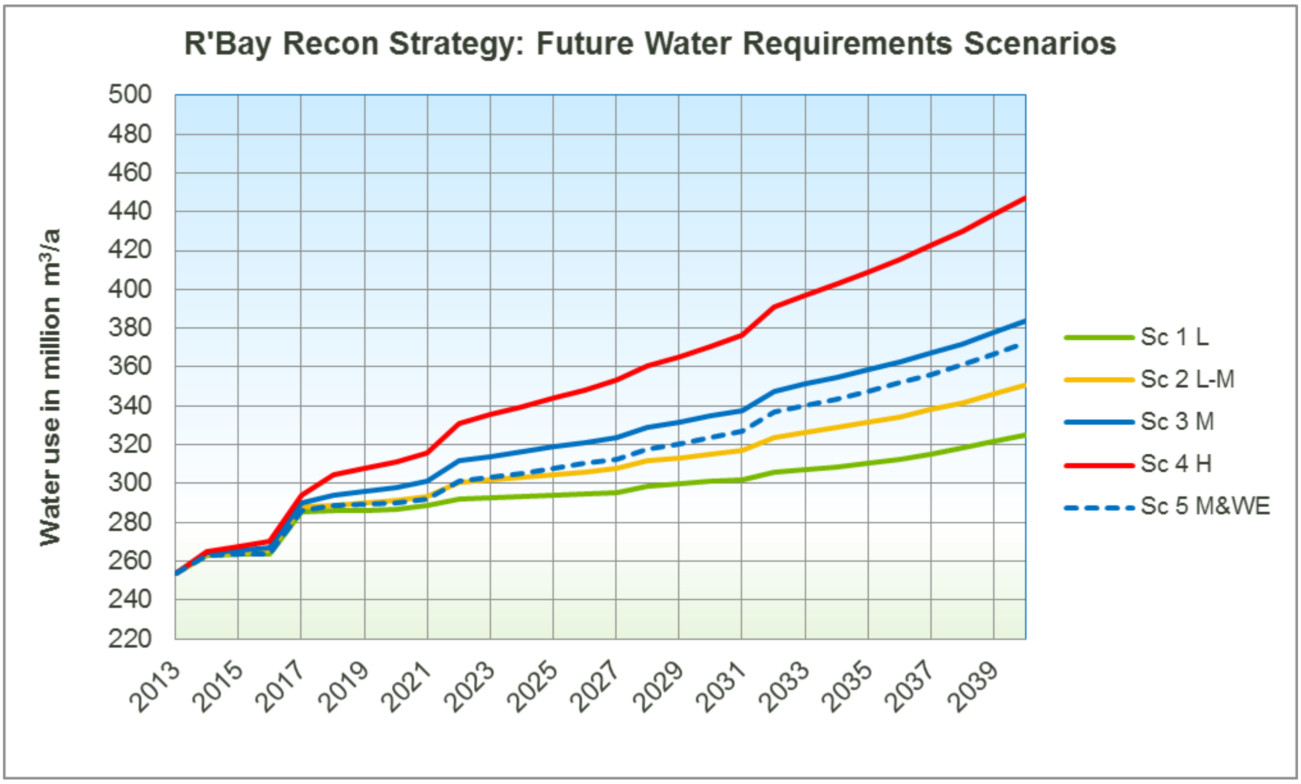

Figure 3-2 | Future water requirements ‘Allocation’ scenarios

For the **Low** growth ‘Allocation’ scenario, water requirements increase from 256 million m^3/a in 2014 to 325 million m^3/a in 2040, i.e. an increase of 27% over 27 years.

For the **Low-Medium** growth ‘Allocation’ scenario, water requirements increase from 256 million m^3/a in 2014 to 351 million m^3/a in 2040, i.e. an increase of 37% over 27 years.

For the **Medium** growth ‘Allocation’ scenario, water requirements increase from 256 million m^3/a in 2014 to 384 million m^3/a in 2040, i.e. an increase of 50% over 27 years.

For the **High** growth ‘Allocation’ scenario, water requirements increase from 256 million m^3/a in 2014 to 447 million m^3/a in 2040, i.e. an increase of 75% over 27 years.

For the **Water-efficient Medium** growth ‘Allocation’ scenario, water requirements increase from 256 million m^3/a in 2014 to 373 million m^3/a in 2040, i.e. an increase of 46% over 27 years.

