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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

CONTINUATION OF THE INTEGRATED VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2)

TRAINING PROGRESS STATUS REPORT 1

October 2018

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Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: NATIONAL WATER RESOURCE PLANNING

STRATEGY STEERING COMMITTEE FOR THE CONTINUATION OF THE VAAL RIVER SYSTEM RECONCILIATION STRATEGY STUDY (PHASE 2)

TRAINING PROGRESS REPORT 1

OCTOBER 2018

COMPILED FOR:	COMPILED BY:
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Title:	***Training Progress Report 1***
Authors:	*Study Team*
Project Name:	*WP11182:* ***Continuation of the Integrated Vaal River system Reconciliation Strategy (Phase 2)***
Status of Report:	*Final*
First Issue:	*October 2018*

Consultants: BATATISE/UWP/WRP Joint Venture

Approved for the Consultants by:

.....

C Talanda

Study Leader

DEPARTMENT OF WATER AND SANITATION

Directorate National Water Resource Planning

Approved for the Department of Water and Sanitation by:

.....

J Rademeyer

Chief Engineer: National Water Resource Planning (Central)

.....

P Mlilo

Director: National Water Resource Planning

TABLE OF CONTENTS

1 BACKGROUND AND PURPOSE

A Training Plan for the Department of Water and Sanitation (DWS) Reconciliation Strategy Studies (Richards Bay, Mbombela, Vaal) has been developed and the main purpose of the document is to provide a consolidated Training Plan for the three parallel Reconciliation Strategies currently being undertaken.

The training approaches proposed by the plan are summarised below:

- **Self-Study:** Provide designated reading material to the trainees to study. The aim of this is to provide the trainees with the background information of the previous Reconciliation Strategies developed for the three study areas. The trainees will be asked to present a summary of the information reviewed, which will be followed by a question and answer session.
- **Lectures:** Eight training courses will be provided in the form of lectures:
    1. Water Requirements
    2. Water Conservation / Water Demand Management
    3. Water Resources Yield Analyses
    4. Water Resources Planning Analyses
    5. Groundwater- surface water interaction
    6. Water Balances
    7. Reconciliation Interventions
    8. Other Specialized Aspects
- **Practical's:** A Practical element will be included as part of the eight training courses where applicable.
- **Mentoring / Coaching:** Mentoring and coaching of trainees on a day to day basis by DWS Study Managers.
- **Site Visits:** Six site visits, two for each Study Area, will be arranged throughout the duration of the studies in order for the trainees to get a practical understanding of certain aspects of the Reconciliation Strategies.

- **Clarification Sessions:** Clarification and explanation discussions will be scheduled shortly after each Technical Support Group (TSG) meeting, in order for the trainees to be provided with additional training on items they may not have understood.

The purpose of this document is to present the Training Plan progress up to 31 October 2018.

2 PROGRESS

The current progress with regards to the difference training approaches are summarised below:

- **Lectures:** Lecture 1: Water Requirements took place on 3 and 4 October 2018. The following information is presented in the Appendices:
    1. Agenda (**Appendix A**)
    2. Presentations (**Appendix B**)
    3. Attendance Register (**Appendix C**)
- **Practical's:** Practical's were included as part of the Lecture 1 training course as presented in the Agenda (**Appendix A**).
- **Self-Study:** The GT's reviewed the previous Reconciliation Strategies developed for the three study areas and presented a summary of these at the Lecture 1 training course. The presentations were followed by a question and answer session, where items
- **Mentoring / Coaching:** Mentoring and coaching of trainees is undertaken on a day to day basis by DWS Study Managers.
- **Site Visits:** No site visits have taken place to date.
- **Clarification Sessions:** Brief clarification and explanation discussions have taken place after the TSG Meetings when required.

APPENDIX A:

LECTURE 1: WATER REQUIREMENTS AGENDA

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Directorate: National Water Resource Planning

TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

AGENDA: DAY 1

Time	**9:00am**	
Date	**Wednesday, 3 October 2018**	
Venue	WRP Offices. Upper Level, 5 Greenpark Estate, 27 George Storrar Drive, Groenkloof Pretoria	
9:00	**1. Welcome and Introduction of Members**	C Seago
9:10	**2. Training Plan Orientation**	C Seago
9:20	**3. Graduate Trainee Presentations**	GT's
10:20	**4. Group Discussion**	All
11:30	**5. Water Requirements Main Components**	S Jahnke
12:00	**6. Theoretical Water Requirement Projections**	S Jahnke
12:30	**LUNCH**	
13: 15	**6. Theoretical Water Requirement Projections (cont.)**	S Jahnke
14:15	**7. PRACTICAL: Theoretical Water Requirements Projections**	S Jahnke/C Talanda
14:45	**TEA**	
15:00	**7. PRACTICAL: Theoretical Water Requirements Projections (cont.)**	S Jahnke/C Talanda
16:00	**CLOSURE**	C Seago

TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

AGENDA: DAY 2

Time	**9:00am**	
Date	**Thursday, 4 October**	
Venue	WRP Offices. Upper Level, 5 Greenpark Estate, 27 George Storrar Drive, Groenkloof Pretoria	
9:00	**1. Overview of Day 1**	C Seago
9:10	**2. Demographic Analysis**	R Aird
11:10	**3. Calibrated Water Requirement Projections**	C Talanda
12:30	**LUNCH**	
13: 15	**4. PRACTICAL: Water Requirement Projections**	C Seago/C Talanda
14:45	**TEA**	
15:00	**5. Return Flows**	C Talanda
16:00	**CLOSURE**	PSP

APPENDIX B:

LECTURE 1: WATER REQUIREMENTS PRESENTATIONS

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REPUBLIC OF SOUTH AFRICA

TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

Day 1 – Item 1: Water Requirements Main Components
Thursday, 4 October 2018

WATER IS LIFE, SANITATION IS DIGNITY

OVERVIEW

1. INTRODUCTION
2. WATER USE SECTORS
3. WATER REQUIREMENTS DATA SOURCES
4. CONCLUSION

1. INTRODUCTION

- Water requirements are defined as the amount of water needed per water use sector
- There are number use sectors, such as:
  - Domestic/ Light Industrial/ Commercial
  - Industrial/ Mines
  - Irrigation
  - Stream flow reduction (indirect water requirement)
    - Afforestation
    - Invasive Alien Plants
  - Reserve
- To determine the actual water requirements of each sector requires extensive consultation with relevant stakeholders and study of existing reports

2.1 WATER USE SECTORS – DOMESTIC/ LIGHT INDUSTRIAL/ COMMERCIAL

- Domestic Water Requirements determined per person/household and respective Level of Service (LOS) category
- Use population statistics from Statistics SA/ Eskom spot building counts e.g.:
  - Census 2001
  - Census 2011
  - 2016 Eskom Spot Building Counts
- LOS population split is derived primarily from income classes for a specific areas
- Light industrial/ commercial users typically accounted for in domestic component

2.1 WATER USE SECTORS – DOMESTIC/ LIGHT INDUSTRIAL/ COMMERCIAL CONT.

- Population allocated to each Level of Service (LOS) category

	Category	Dwelling Type		Average Consumption (l/capita/day)
FORMAL	1	Flats		226
	2	Clusters		255
	3	Single Residential	Low Income	101
	4		Medium Income	189
	5		High Income	304
	6		Very High Income	442
INFORMAL	7	Informal	Below RDP Level	12
	8		RDP Level	40
	9		Above RDP Level	80

2.1 WATER USE SECTORS – DOMESTIC/ LIGHT INDUSTRIAL/ COMMERCIAL CONT.

- In addition to direct per capita water usage there are secondary uses – for public and private services (DWAF, 2001)

Classification	Component				
	Commerce	Industrial	Institutional	Municipal	Total
Metropolitan Cities / Towns Isolated / Towns Industrial	0.20	0.30	0.15	0.08	0.73
Towns Country	0.10	0.15	0.03	0.10	0.38
Towns Special	0.30	0.15	0.08	0.03	0.56
New Centres	0.15	0.08	0.08	0.08	0.39

- Water Treatment Losses =5%, Distribution Losses = 15% (DWS Guidelines)

2.2 WATER USE SECTORS – INDUSTRIAL/ MINING USERS

- Industrial and mining water usage determined through water service provider, municipality or direct consultation with stakeholders
- Water use varies significantly for different industries, processes and locations
- Can also be estimated with derived factors

2.3 WATER USE SECTORS – IRRIGATION USERS

- Irrigation water use accounts for major portion of water requirements in South Africa
- Water requirements can be obtained directly from irrigation boards and water user associations
- Use Verification and Validation (V&V) irrigation datasets as benchmark/ check
- Land Use datasets for area verification

2.4.1 STREAM FLOW REDUCTION – AFFORESTATION

- Make use of Verification and Validation (V&V) afforestation datasets
- Possible use of Land Use datasets to verify areas if budget is available
- Stream Flow Reduction can be derived from areas, though modelling, e.g. modelling (Pitman)

2.4.2 STREAM FLOW REDUCTION – INVASIVE ALIEN PLANT SPECIES

- Invasive alien plant species (IAPs) are known to reduce runoff
- Distinguished between riparian and upland IAPs
- Riparian IAPs have greater runoff reduction
- Use existing IAP surveys to determine IAP areas, classification (small, medium, tall trees) and densities
- No database to continuously track changes in IAP areas and densities

2.4.2 STREAM FLOW REDUCTION – INVASIVE ALIEN PLANT SPECIES

- Various IAP eradication programs are currently active, such as:
  - Working for Water Initiative under the Department of Environmental Affairs (DEA)
  - SANBI smaller IAP eradication programs
  - Individual stakeholders
- Stream Flow Reduction can be derived from areas, though modelling, e.g. modelling (Pitman)

2.6 RESERVE

- Reserve consists of an Ecological (Environmental) Water Requirements and a Basic Human Needs (BHN) component
- Ecological Water Requirements are determined for a specific point in a catchment after extensive reserve classification studies have been undertaken (iterative process)
- Final reserve flow rates and volumes published in a Government Gazette
- Percentage of natural runoff (not constant demand)

3.1 SOURCES FOR WATER REQUIREMENTS – DOMESTIC/ LIGHT INDUSTRIAL/ COMMERCIAL WATER REQUIREMENTS

- Obtain existing Study Reports
  - Water Reconciliation Reports
  - Water Availability Assessments Study (WAAS) Reports
  - Municipal Master Plan Reports
- Use Blue and Green Drop Reports as benchmark of water and waste water volumes, and capacities
- Engage with Local Municipalities and Water Service Providers
- Use population statistics and trends to determine possible growth rates
- Note: Average annual compounded population growth 1.1% to 1.5% → guideline to increase in Water Requirements Projection

3.2 SOURCES FOR WATER REQUIREMENTS – MINING AND INDUSTRIAL WATER REQUIREMENTS

- Mining and industrial water requirements sourced directly from stakeholders and municipal/ DWS accounts
- Can estimate and model water requirements
- Obtain water allocations and license volumes as check
- Some mines or industrial water users might not use allocated volumes

3.3 SOURCES FOR WATER REQUIREMENTS – IRRIGATION AND AFFORESTATION DATASETS

- Existing WAAS and V&V studies
- Interrogate irrigation and afforestation datasets
- Ensure that changes in irrigation and afforestation areas and corresponding crop water requirements are realistic
- Identify discrepancies in dataset and complete "ground truthing" exercise

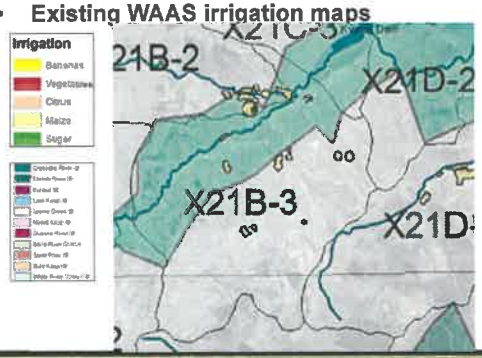
3.3 SOURCES FOR WATER REQUIREMENTS – Irrigation and Afforestation Datasets

- Example of discrepancies which are addressed by ground truthing exercise

- Use Satellite images from different years
- **Land Cover dataset**
- Existing WAAS irrigation map

3.3 SOURCES FOR WATER REQUIREMENTS – Irrigation and Afforestation Datasets

- Use Satellite images from different years
- Land Cover dataset
- **Existing WAAS irrigation maps**