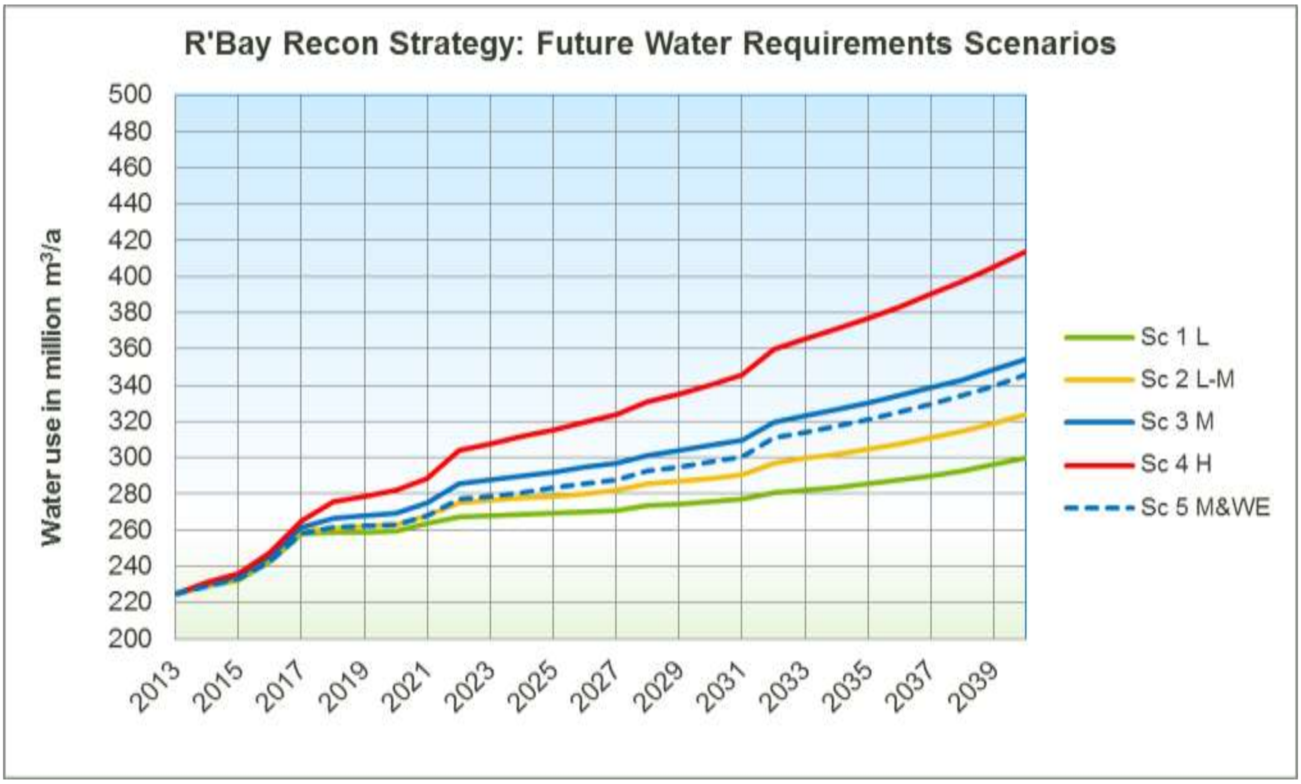

Figure 3-3 | **Future water requirements 'Best-Estimate' scenarios**

For the **Low** growth 'Best-estimate' scenario, water requirements increase from 227 million m^3/a in 2014 to 300 million m^3/a in 2040, i.e. an increase of 32% over 27 years.

For the **Low-Medium** growth 'Best-estimate' scenario, water requirements increase from 227 million m^3/a in 2014 to 324 million m^3/a in 2040, i.e. an increase of 43% over 27 years.

For the **Medium** growth 'Best-estimate' scenario, water requirements increase from 227 million m^3/a in 2014 to 354 million m^3/a in 2040, i.e. an increase of 56% over 27 years.

For the **High** growth 'Best-estimate' scenario, water requirements increase from 227 million m^3/a in 2014 to 413 million m^3/a in 2040, i.e. an increase of 82% over 27 years.

For the **Water-efficient Medium** growth 'Best-estimate' scenario, water requirements increase from 227 million m^3/a in 2014 to 345 million m^3/a in 2040, i.e. an increase of 52% over 27 years.

Sectoral water use in 2013 is shown in Figure 3-4.

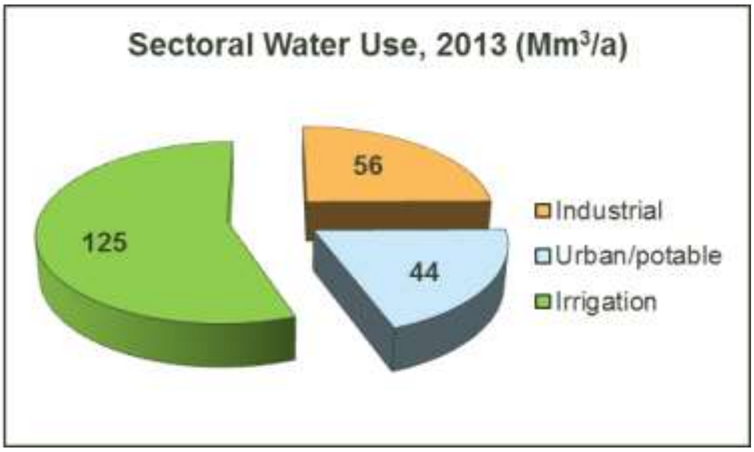

Figure 3-4 | Sectoral water use in 2013 (million m^3/a)

For illustration, sectoral water is shown for the Best-Estimate Water Requirements Scenario 3 (Medium Growth Scenario) in 2040 in Figure 3-5. This shows how, for this Scenario, bulk industrial water requirements may overtake irrigation as the most significant water use sector.

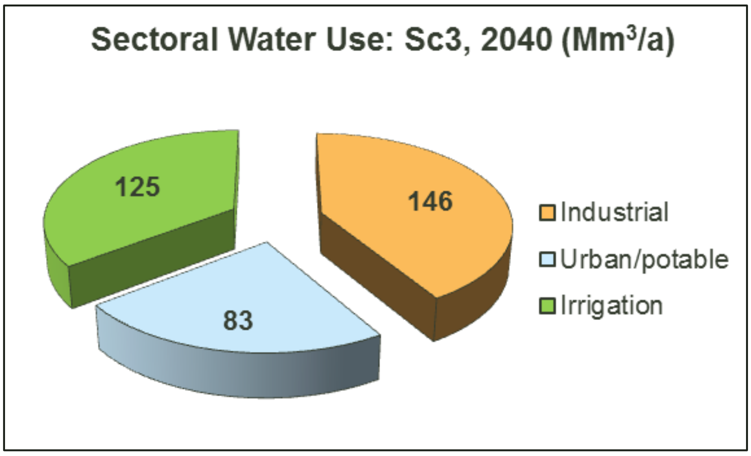

Figure 3-5 | Sectoral water use for 'Best-Estimate' Scenario 3 in 2040 (million m^3/a)

4 Conclusions

The Richards Bay/ uMhlathuze Local Municipality area is a centre for industrial and urban development. The water requirements of users in the area are expanding, and this expansion is expected to continue over the study period of 27 years, until 2040. Various scenarios based on differing assumptions of growth rates. Possible industrial developments and urban growth have been presented.

The focus has been on industrial and, to a certain extent, urban requirement. Other uses such as forestry and irrigation have been dealt with, but are not likely to expand in this area and have been given less detailed consideration.

The delimitation of the study area will continue to be refined as the understanding of the system is developed and the relevant water sources are identified.