3.3 SOURCES FOR WATER REQUIREMENTS – Irrigation and Afforestation Datasets

- Polygons drawn to measure "realistic" areas

3.4 SOURCES FOR WATER REQUIREMENTS – IAPS

- Information on actual IAP areas and densities sourced from national IAP survey or WAAS reports
- Only Few records available, which track the changes in IAP after eradication programs
- Most recent national IAP Survey was completed in 2011 http://bgis.sanbi.org/Projects/Detail/162
- Some eradication data can be sourced from working for water program https://www.environment.gov.za/projectsprogrammes/wfw

3.5 SOURCES FOR WATER REQUIREMENTS – RESERVE

- Obtain Classification Studies which determined the Reserve
- Some catchments have a minimum Reserve flow rate which is gazetted
- Note that the reserve is not a fixed water requirement, but it varies with the natural mean annual runoff, to mimic natural streamflow cycles

4 CONCLUSIONS

- Extensive efforts required to determine comprehensive water requirements
- Historic water use data and projected water requirements important to understand trends and to develop timeous intervention strategies
- Recordkeeping of water use is often neglected
- Interrogate data – Does it make sense?
- Make use of simple checks to determine quality of data
- Urgent action should be taken by local authorities to track water use and to understand trends and make provision for changes in demands

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TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES
LECTURE 1: WATER REQUIREMENTS

Day 1 – Item 2: Theoretical Water Requirements
Thursday, 4 October 2018

WATER IS LIFE, SANITATION IS DIGNITY

OVERVIEW

1. INTRODUCTION
2. METHODOLOGY
3. CONCLUSION

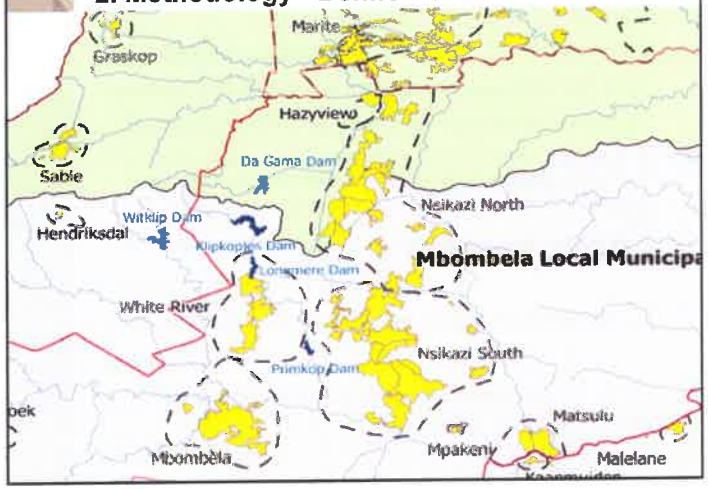
1. INTRODUCTION

- Focus on domestic/ light industrial/ commercial water requirements
- Determine what the theoretical total water requirements are
- Use as benchmarking instrument
- If major differences are found between actual and theoretical water requirements, investigate:
  - actual > theor. more losses or pop. Split/ number incorrect
  - actual < theor. then possible supply shortage or drought
- Nine level of service (LOS) categories with population splits to determine theoretical water requirements, with secondary water requirements and losses

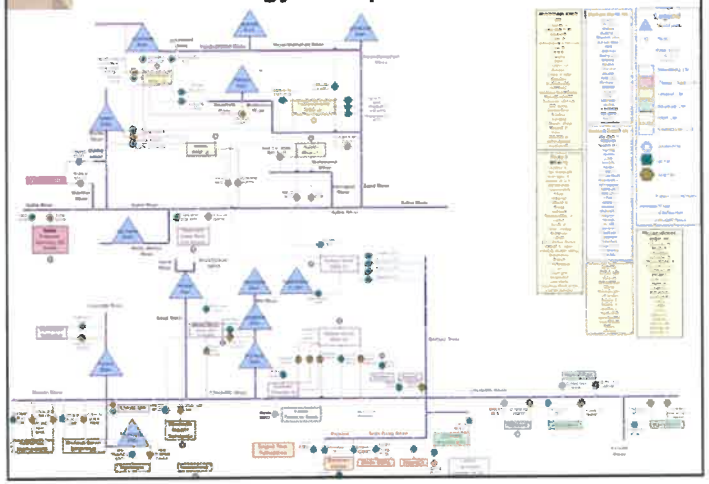
2. METHODOLOGY

- Understand the water supply scheme:
  - Raw water sources
  - treatment works capacities
  - distribution system sanitation levels
  - waste water treatment works capacities
  - return flow destination
- Determine the demand centre boundaries
- Create simplified system layout, to depict sources, demand centres and return flows

2. Methodology - Define Demand Centers



2. Methodology - Simplified Schematic



2. METHODOLOGY

- Use Demographer to determine population trends, such as:
  - Current population per demand centre
  - LOS
  - Projected changes in LOS and population Figures
  - Migration trends etc.
- Alternatively make use of Census/ Eskom Spot Building counts population database
- Obtain a realistic and high population projection (uncertainty envelope)
- Obtain actual secondary water requirements, distribution and treatment losses

2. METHODOLOGY – LOS CATEGORIES

- Population allocated to each Level of Service (LOS) category

	Category	Dwelling Type		Average Consumption (l/capita/day)
FORMAL	1	Flats		226
	2	Clusters		255
	3	Single Residential	Low Income	101
	4		Medium Income	189
	5		High Income	304
	6		Very High Income	442
INFORMAL	7	Informal	Below RDP Level	12
	8		RDP Level	40
	9		Above RDP Level	80

2. METHODOLOGY – SECONDARY AND LOSS FACTORS

- In addition to direct per capita water usage there are secondary uses – for public and private services (DWAF, 2001)

Classification	Component				
	Commerce	Industrial	Institutional	Municipal	Total
Metropolitan	0.20	0.30	0.15	0.08	0.73
Cities					
Towns Isolated					
Towns Industrial					
Towns Country	0.10	0.15	0.03	0.10	0.38
Towns Special	0.30	0.15	0.08	0.03	0.56
New Centres	0.15	0.08	0.08	0.08	0.39

- Water Treatment =5%, Distribution = 15% (DWS Guidelines) and Distribution Losses

2. METHODOLOGY - STEPS

- Split total population per demand centre into the determined LOS categories for entire projection period
- Add the secondary water use components with factors
- Add system losses
- Theoretical water requirements
- No changes in LOS over time is assumed for the theoretical calculation
- Follow the population growth rate for the theoretical water requirements projection

2. METHODOLOGY - STEPS

- Using a theoretical realistic and theoretical high water requirements – provides an uncertainty envelope
- Important to compare theoretical with actual water requirements

3. CONCLUSIONS

- Theoretical water requirements are an important instrument, to indicate anomalies, which need further investigation or a logical explanation
  - Many illegal connections, causing excessive losses
  - High real water consumption
  - Insufficient water supply/ sources
  - etc.
- Theoretical data can be used instead of actual recoded water use if no real data is available (worst case scenario)
- Every study area is unique, can not apply factors and average water consumption per capita to the entire country

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TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES
LECTURE 1: WATER REQUIREMENTS

Day 1 – Item 4: Practical Theoretical Water Requirements
Thursday, 4 October 2018

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PRACTICAL OVERVIEW

- Derive theoretical water requirements from first principals
- Basic assumptions/ characteristics provided
- Compare participants solution and assumption to completed example
- Results should be given in million m^3/a for each year in the projection period, for the realistic and high population projections

EXAMPLE

- Characteristics
  - Medium sized town with acceptable service delivery
  - Realistic and high population projection figures given
  - LOS splits given

Years	2018	2020	2025	2030	2035	2040
Population Realistic	72 000	73 593	77 730	82 101	86 717	91 592
Population High	72 000	74 615	81 577	89 188	97 509	106 606

Category	Dwelling Type		Average Consumption (l/capita/day)	Percentage Population
1	Flats		225	4%
2	Clusters		255	6%
3	Single Residential	Low Income	101	20%
4		Medium Income	189	13%
5		High Income	304	10%
6		Very High Income	442	3%
7	Informal	Below RDP Level	12	8%
8		RDP Level	40	20%
9		Above RDP Level	80	16%

EXAMPLE

COMPOUNDED ANNUAL GROWTH RATE (CAGR)

$$CAGR = (B/A)^{(1/n)}\text{-}1$$

CAGR: COMPOUNDED ANNUAL GROWTH RATE (%)

B: END VALUE

A: NUMBER OF YEARS

- CAGR USUALLY VARY BETWEEN +-0.8% AND +- 3.0 % (HIGH)

EXAMPLE

- Indirect Usage Component (DWAF, 2001)

Classification	Component				
	Commerce	Industrial	Institutional	Municipal	Total
Metropolitan Cities Towns Isolated Towns Industrial	0.20	0.30	0.15	0.08	**0.73**
Towns Country	0.10	0.15	0.03	0.10	**0.38**
Towns Special	0.30	0.15	0.08	0.03	**0.56**
New Centres	0.15	0.08	0.08	0.08	**0.39**

- Losses Water Treatment =5%, Distribution = 15% (DWS Guidelines)

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TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

Day 2 – Item 2: Demographic Analysis

Thursday, 4 October 2018

DEMOGRAPHIC ANALYSIS

CONTENTS

- Population and growth
- Geographic level of study
- Projection methodology
- Sources of data
- Base population determination
- Socio-economic characteristics
- Understanding growth
- Factors to consider in projections
- Scenarios
- Growth projections

Population and growth

POPULATION DEFINITION

- THE WHOLE NUMBER OF PEOPLE OR INHABITANTS IN A COUNTRY OR REGION
- THE TOTAL OF INDIVIDUALS OCCUPYING AN AREA OR MAKING UP A WHOLE

DEMOGRAPHICS

- THE STATISTICAL CHARACTERISTICS OF HUMAN POPULATIONS (SUCH AS AGE OR INCOME) USED ESPECIALLY TO IDENTIFY MARKETS
- RELATING TO THE DYNAMIC BALANCE OF A POPULATION AND CAPACITY FOR EXPANSION OR DECLINE, DEMOGRAPHIC TRENDS A DEMOGRAPHIC SHIFT

POPULATION GROWTH

- Population change is caused by two factors:
  - Natural increase/decrease the net impact of births adding to population size and deaths reducing it.
  - Net migration: the difference between the number of people who move into an area and those who leave.

$$P_{time2} = P_{time1} + births - deaths + (in\text{-}migration - out\text{-}migration)$$

Ptime2 and Ptime1 refer to the populations at the chosen time points between which change is being considered, and births, death and in/out migrations are the levels of the processes that occur in the given time period in the place under consideration. The net of the first two components of the equation (births-deaths) is often referred to as natural population increase/decrease. The result of the calculation of in-migration and out-migration is net migration and can bet either positive or negative.

MIGRATION

•No universally agreed upon definition of 'migration'

•The term 'migration' comprises two components:

- Domestic or internal migration (within a country)
- Foreign or international migration (from one country to another)

•Migration is the incidence of movement by individuals, families or groups seeking to make permanent changes of residence

•Migration adds or subtracts to a given area's population and generally has its most noticeable influence on small areas.

•Migration is a selective process in that it is tied to the life cycle, with greatest chances of migration occurring at major life events such as graduations, marriages and retirements. Thus, migration can have very noticeable effects on the structure of a population. Among other things, over time migration can alter a community's size, age, sex, ethnic and racial profile.

POTENTIAL PUSH & PULL FACTORS FOR MIGRATION

Push factors:

- Forced off land by owner
- War and civil unrest
- Failed crops of subsistence farmers
- Extremes of weather (droughts)
- Rapid increases in populations
- Lower living standards in rural areas
- Boredom with rural life
- Increased mechanisation of farming
- Lack of services

Pull factors:

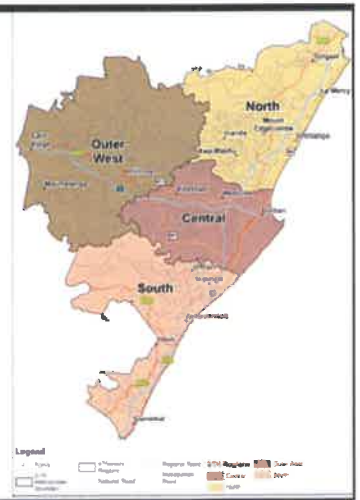
- Perception of better employment opportunities in cities
- Promise of better access to essential services
- Better health facilities in the cities
- Greater opportunities for an education
- More access to entertainment and recreational activities
- Family or friends

Geographic level of study and data

GEOGRAPHIC AREA OF STUDY

- STUDY AREA DEMARCATION
- POSSIBLE SUB-REGIONS
- THE SMALLER THE AREA THE MORE DIFFICULT
- DATA AVAILABILITY
- AREAS OF COMPARISON

Municipality and Sub-Regions



Water Supply Schemes (WSS)

13 WATER IS LIFE - SANITATION IS DIGNITY

Town area demarcation

14 WATER IS LIFE - SANITATION IS DIGNITY

Municipal boundary changes

15 WATER IS LIFE - SANITATION IS DIGNITY

uMhlathuze LM base population data

	KCDM	IMFOLOZI	UMHLATHUZE	UMLALAZI	MTHONJANENI	NKANDLA
2011	907 519	122 889	334 459	213 601	47 818	114 416
2016	971 135	144 363	410 465	233 140	78 883	114 284
% Growth	7,01%	17,47%	22,73%	9,15%	64,97%	-0,12%

Source: uMhlathuze SDF

16 WATER IS LIFE - SANITATION IS DIGNITY

Typical methodology for projections

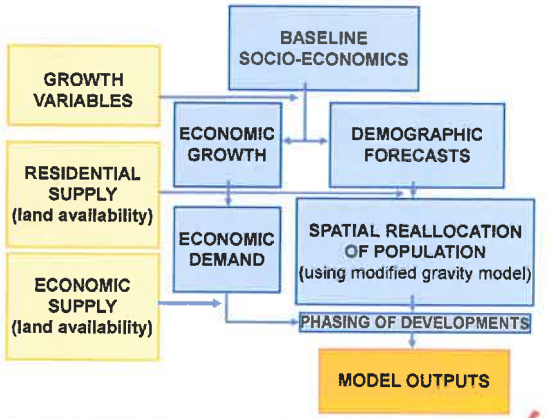
Approach

- Orientation
- Review of existing reports and data sources
- Additional data collection
- Data compilation, analysis and interpretation
- Scenario development and modelling

Approach

- Demographics for previous studies and reports was reviewed
- Determined the existing size and distribution of population and economy. Base year 2016
- Consulted with relevant stakeholders regarding:
  - Municipal plans
  - Current commercial, industrial and residential developments
  - Future proposals for developments and projects
- Modelled population growth and distribution in terms of realistic and high growth scenarios
- Compared to other demographic projections and previous reconciliation studies

Socio-economic Model



Sources of information

POSSIBLE SOURCES OF INFORMATION

STAKEHOLDERS CONSULTED:

- Municipal Departments:

City of Mbombela LM	Bushbuckridge LM
City Planning & Development	Planning
Strategic Planning	LED
Local Economic Development	
Land Use Management	
Dept. of Human Settlements	

- Other stakeholders:
  - Mbombela Economic Development Partnership
  - University of Mpumalanga
  - MP Dept. of Human Settlements
  - Kruger Lowveld chamber of business & tourism

MUNICIPAL PLANS:

- Bushbuckridge LM:
  - SDF, 2017
  - IDP, 2017-2022
  - LED strategy, 2010 – 2014
- City of Mbombela LM:
  - IDP, 2017-2022
  - LED strategy, 2016
  - SDF, 2017
  - Draft Vision 2030, 2017
- Ehlanzeni DM:
  - IDP Review

- **SECONDARY DATA SOURCES:**
  - Statistics SA: Census 2001, Census 2011, Community Survey 2016
  - Eskom Spot Building Counts (SBC), 2007-2015

Sources for Ethekwini

- KZN Provincial Growth and Development Plan (2014)
- KZN Provincial Growth and Development Strategy (2011)
- KZN Provincial Spatial Development Framework (2011)
- KZN Provincial Spatial Economic Development Strategy
- eThekwini Integrated Development Plan (2014/2015)
- eThekwini Draft Spatial Development Framework: Review (2015/2016)
- Central Spatial Development Plan (2013/2014)
- North Spatial Development Plan (2013/2014)
- Outer West Spatial Development Plan (2013/2014)
- South Spatial Development Plan (2013/2014)
- eThekwini Housing Sector Plan (2012)
- eThekwini Industrial Land Strategy (2014)
- eThekwini City Density Strategy (2013)
- Local Area Plans
- Cornubia Framework Plan (2014)
- Development Register for eThekwini per Planning Region (2015)
- Subsidy Housing Projects MTEF, Status, Number of Units and Shapefiles (2015)
- Tongaat Hulett North Western Services Report (2015)
- Transnet Port Development Framework Plan (2014)

Base population

Base population determination

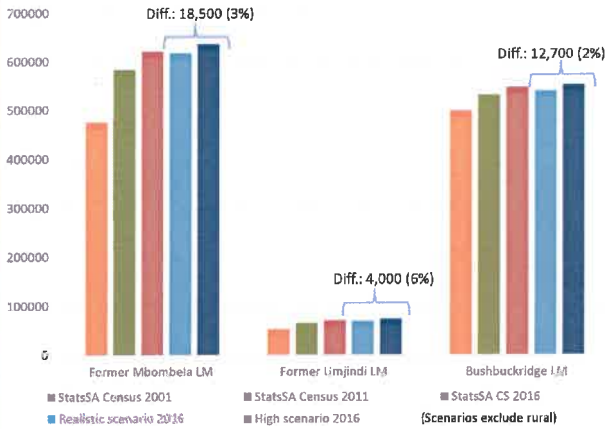
- A 2016 base population was needed at Water Supply Scheme (WSS)
- **Based on latest official StatsSA data :**
  - StatsSA 2016 Community Survey only available at LM level, forms basis
  - WSS base StatsSA 2011 Census

Base population determination

- **Change in distribution (2011 – 2016) accounted:**
  - Analysing growth in Spot Building Counts from 2011 to 2015
  - Consultations with municipal stakeholders

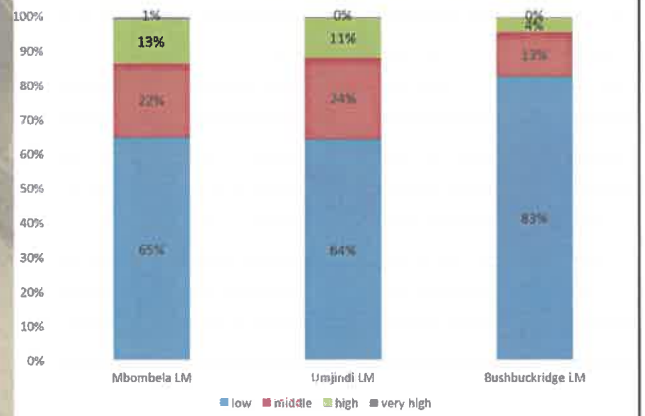
SBC comparison:
2011 vs 2015

2016 Base Population Results



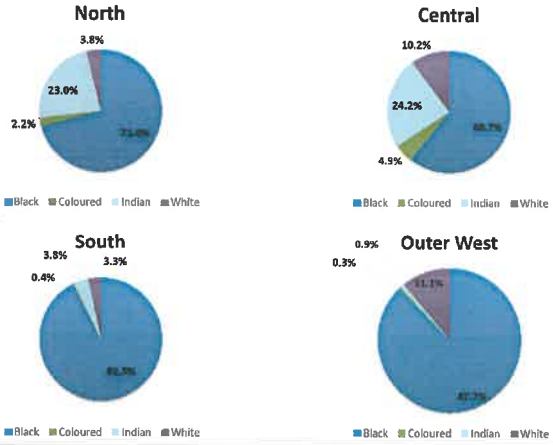
Socio-economic characteristics

Household Income Distribution per LM



Low – less than R40 k Middle – up to R155 k High – up to R1 mil Very high – over R1 mil

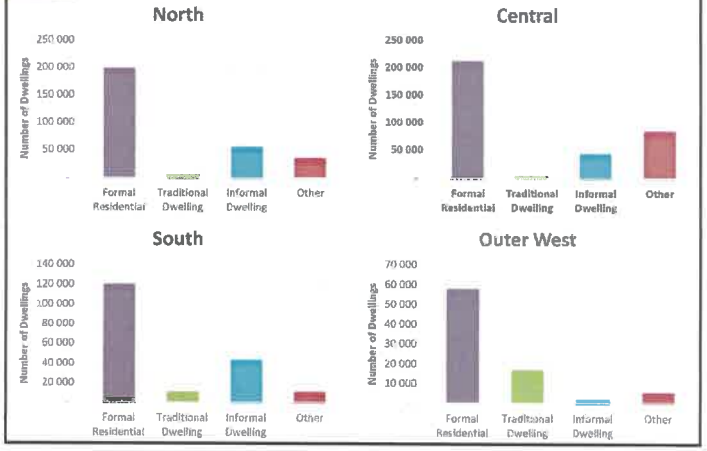
Race Distribution per Region

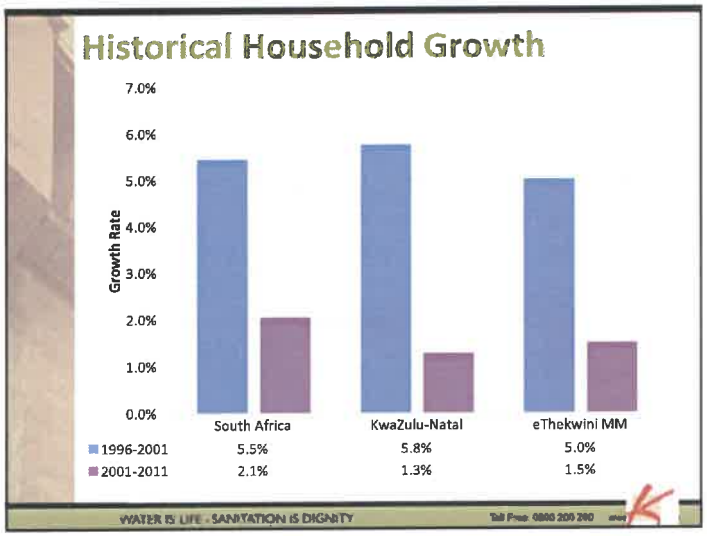


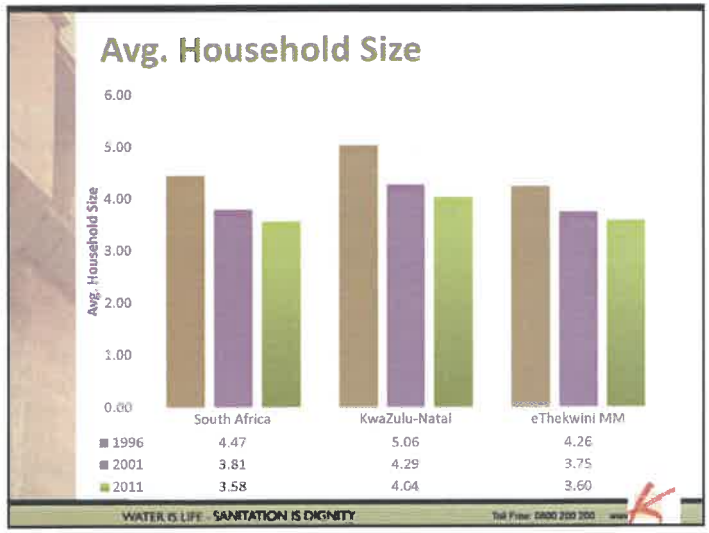
Population by Sub-Place Type

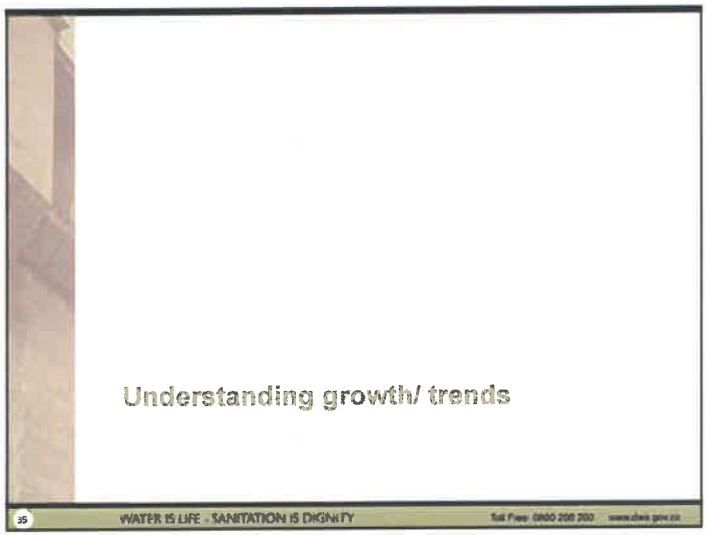
Type	Population	% Distribution
Formal residential	2 356 509	68.5%
Informal residential	492 521	14.3%
Traditional residential	510 710	14.8%
Farms	10 108	0.3%
Parks and recreation	1 121	0.0%
Collective living quarters	25 938	0.8%
Industrial	12 917	0.4%
Small holdings	9 981	0.3%
Vacant	1 414	0.0%
Commercial	21 149	0.6%
Total	3 442 368	100%