Further insight into the area's future will be obtained in the succeeding phases of the project, and conclusions will be reached for the best estimate of growth rates and hence the best scenario for future water requirements.

Strategy water balances will be developed using the Water Resources Planning model for the selected 'Best-estimate' water requirements scenarios. It is possible that some of these future water requirements may be refined further in the process as improved information is made available. As a result of the yield modelling to be undertaken, it may be found that not all future water requirements for these scenarios can be met all the time during the planning period, and it is possible that the requirements will be refined following the modelling exercise.

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Appendices

Appendix A
Bulk Industrial Use

Mondi Richards Bay

Mondi is the single largest water user in the Richards Bay area. It processes pulp and paper and produces two key products, which are Baycel, a premier grade bleached hardwood pulp, and Baywhite, a white top kraft linerboard. Large amounts of water are used in the process, and the requisite quality is high – the water supplied to the Richards Bay plant is of a potable standard. Recycled effluent needs to be treated to a high standard to be usable in the processes, which is not considered economically viable by Mondi[20]. Mondi would be willing to consider the feasibility of substituting fresh water with treated municipal wastewater if this were to become economically feasible.

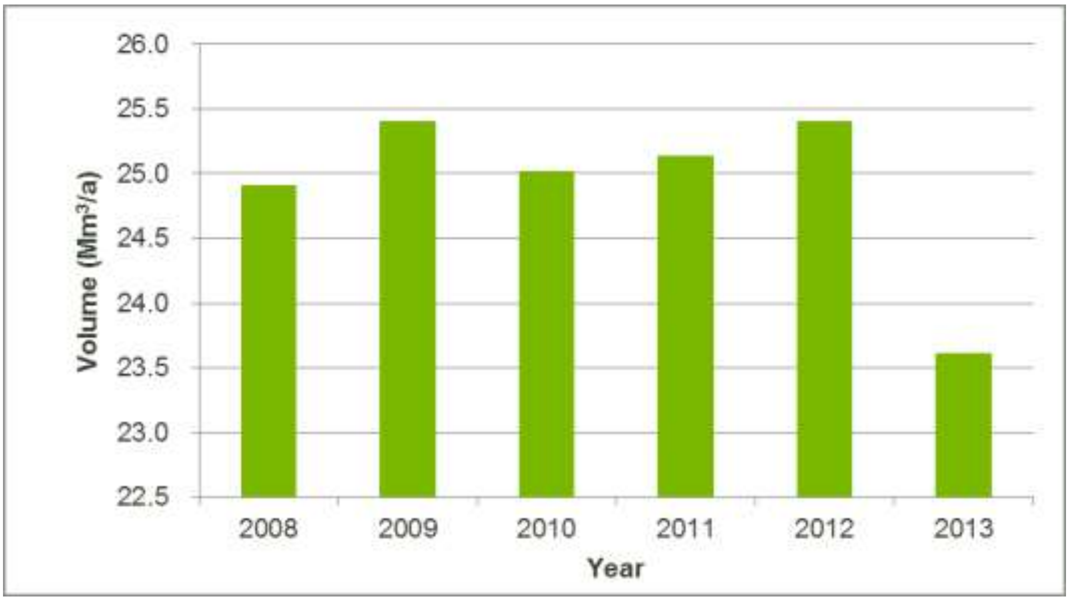
Historical Water use

Mondi RB obtains treated water directly from Mhlathuze Water, as the requirement is so large. The allocation is 90 Ml/d, 32.85 million m^3/a. However, the recorded use since 2008 ranges between 60-70 Ml/d. The allocation is effective until 2029, and it is unlikely that Mondi would require more than 90 Ml/d.

Historical water use by Mondi is as depicted in the following Table and Graph:

Mondi Water Use

Year	Annual (Mm^3)	Daily (Ml)
2008	24.91	68.25
2009	25.41	69.61
2010	25.02	68.54
2011	25.14	68.87
2012	25.40	69.60
2013	23.61	64.70



Mondi Water Use 2008-2013

Effluent Treatment

Effluent from the plant is treated in Mondi's own WWTW (capacity 55 Ml/d), and then discharged by Alkantstrand to the sea outfall, via pipeline A. Treatment begins in the primary clarifiers where the solids – predominantly fibre - are removed.

Effluent is then treated in a secondary effluent treatment plant with activated sludge, primarily to reduce the COD load in the effluent before it is sent to the sea outfall.

Mondi Required Treatment Standards

pH	2 - 10
Temperature	<56°C
Colour	4400 Hazen
Total Suspended Solids	500ppm
C.O.D.	2000ppm

The above values are the effluent quality specifications in terms of the contract with Mhlathuze Water.

Richards Bay Minerals

Mines

Richards Bay Minerals (RBM) mines the sand dunes in the Richards Bay area for heavy minerals including ilmenite (which yields iron and titanium), zircon and rutile. There are two existing mining areas, namely the Tisand/ Zulti North area, which is to the north of Richards Bay and the Zulti South, which is to the south of Richards Bay, in the vicinity of eSikhaleni. Large-scale mining operations are currently being conducted in the northern area of the Zulti North/ Tisand area. Large-scale mining operations are contemplated to start in the Zulti South area from 2016, and will reach full-scale operation in 2018. Using current technology the mining operations are expected to be completed by 2036, but it is possible that mined areas may be re-mined in the future, depending on market conditions and advances in technology. The smelters will continue to operate after mining on the Tisand/ Zulti North area and the Zulti South areas has been terminated, with minerals being imported from mines elsewhere.

Water is used in the mining process to liquefy the sand for separation from the heavy minerals in the concentrator plant which floats on the mining ponds. Currently the mining ponds at Zulti North are supplied from Lake Nhlabane and supplemented by raw water from the Mfolozi River. The Sokhulu Balancing Dam is used to ensure a reliable supply. The dam is in the mining path and is also geologically unstable. Usage from it is therefore being phased out, and after mining has been completed the Sokhulu Reservoir will be re-established. There are concerns by RBM about the reliability of yield from Lake Nhlabane, as it has very limited surface water augmentation and RBM is of the opinion that the many small, unlawful plantations being established in the area reduce the surface runoff and groundwater augmentation potential. The mining ponds cannot use salt water, as this corrodes the equipment, but raw water can be used, provided there is not too much sediment.

Lake Nsezi is a communal source and expensive, so RBM’s aim is to reduce usage from there by 20% relative to the average 2008-2013 volume.

Smelter

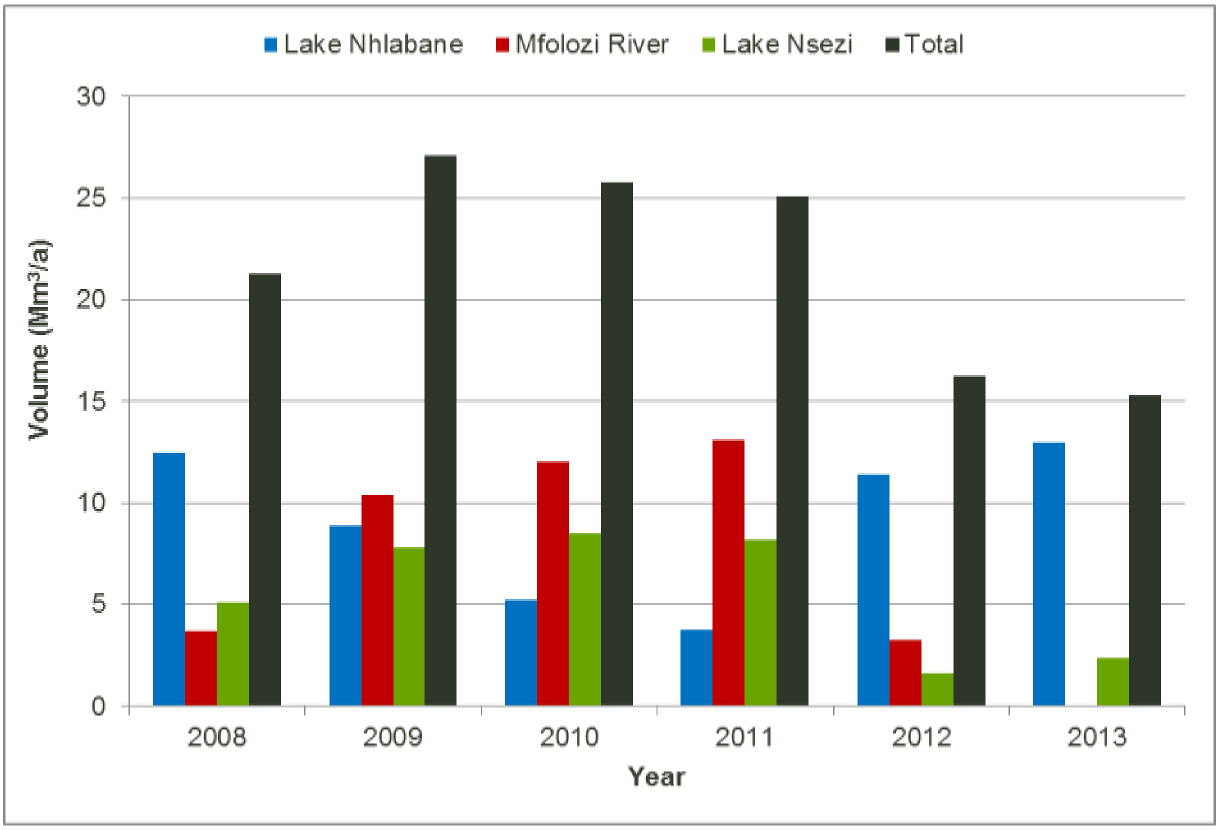
The minerals that are produced from the mining process are stockpiled and then processed in the smelters. Water for the smelter is abstracted from Lake Nsezi. The smelter has its own treatment works and raw water is treated on site for potable use.

Historical Water Use

The RBM annual and daily usages for the different water sources are shown below:

RBM Water Sources

Year	Lake Nhlabane		Mfolozi River		Lake Nsezi		Total	
	Annual *(Mm^3)*	***Daily*** *(Ml)*	***Annual*** *(Mm^3)*	***Daily*** *(Ml)*	***Annual*** *(Mm^3)*	***Daily*** *(Ml)*	***Annual*** *(Mm^3)*	***Daily*** *(Ml)*
2008	12.48	34.20	3.71	10.17	5.10	13.97	**21.30**	**58.34**
2009	8.86	24.28	10.41	28.51	7.80	21.38	**27.07**	**74.17**
2010	5.23	14.34	12.01	32.90	8.51	23.30	**25.75**	**70.55**
2011	3.77	10.32	13.13	35.97	8.20	22.47	**25.10**	**68.76**
2012	11.37	31.16	3.27	8.96	1.62	4.44	**16.27**	**44.57**
2013	12.95	35.49	0.00	0.01	2.38	6.53	**15.34**	**42.02**



RBM Water Use 2008-2013

Allocations

The allocations for the different sources are shown below, as well as the proposed requirement for Zulti South. The water source for Zulti South has not been finally determined. Options include Lake Nsezi and the Mhlatuze River. This supply will be supplied under the existing allocation granted to Mhlathuze Water and in terms of a water supply agreement to the concluded between RBM and Mhlathuze Water. RBM would like to investigate the possibility of being able to swap water from its existing sources. RBM would investigate the possibility of supplying to Mhlathuze Water from its existing schemes and Mhlathuze Water in turn supplying the equivalent volume of water to RBM to Zulti South.

RBM Allocations

	Average		Maximum		Note
	Annual (Mm^3)	Daily (Ml)	Annual (Mm^3)	Daily (Ml)	
uMfolozi River	21.8	59.6	78.8	216.0	
Lake Nhlabane	-	-	23.7	65.0	
Lake Nsezi	16.4	45	18.3	50.0	
Lake Mzingazi	7.3	20	12.8	35.0	Now swapped with water from Lake Nsezi
RBM Boreholes	-	-	0.2	0.5	Not currently abstracting
Sokhulu Well Field	-	-	3.7	10.0	Not currently abstracting
Total			**30.00**	**82.2**	
Zulti South (future)			14.60	40.0	

It is important to note that RBM's total allocation is less than the sum of the individual allocations for each potential source. This is to enable the different water sources to be used flexibly, dependant on availability.