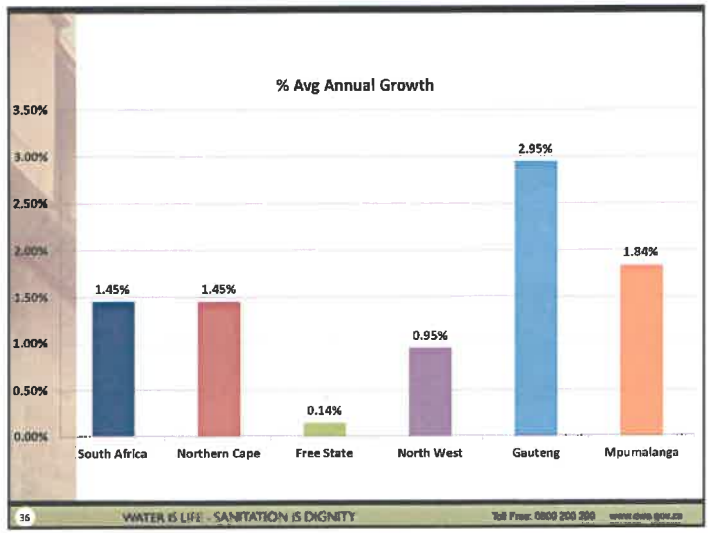
Major Dwelling Type per Region



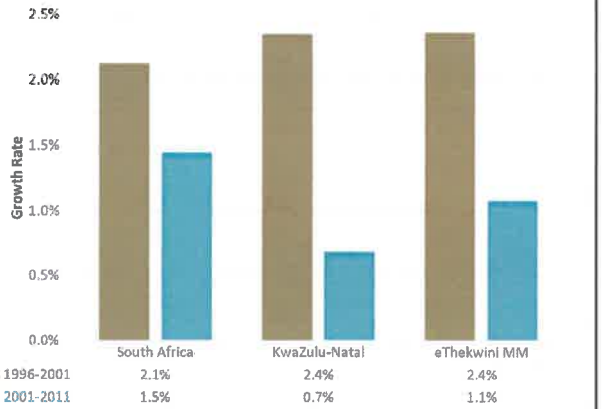

Historical Household Growth
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
Growth Rate
South Africa
KwaZulu-Natal
eThekwini MM
1996-2001 5.5% 5.8% 5.0%
2001-2011 2.1% 1.3% 1.5%
WATER IS LIFE - SANITATION IS DIGNITY


Avg. Household Size
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Avg. Household Size
South Africa
KwaZulu-Natal
eThekwini MM
1996 4.47 5.06 4.26
2001 3.81 4.29 3.75
2011 3.58 4.04 3.60
WATER IS LIFE - SANITATION IS DIGNITY


Understanding growth/ trends
35
WATER IS LIFE - SANITATION IS DIGNITY


% Avg Annual Growth
3.50%
3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%
1.45%
1.45%
0.14%
0.95%
2.95%
1.84%
South Africa
Northern Cape
Free State
North West
Gauteng
Mpumalanga
36
WATER IS LIFE - SANITATION IS DIGNITY

Historical Population Growth



STELLA – 15.5% PA

KATHU – 8.4%PA

DIBENG – 6.9%PA

ERMELO – 5%PA

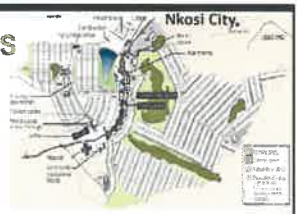
REASONS FOR HIGH GROWTH

- URBANISATION & ECONOMIC OPPORTUNITIES (PERCEIVED)
- INTERNATIONAL INMIGRATION
- MIGRATION FROM E. CAPE AND LIMPOPO
- MINING GROWTH
- POWER STATION RE/ DEVELOPMENT
- LAND REFORM/ FARM REMOVALS/ MIN. WAGES
- SUBSIDY HOUSING/ SERVICE DELIVERY

Factors to consider for projections

Residential Buildings Completed

FUTURE DEVELOPMENTS



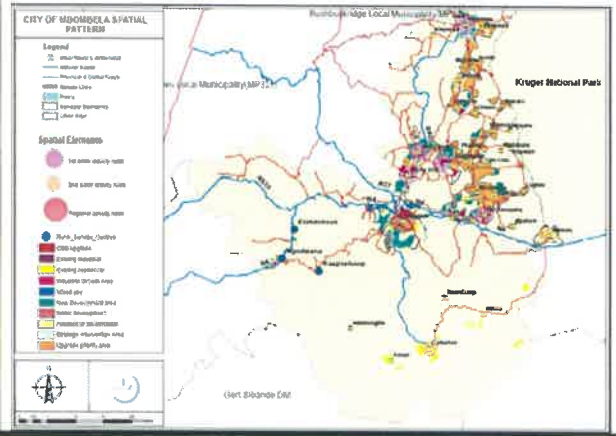
Residential Developments:

- Major residential:
  - Mbombela: e.g. Nkosi City, Phumalani
  - BBR: west of crossing R40 & D4358
- Future Growth Regions:
  - Mbombela: e.g. Matsulu (S), Tshabalala (E), Hazyview (N), N.E of Daantjie (C)
  - BBR: e.g. Orinoco-A SP to Dwarsloop-A and further north to Arthurstone

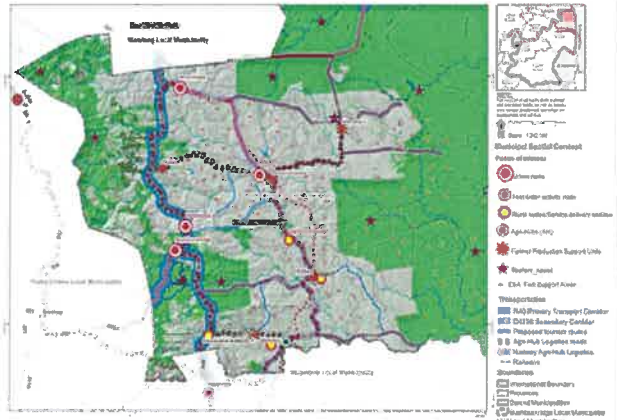
Commercial & Industrial Developments:

- Commercial and mixed use: e.g. Riverside (Mbombela)
- Retail and office developments: e.g. Mataffin node (Mbombela)
- New shopping centres: Intersection R40 & R536 (Mbombela)
- Industrial & commercial growth hubs: e.g. Acornhoek & Mkhulu hub (BBR)

City of Mbombela LM SDF



Bushbuckridge LM SDF

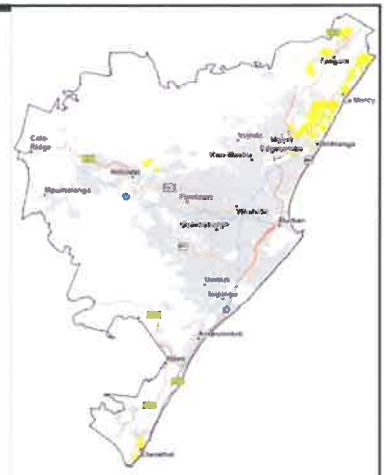


Economic growth

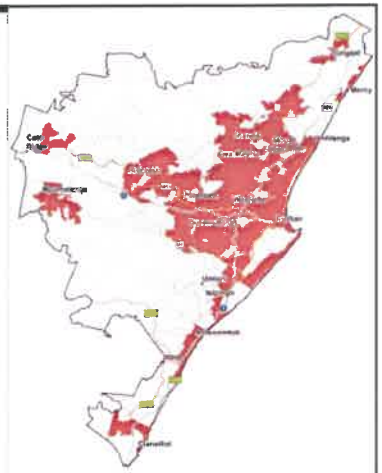
Sector	Growth per Sector (2006-2016)		
	Mbombela (former)	Umjindi (former)	Bushbuckridge
Agriculture	2,9%	2,1%	2,5%
Mining	2,4%	-6,2%	-4,6%
Manufacturing	-0,7%	-0,8%	-0,4%
Utilities	0,9%	-1,1%	2,4%
Construction	3,4%	3,9%	2,4%
Retail Trade	2,0%	0,9%	1,3%
Transport	2,9%	2,5%	0,9%
Business Services	2,2%	1,3%	1,7%
Social Services	3,4%	2,9%	2,6%
Government Services	1,0%	0,8%	0,5%
Total	**2,0%**	**0,04%**	**1,6%**

Detailed analysis

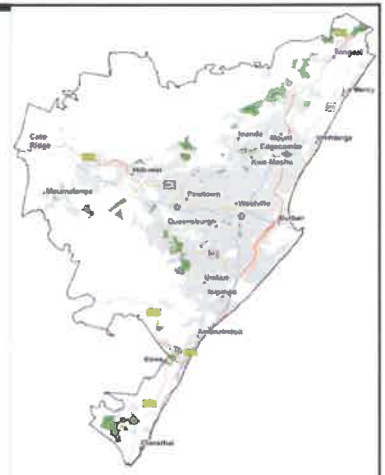
Developments



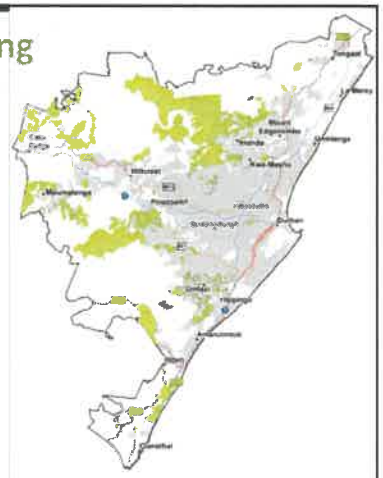
Densification



Greenfields



In-Situ Upgrading



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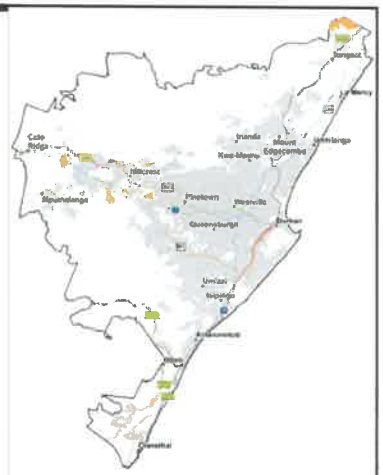
Strategic Development Areas



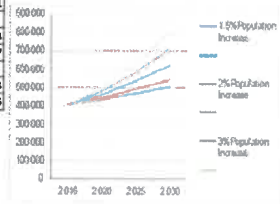
WATER IS LIFE - SANITATION IS DIGN

Scenarios

Municipal population projections

	2 016	2 020	2 025	2 030
1.5% Increase	410 465	435 653	469 322	505 593
Households	103 915	110 292	118 816	127 998
2% Increase	410 465	444 301	490 544	541 600
Households	103 915	112 481	124 188	137 114
3% Increase	410 465	461 982	535 564	620 865
Households	103 915	116 957	135 586	157 181
4% Increase	410 465	480 186	584 220	710 793
Households	103 915	121 566	147 904	179 947
5% Increase	410 465	498 923	636 766	812 693
Households	103 915	126 310	161 207	205 745

According to the municipality's strategy report served before the Corporate Services Portfolio Committee earlier this month, an 'all-embracing road map' is crucial to accelerate transformation and job creation, especially since the municipal population is expected to double by the year 2050.