Foskor

Foskor is one of the large water users in the Richards Bay area. The company produces fertiliser, and the Richards Bay plant produces sulphuric and phosphoric acid, as well as granular fertiliser.

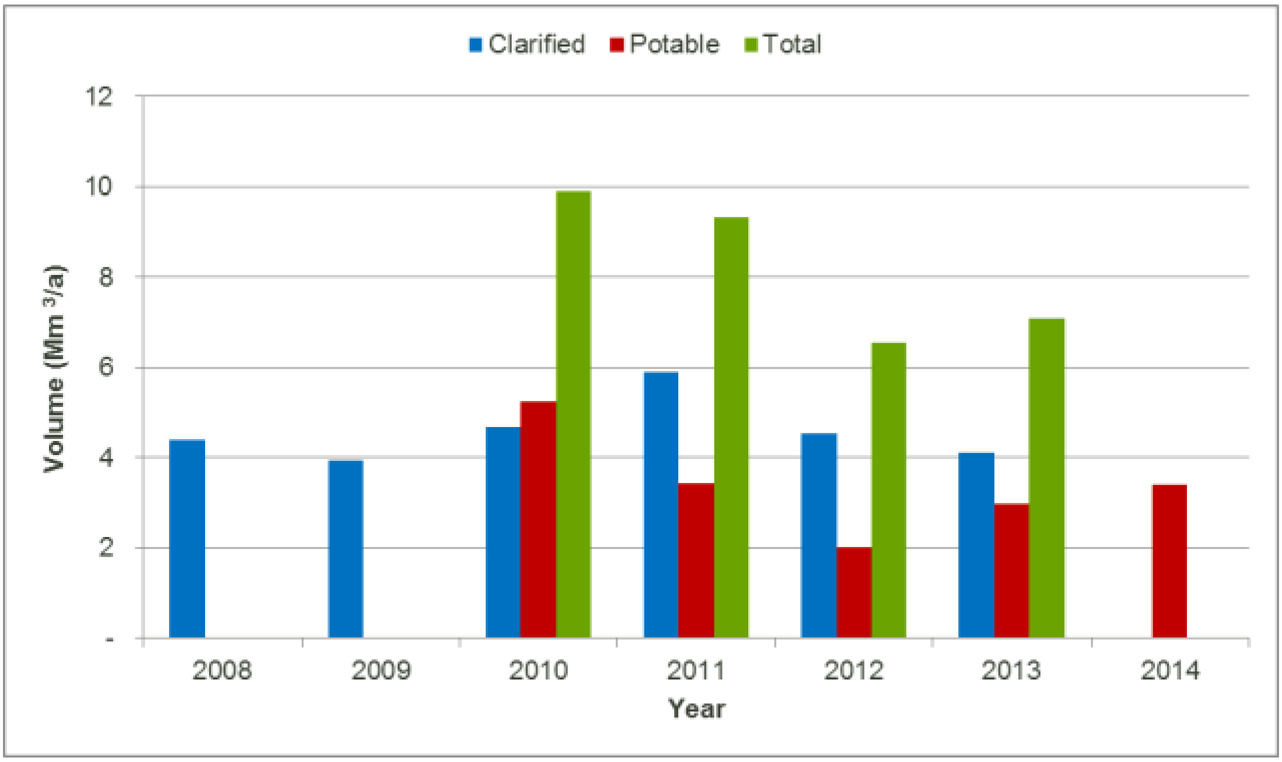
Foskor requires water in two grades – clarified and potable. The clarified water is supplied from the Nsezi WTW, and the potable water from the Mzingazi WTW.

Historical Water Use

The water use volumes for clarified and potable water are given below:

Foskor Water Use

Year	Clarified		Potable		Total	
	Annual (Mm^3)	***Daily (Ml)***	***Annual (Mm^3)***	***Daily (Ml)***	***Annual (Mm^3)***	***Daily (Ml)***
2008	4.40	12.05	-	-	-	-
2009	3.95	10.83	-	-	-	-
2010	4.67	12.79	5.24	14.37	**9.91**	**27.16**
2011	5.90	16.17	3.43	9.40	**9.33**	**25.57**
2012	4.55	12.46	2.01	5.50	**6.56**	**17.96**
2013	4.12	11.28	2.97	8.14	**7.09**	**19.42**
2014	-	-	3.41	8.76	-	-



Foskor Water Use 2008-2013

Foskor Allocation

	Mm^3/a	Ml/d
Clarified	5.48	17.0
Potable	4.96	13.6
Total	**10.44**	**30.6**

Foskor's clarified water allotment was recently increased, from 15 Ml/d to 17 Ml/d (5.48 million m^3/a to 6.205 million m^3/a), and will require a further increase in allocation in future (to 22.75 Ml/d, 8.3 million m^3/a by 2025).

Foskor Future Requirements

Year	Clarified		Potable		Total	
	Annual (Mm^3)	**Daily (Ml)**	**Annual (Mm^3)**	**Daily (Ml)**	**Annual (Mm^3)**	**Daily (Ml)**
2015	6.57	18.00	3.20	8.76	**9.87**	**26.76**
2017	8.07	22.10	4.34	11.90	**12.41**	**34.00**
2018	8.30	22.75	4.47	12.25	**12.78**	**35.00**
2025	8.30	22.75	4.47	12.25	**12.78**	**35.00**

Tronox

Tronox, formerly called Exxaro Sands, mines the coastal dunes south of Richards Bay for heavy minerals – ilmenite, zircon and rutile. The Hillendale mine, near eSikhaleni, has been exhausted and is being decommissioned, and the Fairbreeze mine, south of Mtunzini, is being prepared for the mining of ilmenite, zircon, rutile and leucoxene. Full mining operations at Fairbreeze are expected to commence in 2016 and be completed by 2027. In 2028, operation of the Port Durnford Mine will commence, and it is planned to be in operation until 2058.