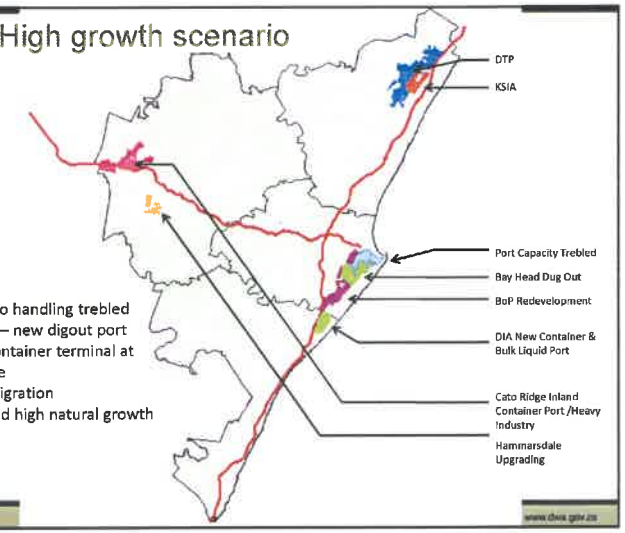
- No selected scenario
- No breakdown by area

Source: uMhlathuze SDF

Population Growth Scenario

- Birth rate to continue to decline
- Death rate stabilised (no new HIV/ AIDS or other shocks)
- Estimated natural growth rate to continue to decline
- In-migration trends and characteristics still largely unknown
- Assumed high in-migration trends are passed and rate will decline further and stabilise
- Household size will continue to decline in line with trends and stabilise

High growth scenario

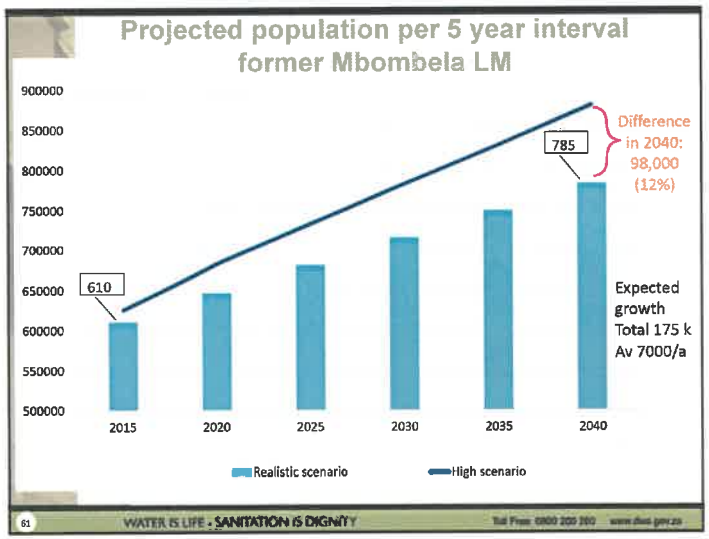


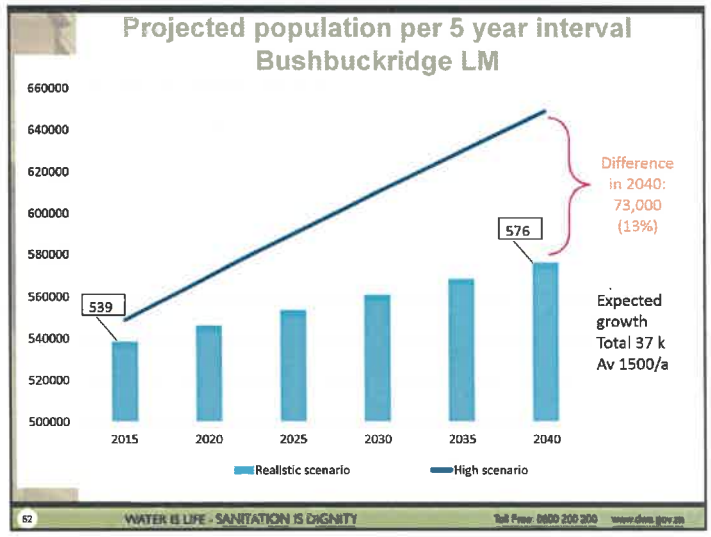
- Port cargo handling trebled
- DIA land – new digout port
- Inland container terminal at Cato Ridge
- High inmigration
- Continued high natural growth

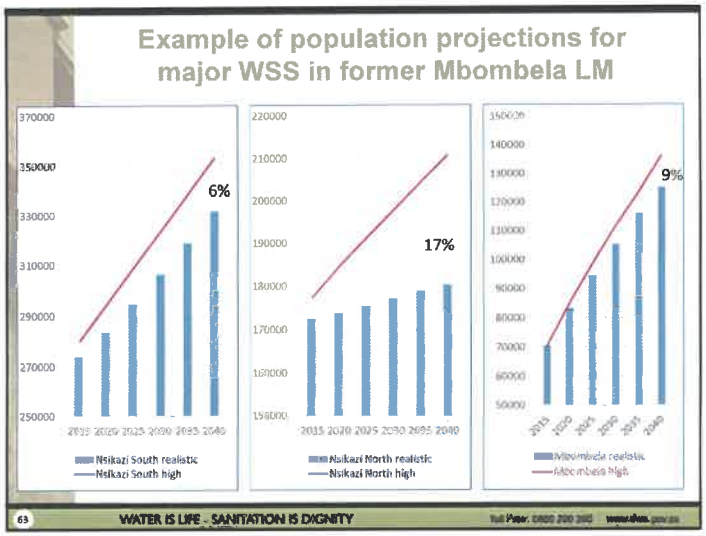
Growth projections

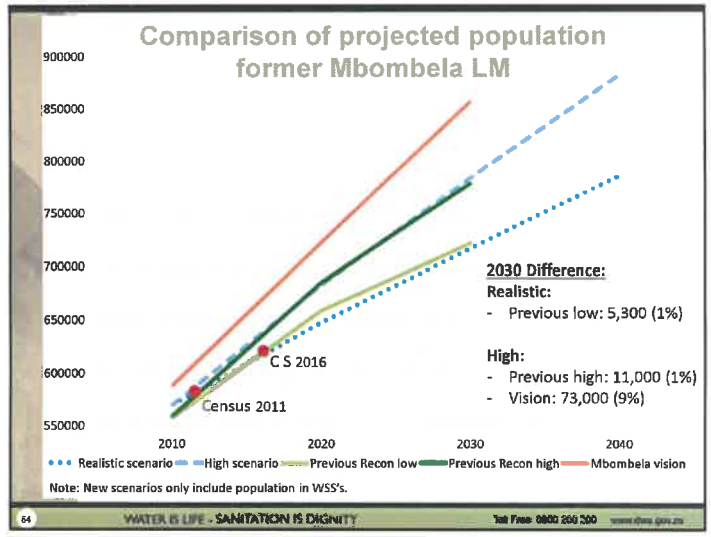
Service levels

Water Supply Scheme	Formal								Informal				TOTAL
			Single Residential										
	Flats	Clusters	Below RDP Level	Low Income	Medium Income	High Income	Very High Income	Total Formal	Below RDP Level	RDP level	Above RDP Level	Total Informal	
Elandshoek	3	1	0	33	7	1	0	46	17	27	11	55	100
Hazyview	2	2	0	20	20	37	2	83	10	5	2	17	100
Matsulu	1	0	13	47	22	5	0	88	7	2	3	12	100
Mbombela	12	11	0	11	14	37	2	87	8	3	2	13	100
Mpakeni	0	0	31	43	23	1	0	98	1	1	0	2	100
Ngodwana	1	4	0	26	7	15	1	54	1	43	2	46	100
Nsikazi North	2	0	28	44	15	4	0	93	4	1	2	7	100
Nsikazi South	2	0	22	42	21	7	0	94	4	1	1	6	100
White River	7	5	0	21	14	28	2	77	13	5	5	23	100
Esperado	0	0	18	49	33	0	0	100	0	0	0	0	100
Mandela/ Mlambongwane	0	0	17	49	34	0	0	100	0	0	0	0	100
Sable River Eco Estate	0	0	0	0	0	0	100	100	0	0	0	0	100
Mbombela LM (former) excl. rural	3	2	19	38	18	11	0	91	5	2	2	9	100

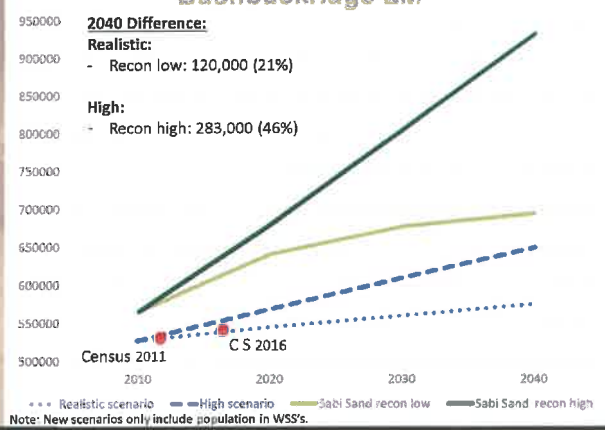

Projected population per 5 year interval
former Mbombela LM
900000
850000
800000
750000
700000
650000
600000
550000
500000
610
785
Difference in 2040: 98,000 (12%)
Expected growth Total 175 k Av 7000/a
2015
2020
2025
2030
2035
2040
Realistic scenario
High scenario
61
WATER IS LIFE - SANITATION IS DIGNITY


Projected population per 5 year interval
Bushbuckridge LM
660000
640000
620000
600000
580000
560000
540000
520000
500000
539
576
Difference in 2040: 73,000 (13%)
Expected growth Total 37 k Av 1500/a
2015
2020
2025
2030
2035
2040
Realistic scenario
High scenario
62
WATER IS LIFE - SANITATION IS DIGNITY


Example of population projections for
major WSS in former Mbombela LM
370000
350000
330000
310000
290000
270000
250000
6%
Nsikazi South realistic
Nsikazi South high
220000
210000
200000
190000
180000
170000
160000
17%
Nsikazi North realistic
Nsikazi North high
160000
140000
120000
100000
90000
80000
70000
60000
50000
9%
63
WATER IS LIFE - SANITATION IS DIGNITY

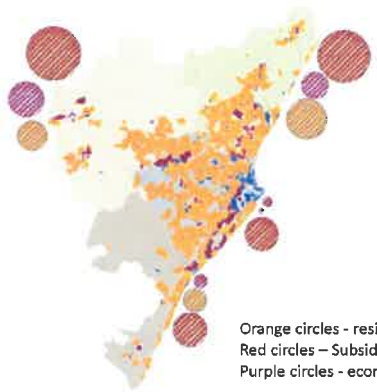

Comparison of projected population
former Mbombela LM
900000
850000
800000
750000
700000
650000
600000
550000
C S 2016
Census 2011
2030 Difference:
Realistic:
- Previous low: 5,300 (1%)
High:
- Previous high: 11,000 (1%)
- Vision: 73,000 (9%)
2010
2020
2030
2040
Realistic scenario
High scenario
Previous Recon low
Previous Recon high
Mbombela vision
Note: New scenarios only include population in WSS's.
64
WATER IS LIFE - SANITATION IS DIGNITY

Comparison of projected population Bushbuckridge LM



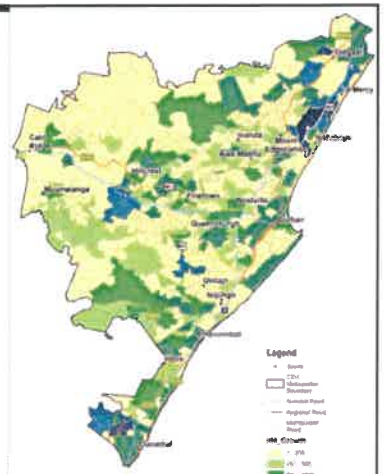
Note: New scenarios only include population in WSS's.

Future land use requirements

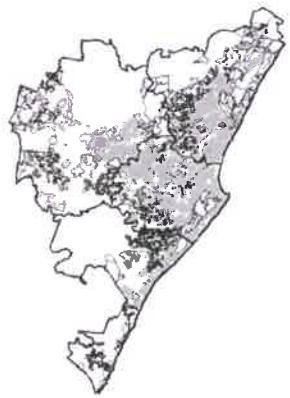


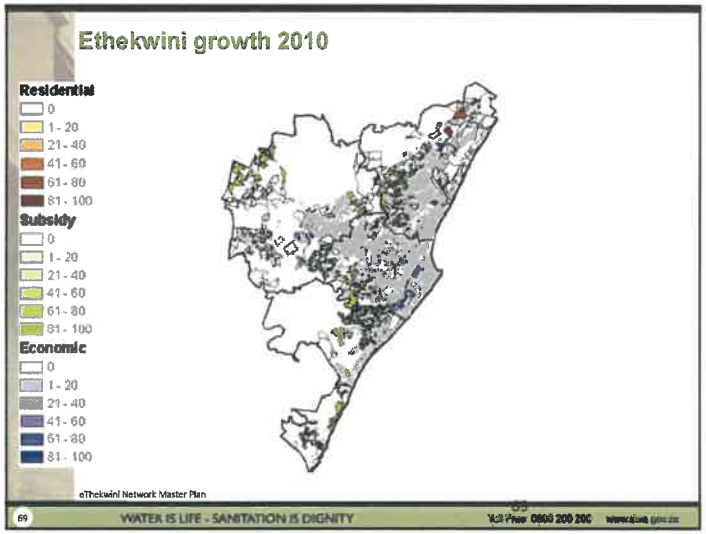
Orange circles - residential growth
Red circles – Subsidy developments
Purple circles - economic growth

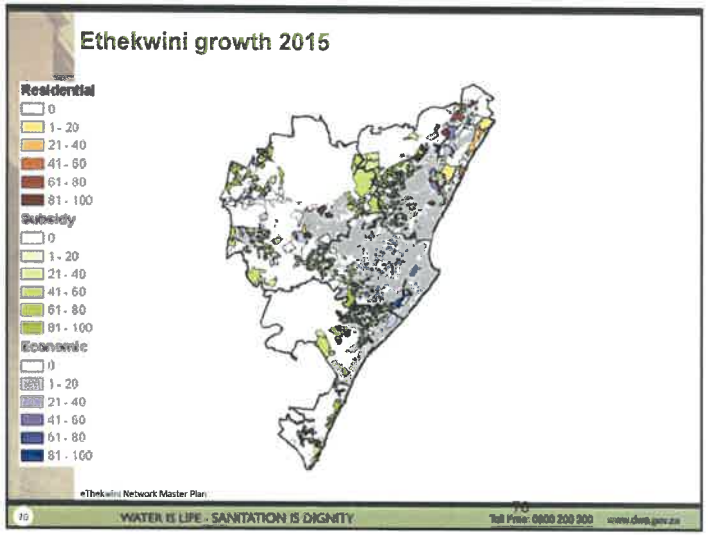
Household Growth

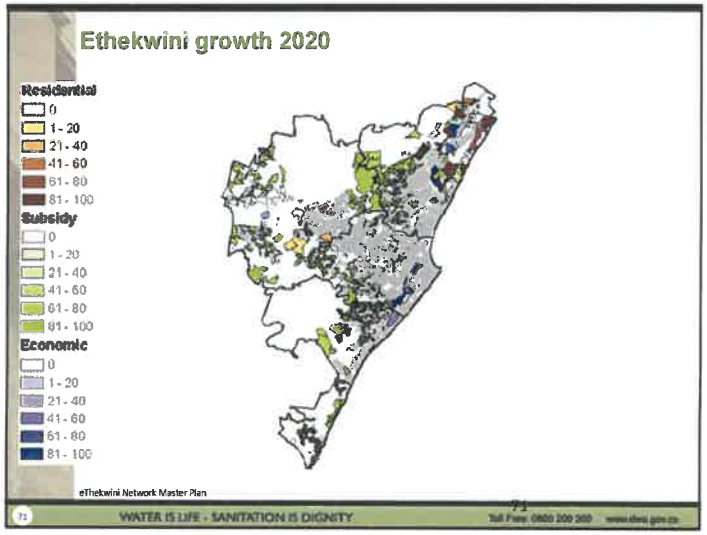


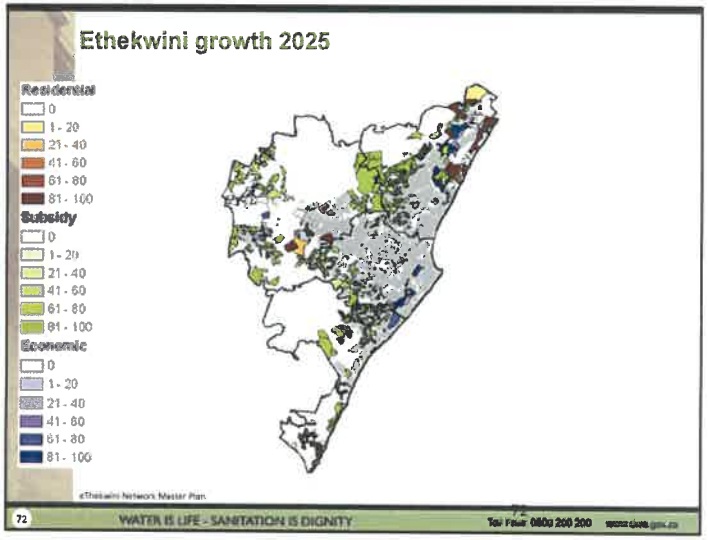
Ethekwini existing and identified developments

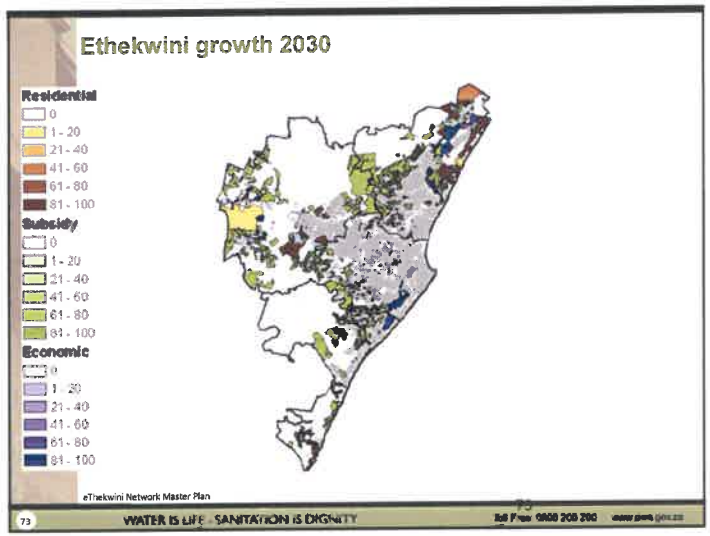



Ethekwini growth 2010
Residential
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Subsidy
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Economic
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
eThekwini Network Master Plan
69
WATER IS LIFE - SANITATION IS DIGNITY


Ethekwini growth 2015
Residential
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Subsidy
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Economic
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
eThekwini Network Master Plan
70
WATER IS LIFE - SANITATION IS DIGNITY


Ethekwini growth 2020
Residential
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Subsidy
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Economic
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
eThekwini Network Master Plan
71
WATER IS LIFE - SANITATION IS DIGNITY


Ethekwini growth 2025
Residential
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Subsidy
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Economic
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
eThekwini Network Master Plan
72
WATER IS LIFE - SANITATION IS DIGNITY


Ethekwini growth 2030
Residential
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Subsidy
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Economic
0
1 - 20
21 - 40
41 - 60
61 - 80
81 - 100
eThekwini Network Master Plan
73
WATER IS LIFE - SANITATION IS DIGNITY

Projected Increase in LOS

Scenario 3 (Village - mostly informal):

- LOS assumed to be at a minimum of RDP Level by 2030.
- 5% increase in Above RDP Level by 2016 to 2030 and a further 6.7% increase by 2040 (total of 11.7%)
- 2.5% increase in Residential Low Income from 2016 to 2030 and a further 3% increase by 2040 (total of 5.5%)

Category	Dwelling Type	
1	Flats	
2	Clusters	
3	Single Residential	Low Income
4		Medium Income
5		High Income
6		Very High Income
7	Informal	Below RDP Level
8		RDP Level
9		Above RDP Level

Water Requirement Projection Calculation

Water Requirement Projection Calibration Steps:

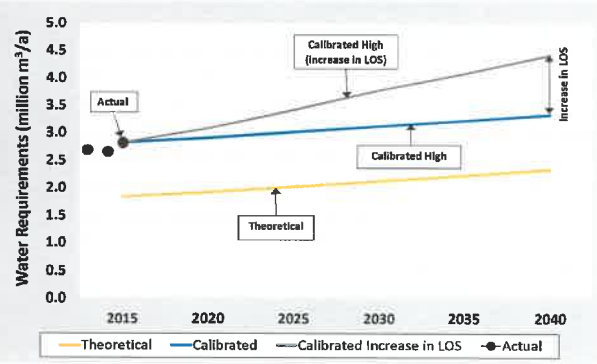
1. Source and assess actual recorded water use for each demand centre
2. Calibrate theoretical projections against the actual water use by applying a constant factor to the unit consumption for all LOS categories.
3. Apply projected increase in LOS according to the selected LOS scenario and the demand centre characteristics.
4. Check against projections from other sources

Current Actual Domestic Water Use

Water Use Areas/ Water Supply Scheme	2016 Water Use (million m³/a)	Data Source (Last data year)
Mbombela	16.8	Sembcorp Raw Supply 2018
White River Total	4.1	GLS Supply 2018
Nsikazi South	19.0	GLS Supply 2018
Nsikazi North	10.7	Recon MB '14
Karino Plaston Corridor	0.6	Sembcorp Potable Supply 2018
Matsulu	6.3	GLS Supply 2018
Ngodwana	0.5	Recon MB '14
Elandshoek	0.1	SPID
Hazyview	1.8	GLS Supply 2018
Bushbuckridge WSS	4.4	All Town BBR '16
Hoxani WSS	13.7	All Town BBR '16
Marite WSS	3.3	All Town BBR '16
Acornhoek WSS	15.5	All Town BBR '16
Thulamahashe WSS	13.0	GLS Master Plan

- NB to get historical data for the past years – do not want to project from a low consumption point (restrictions)

Water Requirement Projections Example 1



Water Requirement Projection Growth

Compounded Annual Growth Rate (CAGR)

$$CAGR = (B/A)^{(1/n)}\text{-}1$$

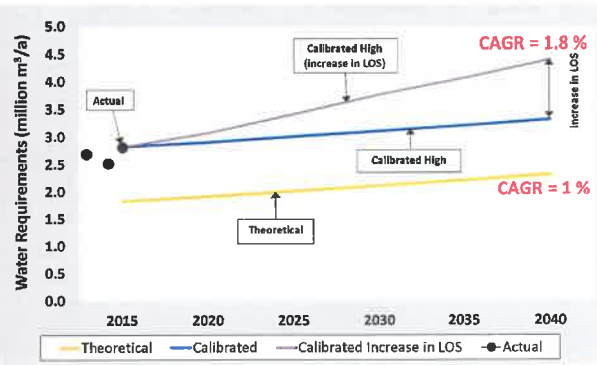
CAGR: Compounded Annual Growth Rate (%)

B: End value

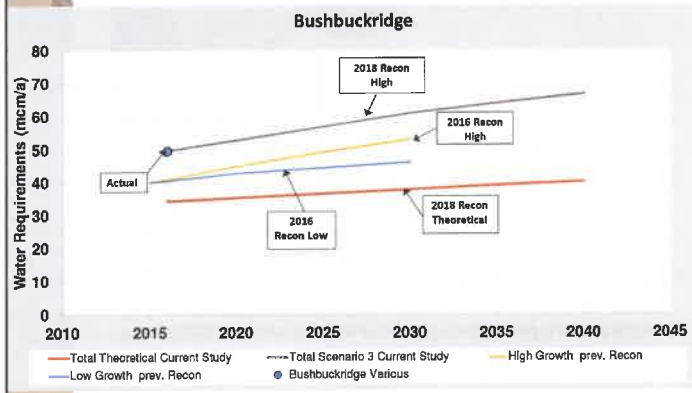
A: Number of Years

- **CAGR usually vary between +-0.8% and +- 3.0 % (high)**

Water Requirement Projections Example 1

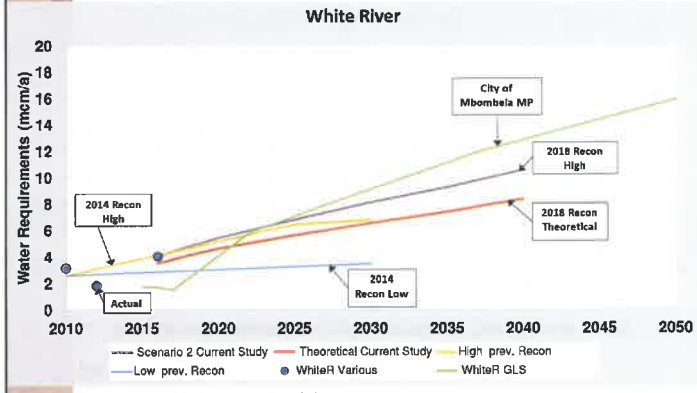


Water Requirement Projections: Example 2



2016 Unit Consumption: 246 l/c/d
DWS MP National Average: 237 l/c/d Target: 173 l/c/d

Water Requirement Projections: Example 3



2016 Unit Consumption: 338 l/c/d
DWS MP National Average: 237 l/c/d Target: 173 l/c/d

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TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