Tronox has a central processing plant north-west of Empangeni, where the heavy minerals are refined and smelted.

Allocations

Mhlathuze Water has set aside an 11.48 million m^3/a (31.46 Ml/d) amount of water from the Mhlatuze weir for use at Hillendale Mine. It is planned that the Fairbreeze Mine will require17.83 million m^3/a (48 Ml/d) when fully operational. This will likely also be supplied from the Mhlatuze weir, via the Hillendale pipeline and along a new pipeline from there to Fairbreeze Mine. A water use licence for this is being processed by DWA. The licence application is for 22.69 million m^3/a (62.16 Ml/d), and will be effective until 2027 when the mining at Fairbreeze will be completed. A mine at Port Durnford is planned to replace Fairbreeze Mine in 2028 and will be worked until 2058. The requirement will be 20.26 million m^3/a (55.5 Ml/d), and presumably a licence will be applied for closer to the time.

The central processing plant outside Empangeni receives potable water from the Nsezi WTW.

It was originally planned that the Fairbreeze Mine would be supplied from the Thukela River. A licence was issued in 2005 for Mhlathuze Water to transfer water from the Thukela River, abstracting at Mandini, some 35km south of Fairbreeze. Of the total amount of 47.3 million m^3/a (130 Ml/d), 45% of the licence was planned to be for Fairbreeze's use. The water supply infrastructure was however not constructed for Tronox to access this licenced use at Fairbreeze Mine. Mhlathuze Water is applying to transfer this allocation to the Middledrift transfer point, but, until this is effected, the Fairbreeze Mine will be supplied from the Mhlatuze weir from Mhlathuze Water's existing water allocation.

Tronox Water Allocations

Allocation	Mm^3/a	Ml/d
Hillendale (current)	11.48	31.46
Fairbreeze (2016-2027)	22.60	62.2

Planned Water Requirements

Planned requirement	Mm^3/a	Ml/d
Fairbreeze (2016-2027)	17.83	48.8
Port Durnford (2028-2058)	20.26	55.5

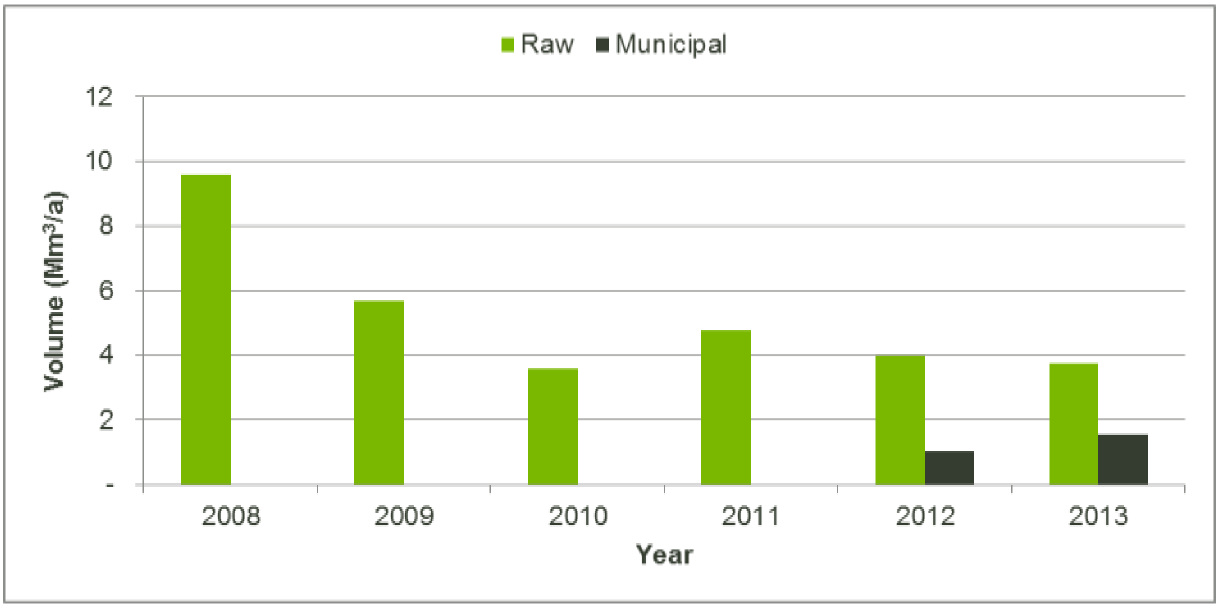
Historical Water Use

In addition to the raw water abstracted from the Mhlatuze weir, potable water from the Nsezi WTW is used for the processing plant.

Tronox Water Use

Year	Raw Water		Treated Water	
	Annual (Mm^3)	Daily (Ml)	Annual (Mm^3)	Daily (Ml)
2008	9.58	26.24		
2009	5.69	15.58		
2010	3.56	9.77		
2011	4.78	13.10		
2012	3.98	10.90	1.04	2.84
2013	3.75	10.28	1.55	4.24

Tronox Water Use 2008-2013



Effluent

Effluent volumes are currently 669,890m^3/a, which is discharged through the sea outfall pipeline.

Hillside and Bayside Aluminium (BHP Billiton)

The two BHP Billiton aluminium smelters are the largest electricity users in the area but their water use is not proportional, although they are still significant users. Hillside produces ingots, and Bayside further processes aluminium.

Bayside Closure

Indications are that Bayside is in the process of closing down, owing to low aluminium prices and increasing competition. The operation of the casthouse will continue, and the assumption that was made for the effect on the water use will be that the potable water use will continue in full and the raw water abstraction will cease.

Only data for 2013 is available for Bayside Aluminium, but it is known that the Hillside smelter uses 0.72Mm^3/a (1.97 Ml/d), and that it receives treated water from the Mzingazi WTW. The allocation is 0.75Mm^3/a (2.05 Ml/d). Bayside abstracts 0.94 Ml/d of raw water from Lake Mzingazi, and its domestic water requirement (0.5 Ml/d) is also supplied by the Mzingazi WTW.

The effluent volume from Hillside was 0.13 million m^3/a for 2013. Recycled water is supplied to Foskor; and the 2013 volume was 1.07 million m^3/a.

Richards Bay IDZ

The Richards Bay IDZ is involved in developing areas in and around Richards Bay for industrial use. This includes planning and provision of all services, including water. The industry is planned to be mostly heavy industrial with some light industrial and some commercial industries.

Two phases are planned for development during the planning period of this reconciliation strategy. Phase 1, which consists of phases 1A, 1D and 1F, is developed first. These sites are all in Richards Bay - see the locality map (Figure 1-1) for the location of the various phases. Phase 1A is currently in development, and is planned to source its water from the municipal system (i.e. Mzingazi WTW). Phase 1D will also use municipal water and the space will mostly be taken up by a pulping plant (Pulp United). A value for the expected usage is given in Mhlathuze Water's feasibility study for the expansion of the Nsezi WTW[23]. This was specified as being required from 2012, but this phase has not been constructed yet. Furthermore, the development of the pulping industry is dependent on the supply of wood, and the DWA stopped issuing licences for forestry in the area about ten years ago, in order to protect the water resources in the Mhlatuze catchment. Although there is the possibility that the pulpers might use wood-chips from sources that are currently exporting, the growth of the industry in this area is still likely to be constrained. The full potential of these plans might not be realised, but the water requirement (or portions thereof) for phase 1D was included in the scenarios, for 2022, when there is likely to be at least some development.

It is planned that the municipal supply to Phase 1F, of which about 30% will be taken up by Tata Steel, should be supplemented from the proposed further phases of the Thukela transfer system, they materialise. Water supply options would need to be considered for different scenarios. The date given in the IDZ report for this phase was 2015, but, again, this phase has not commenced yet. It is possible that by 2017 there will be some requirement, so this date was used in the scenarios.

Finally Phase 2, which is to be located north of Richards Bay, near RBM, is planned to have its water services integrated with a new bulk water system for supplying KwaMbonambi from Nsezi WTW[8]. A commencement date of 2013 was given, and 2022 was again used in the scenarios.

IDZ Phases and Water Requirements

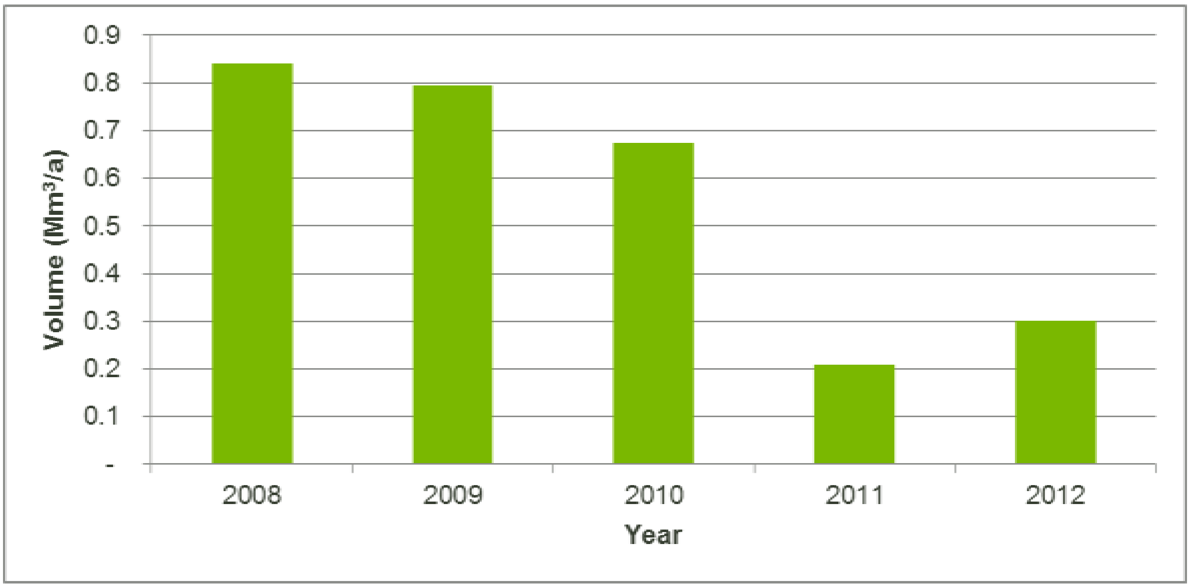
Period	Phase	Area (Ha)	Water Requirement (Mm^3/a)	Water Requirement (Ml/d)	Source
Under construction	1A	60	0.62	1.69	Municipal (Mzingazi WTW)
2012 (assumed 2022)	1D	65	5.48	15.00	Municipal (Mzingazi WTW)
2015 (assumed 2017)	1F	175	0.82	2.26	Municipal (Mzingazi WTW)
2013 (assumed 2022)	2	1000	6.31	17.29	New bulk system
2022-32	2	unknown	15.44	42.30	

Richards Bay Coal Terminal

The RBCT and Harbour was previously amongst the larger water users, but as a result of the implementation of an effective water efficiency project, this use has been significantly diminished in recent years, and is no longer one of the larger users in Richards Bay.

RBCT Water Use

Year	Annual (m^3)	Daily (Ml)
2008	839,500	2.30
2009	794,478	2.18
2010	672,779	1.84
2011	208,711	0.57
2012	300,831	0.82



RBCT Water Use 2008-2012

Tongaat Hulett Sugar Mill and Mpact

The Felixton Sugar Mill processes all the harvested sugar cane in the area. The mill was constructed by Tongaat Hulett in the 1970's, as the largest in the Southern Hemisphere, replacing three smaller, ageing mills, one of which had been on the site since 1911. It employs some 4 100 people directly and indirectly and contributes R 600 million to the GDP, but is presently running at some 50% of its capacity.