Day 2 – Item 3: Calibrated Water Requirements

Thursday, 4 October 2018

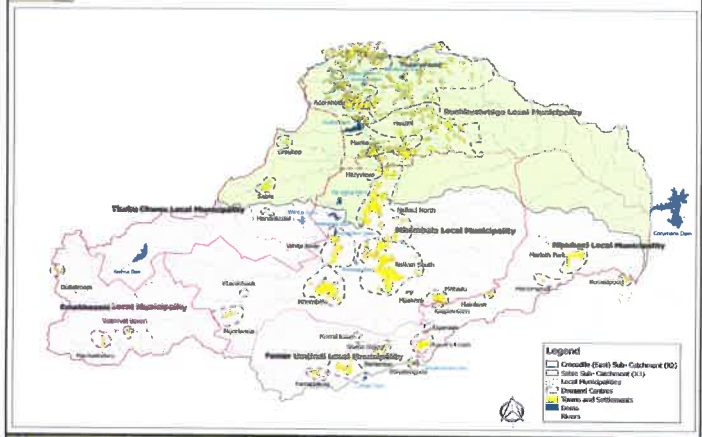
Calibrated Water Requirement Projections

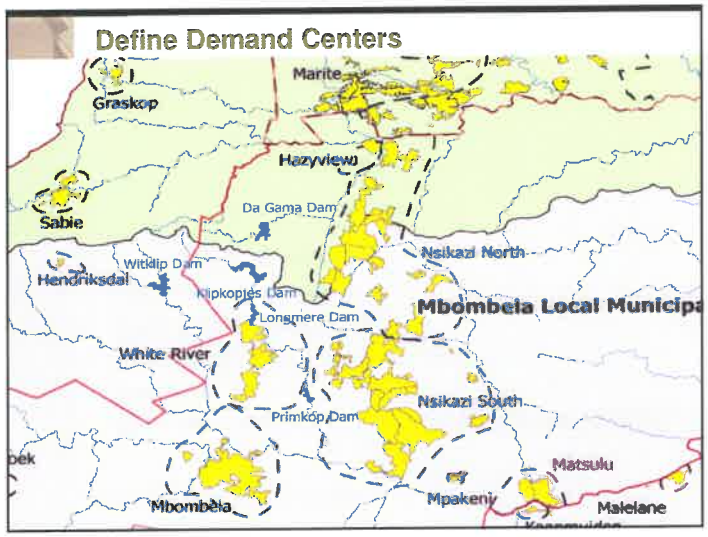
1. Source and assess existing info (recorded water use and projections)
2. Define Demand Centers
3. Demographic Projections and Levels of Service
4. Theoretical Water Requirements (covered on Day 1)
5. Calibrated Water Requirement Projections
6. Check Against Projections from other Sources
7. Monitor Actual Water Use Against Projection

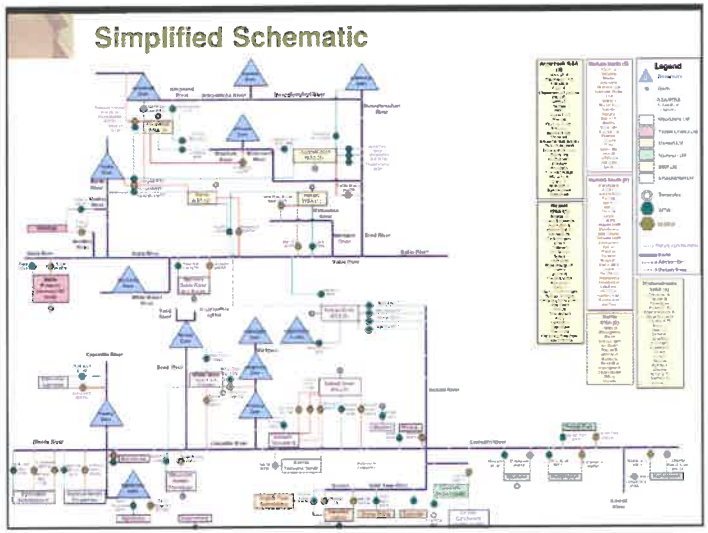
Information Sources

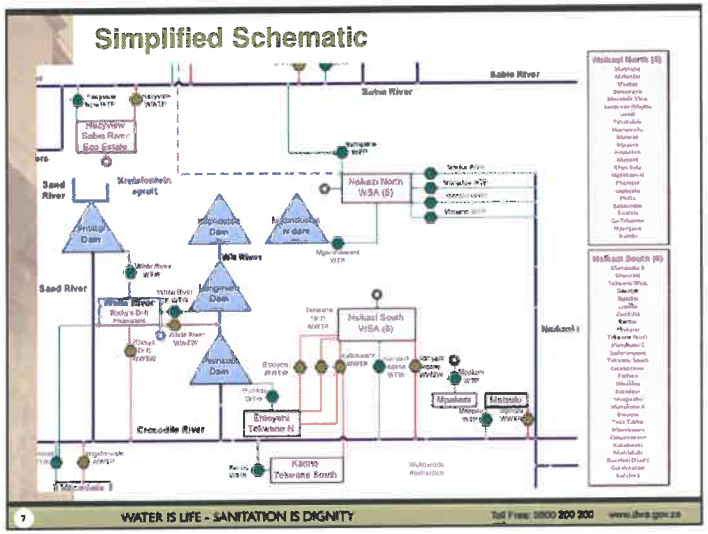
- Recorded data from municipalities/water services providers
- Past studies (DWS and Municipal)
- DWS Blue & Green Drop
- Municipal Master Plans
- Municipal documents

Define Demand Centers




Define Demand Centers
Marite
Graskop
Hazyview
Sabie
Da Gama Dam
Nsikazi North
Witklip Dam
Hendriksdal
Klipkopjes Dam
Longmere Dam
Mbombela Local Municipa
White River
Nsikazi South
Primkop Dam
Matsulu
Mpakeni
Mbombela
Malelane


Simplified Schematic
Legend


Simplified Schematic
Sabie River
Hazyview Sabie River Eco Estate
Sand River
Klipkopjes Dam
Witklip Dam
Nsikazi North WSA (S)
White River
Longmere Dam
White River Rocky's Drift Properties
Primkop Dam
Nsikazi South WSA (S)
Crocodile River
Entokozweni Tekwane N
Kanyamazane Tekwane South
Nsikazi North (S)
Nsikazi South (S)
7
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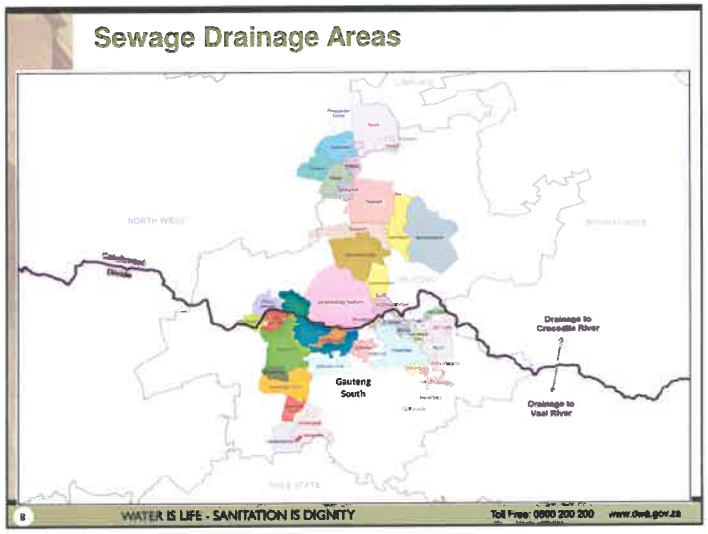
www.dwa.gov.za


Sewage Drainage Areas
Drainage to Crocodile River
Drainage to Vaal River
Gauteng South
8
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Water Requirement Projection Calculation

Theoretical Water Requirement Projection Steps:

1. Source population projection and associated LOS's for each demand centre (Demographic Analysis)
2. Apply theoretical unit consumptions to population split into the different LOS categories (Unit Consumption per LOS Table).
3. Add indirect consumption component i.e. 51% for intermediate towns, and 38% for smaller towns etc. (Indirect Consumption Table)
4. Include treatment and distribution losses of 20% (DWAF, 1997)
5. Multiply population projection with the theoretical unit consumption per LOS category, indirect use component and losses.

Theoretical Unit Consumptions

- Population allocated to each Level of Service (LOS) category

	Category	Dwelling Type		Average Consumption (l/capita/day)
FORMAL	1	Flats		226
	2	Clusters		255
	3	Single Residential	Low Income	101
	4		Medium Income	189
	5		High Income	304
	6		Very High Income	442
INFORMAL	7	Informal	Below RDP Level	12
	8		RDP Level	40
	9		Above RDP Level	80

Indirect Usage Component

- Indirect Usage Component (DWAF, 2001)

Classification	Component				
	Commerce	Industrial	Institutional	Municipal	Total
Metropolitan Cities / Towns Isolated / Towns Industrial	0.20	0.30	0.15	0.08	**0.73**
Towns Country	0.10	0.15	0.03	0.10	**0.38**
Towns Special	0.30	0.15	0.08	0.03	**0.56**
New Centres	0.15	0.08	0.08	0.08	**0.39**

- Water Treatment =5%, Distribution = 15% (DWS Guidelines)

Water Requirement Projections

Scenario 1 (Established Town - mostly formal):

- LOS assumed to be at a minimum of Residential Low Income by 2030
- 5% increase in Residential Medium Income 2016 to 2030 and a further 6% increase by 2040 (total of 11%)
- 2.5% increase in Residential High Income from 2016 to 2030 and a further 3.3% increase by 2040 (total of 5.8%)

Category	Dwelling Type	
1	Flats	
2	Clusters	
3	Single Residential	Low Income
4		Medium Income
5		High Income
6		Very High Income
7	Informal	Below RDP Level
8		RDP Level
9		Above RDP Level

Projected Increase in LOS

Scenario 1 (Established Town - mostly formal):

- LOS assumed to be at a minimum of Residential Low Income by 2030
- 5% increase in Residential Medium Income 2016 to 2030 and a further 6% increase by 2040 (total of 11%)
- 2.5% increase in Residential High Income from 2016 to 2030 and a further 3.3% increase by 2040 (total of 5.8%)

Category	Dwelling Type	
1	Flats	
2	Clusters	
3		Low Income
4	Single	Medium Income
5	Residential	High Income
6		Very High Income
7		Below RDP Level
8	Informal	RDP Level
9		Above RDP Level

Projected Increase in LOS

Scenario 2 (Town/Village - formal and informal)

- LOS assumed to be at a minimum of Above RDP Level by 2030
- 5% increase in Residential Low Income 2016 to 2030 and a further 6% increase by 2040 (total of 11%)
- 2.5% increase in Residential Medium Income from 2016 to 2030 and a further 2.3% increase by 2040 (total of 4.8%)

Category	Dwelling Type	
1	Flats	
2	Clusters	
3		Low Income
4	Single	Medium Income
5	Residential	High Income
6		Very High Income
7		Below RDP Level
8	Informal	RDP Level
9		Above RDP Level

Projected Increase in LOS

Scenario 2 (Town/Village - formal and informal)

- LOS assumed to be at a minimum of Above RDP Level by 2030
- 5% increase in Residential Low Income 2016 to 2030 and a further 6% increase by 2040 (total of 11%)
- 2.5% increase in Residential Medium Income from 2016 to 2030 and a further 2.3% increase by 2040 (total of 4.8%)

Category	Dwelling Type	
1	Flats	
2	Clusters	
3		Low Income
4	Single	Medium Income
5	Residential	High Income
6		Very High Income
7		Below RDP Level
8	Informal	RDP Level
9		Above RDP Level

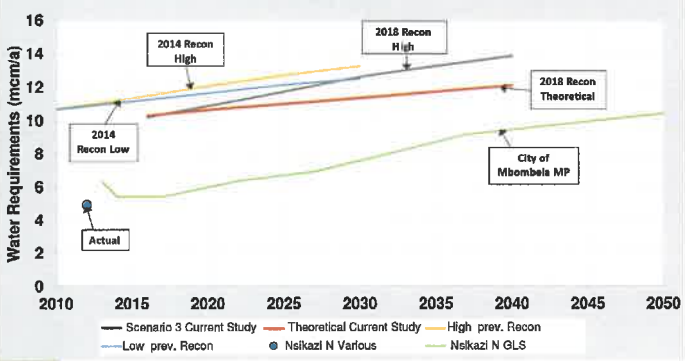
Projected Increase in LOS

Scenario 3 (Village - mostly informal):

- LOS assumed to be at a minimum of RDP Level by 2030.
- 5% increase in Above RDP Level by 2016 to 2030 and a further 6.7% increase by 2040 (total of 11.7%)
- 2.5% increase in Residential Low Income from 2016 to 2030 and a further 3% increase by 2040 (total of 5.5%)

Category	Dwelling Type	
1	Flats	
2	Clusters	
3		Low Income
4	Single	Medium Income
5	Residential	High Income
6		Very High Income
7		Below RDP Level
8	Informal	RDP Level
9		Above RDP Level

Water Requirement Projections: Example 4



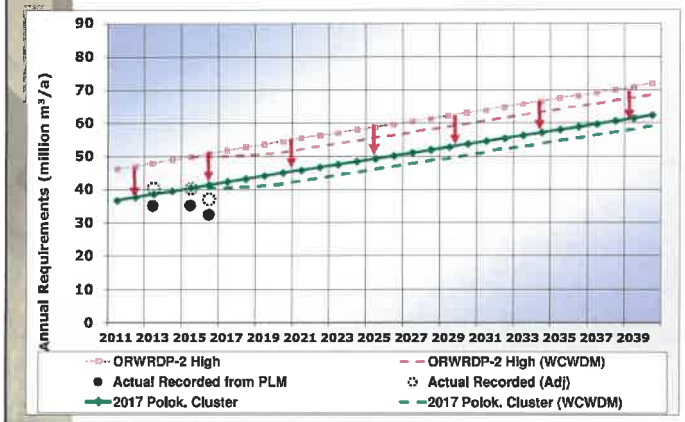
2016 Unit Consumption: 158 l/c/d

DWS MP National Average: 237 l/c/d Target: 173 l/c/d

Monitoring Water Requirement Projections

- Water requirement projections based on population projections, projected increase in levels of service and projected from actual water use.
- With the associated uncertainties, very seldom that future water use track exactly against the projection.
- Very important to monitor, understand reasons for possible deviations, and adjust accordingly.

Monitoring Projections



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TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

Day 2 – Item 4: Water Requirements Practical

Thursday, 4 October 2018

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Practical 1a: Water Requirement Projection

Population

Years	2018	2020	2025	2030	2035	2040
Population Realistic	50 400	51 515	54 411	57 470	60 702	64 114
Population High	50 400	52 231	57 104	62 432	68 256	74 625

Levels of Service

Category	Dwelling Type		Average Consumption (l/capita/day)	Percentage Population
1	Flats		225	4%
2	Cluster		255	1%
3	Single Residential	Low Income	101	20%
4		Medium Income	189	16%
5		High Income	304	4%
6		Very High Income	442	1%
7	Informal	Below RDP Level	12	32%
8		RDP Level	40	20%
9		Above RDP Level	80	8%

Agricultural Town

2018 Recorded Water Use: 4.65 million m^3/a

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Practical 1b: Water Requirement Projection

- LOS to be at a minimum of RDP Level by 2030
- No further increase in LOS expected

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TRAINING PLAN FOR RECONCILIATION STRATEGY STUDIES

LECTURE 1: WATER REQUIREMENTS

Day 2 – Item 5: Return Flows

Thursday, 4 October 2018

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Return Flows

- An increase in the water use also increase the return flows generated at the Waste Water Treatment Works (WWTW) in formal sanitation areas.
- Major return flows form significant contributions to the water resources of the area

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Return Flows

- The return flow projections are derived by applying the Return Flow Factors (RFFs) to the water requirement projections for each of the demand centre.

$$RFF = \frac{Return\ Flow}{Water\ Use}$$

- The RFFs will likely increase in future as additional sanitation services are implemented with improved level of services.
- A constant RFF is generally assumed which is conservative from a water resources perspective.

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Information Sources

- Recorded data return flow from municipalities/WWTW Operators
- Past studies (DWS and Municipal)
- DWS Green Drop
- Municipal Master Plans
- Municipal documents

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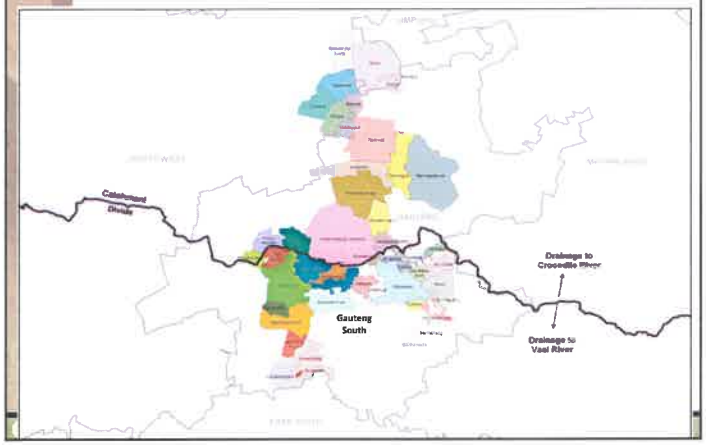
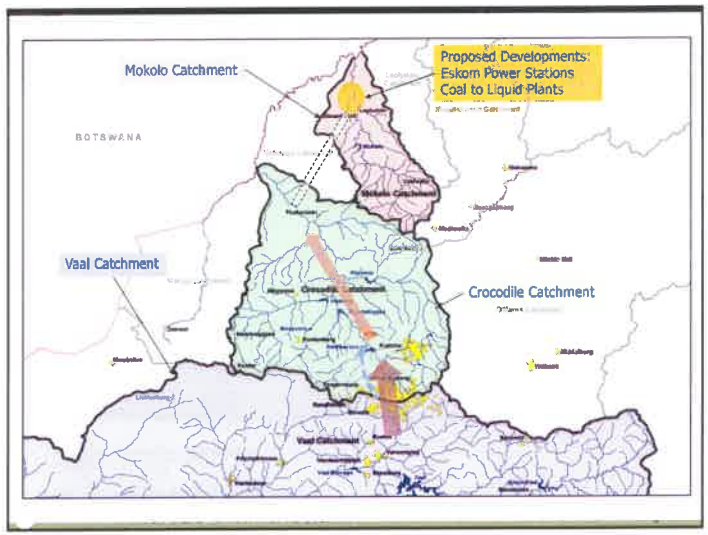
Water Requirement and Return Flow Model

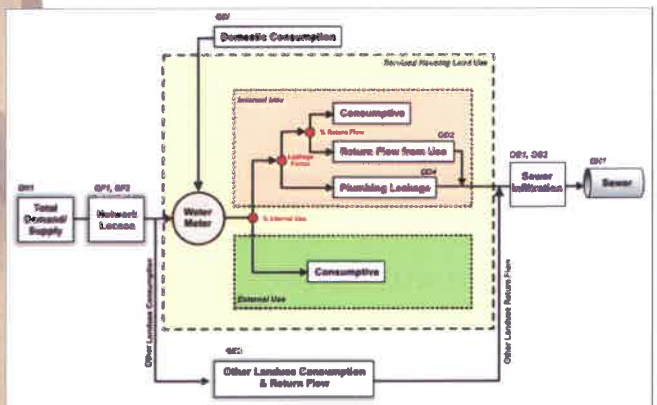
- Typically applied in larger demand centres consisting of various WWTWs/SDA's
- Typical studies where the model as been applied:
  - The Development of a Reconciliation Strategy Study for the Crocodile (West) Water Supply System
  - The Integrated Vaal River System Reconciliation Strategy Study
  - Reconciliation Strategy for the Kwazulu-Natal Coastal Metropolitan Area (Durban and PMB)

SEWAGE DRAINAGE AREAS (SDAS)





Water Requirement and Return Flow Model



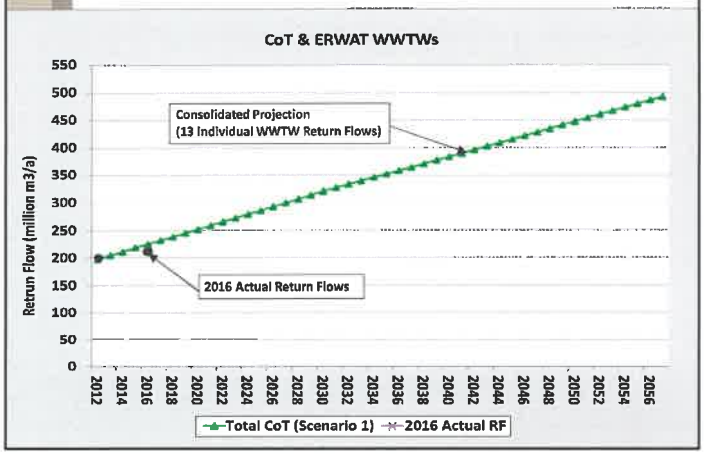
Water Requirements and Return Flow Modelling

- Source and assess required data
- Configured model for all SDAs (recorded actuals, population projections etc.)
- Split water use into direct and in-direct
- Calibrate requirements against actual water use
- Calibrate return flows against recorded return flows

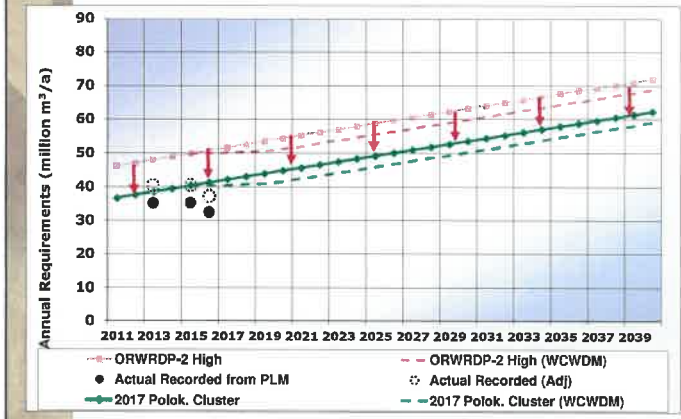
Monitoring Return Flow Projections

- Impact of Water Conservation and Demand Management on Return Flows ??
- With the associated uncertainties, very seldom that future water use track exactly against the projection.
- Very important to monitor, understand reasons for possible deviations, and adjust accordingly.

Return Flow Monitoring: Example 1



Monitoring Proejctions



APPENDIX C:

LECTURE 1: WATER REQUIREMENTS ATTENDANCE REGISTER

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Attendance Register

Training Topic:	LECTURE 1 : WATER REQUIREMENTS		
Venue:	WRP OFFICES	Date:	3 | 10 | 2018

Present

Name	Organization	Telephone	Cellphone	E-mail	Signature	4 OCT
Colin Tukundy	WRP	012 346 3496	084 555 8046	colint@wrp.co.za		
Sibu Majozi	DWS	012 336 6678	0717350580	MajoziS@dws.gov.za		
Paarlelh Shiwambare	DWS	012 336 8500	0720660393	ShiwambareP2@dws.gov.za		
Sivashni Naicker	DWS: WRPS	012 336 8171	063501 0114	naickers@dws.gov.za		
Thandekile Mbili	DWS: NWRP	012 336 8231	0731359140	MbiliT@dws.gov.za		
SERGE NGAMBA	Batatise consulting Engineers	010 442 6759	0781381392	Serge@batatiseconsulting.com		
Tshisevhe Nesengani	UWP (Dept Public Works)	081 594 0721	0762926831	tshisevhen@uwp.co.za TshisevheN		
Sakhile Mamba	DWS: NWRP	012 336 7481	063 697 4388	mambas2@dws.gov.za		
CARYN SEAGO	WRP	0123463496	0823233998	carynS@wrp.co.za		
Sebastian Tukundy	WRP	012 346 3496	079 736 5337	Sebastian@wrp.co.za		
~~Sibu Majozi~~	~~DWS~~	~~012 336 6678~~	~~0717350580~~			