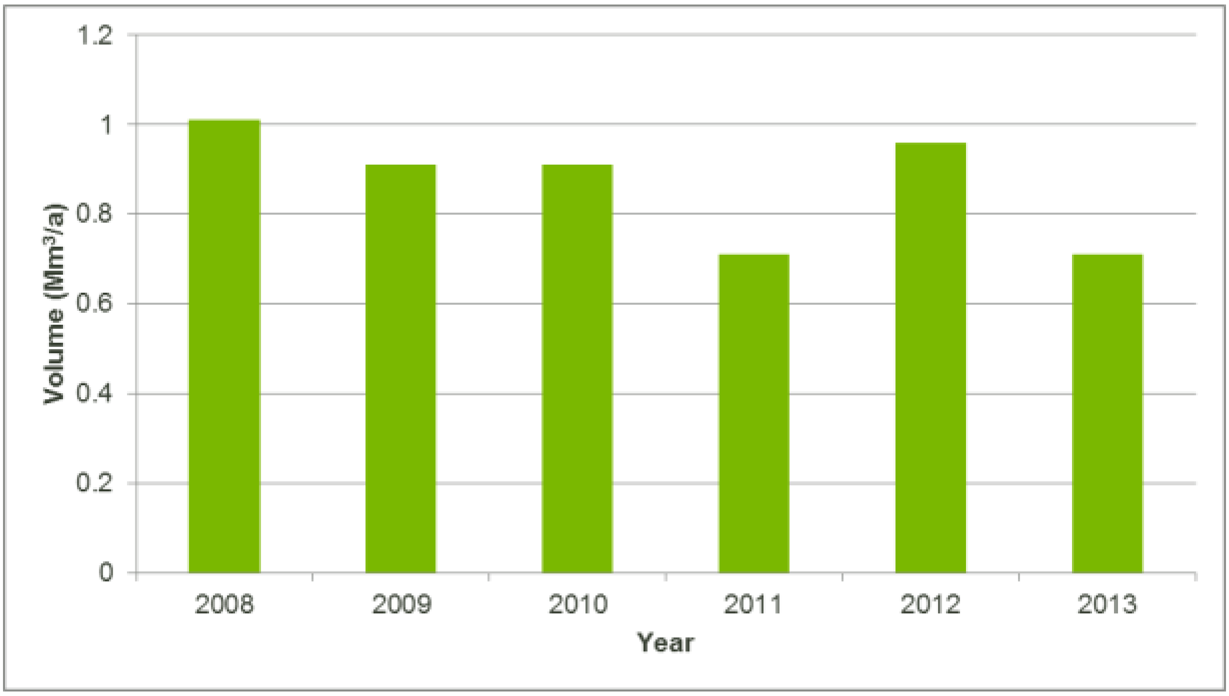
The Mpact Paper Mill started life as the Ngoye Paper Mill in order to utilise bagasse from the adjacent sugar mill. It was later purchased by Mondi Packaging South Africa, and in 2011, Mpact demerged from Mondi, to become a separately registered entity on the JSE.

These two users are located outside of the urban area and were granted a Water Court order for the abstraction of water from the Mhlatuze River. Potable water is supplied from Tongaat-Hulett WTW to both of these users[20]. They abstract raw water individually from the Mhlatuze River. Previously Mhlathuze Water was registered for abstracting 3.15 million m^3/a (8.63Ml/d) nominally for Mpact[2], although this actually supplied Tongaat-Hulett as well. Following the Compulsory Licensing exercise in the catchment, Tongaat-Hulett is to be issued with its own licence for 1.89 million m^3/a (5.17Ml/d) and Mpact is to be licensed for 2.48 million m^3/a. Effluent from both users is treated in the Tongaat-Hulett WWTW and discharged to Tongaat-Hulett WWTW, and then into the uMhlatuze River[20].

Tongaat-Hulett is interested in obtaining an additional 1Mm^3/a from Mhlathuze Water for a project involving electricity generation from their by-products.

Tongaat-Hulett Water Use

Year	Annual Use (Mm^3)	Daily use (Ml)
2008	1.01	2.77
2009	0.91	2.49
2010	0.91	2.49
2011	0.71	1.95
2012	0.96	2.63
2013	0.71	1.95



Tongaat Hulett Water Use 2008-2013

Jindal Mine

Jindal Mining KZN is currently carrying out an exploration in the Melmoth area for a possible iron ore mine. To date, the investigations have found that there is an iron ore body in the mountains north of Goedertrouw Dam, between Melmoth and Eshowe. A scoping study has been completed, and Jindal is progressing to the pre-feasibility study stage. An environmental and social impact assessment (ESIA) is also being undertaken.

The mine will likely include elements such as an open pit mine, a beneficiation plant where the ore is processed and refined, and a pelletizing plant where the iron ore concentrate from the beneficiation plant would be pelletized. Associated infrastructure for transporting the products and the water supply will also form part of the operation. The life of the mine is anticipated to be approximately thirty years. Production could commence, all circumstances being favourable, by 2017, with the mine reaching full production in 2018.

The production of the mine is expected to be in the order of 20 million tons/a delivered to the beneficiation plant. The beneficiation plant processes the ore into wet iron ore concentrate, which is then fed into the pelletizing plant and the pellets would then be exported.

The water requirements for this development will vary depending on the location of the plants relative to the mine. The base case, where the pelletizing plant would be located at the mine site, would give rise to a water requirement of 8 million m^3/a. The alternate case, where the iron ore concentrate slurry would be pumped to a plant in Richards Bay, would require a volume of 14 million m^3/a for water requirement. The indication currently is that the water for the mine will be sourced from Goedertrouw Dam. The mine and plants would be supplied from the dam via a pump station built and operated by Jindal.

For the scenarios in this report the base case is used for water use predictions.

Other industries

The industries discussed above are the major water users in the study area. However, there are also a large number of smaller users and the light-industry in Richards Bay and Empangeni contributes to the water requirements of each town.

Smaller users include Tata Steel, Bell Equipment and many others. It is planned that Tata steel will occupy about 55ha of the Richards Bay IDZ phase 1F, and will be supplied according to those plans. Otherwise, those industries within Empangeni and Richards Bay are supplied by the same WSS as the urban use for the towns.

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