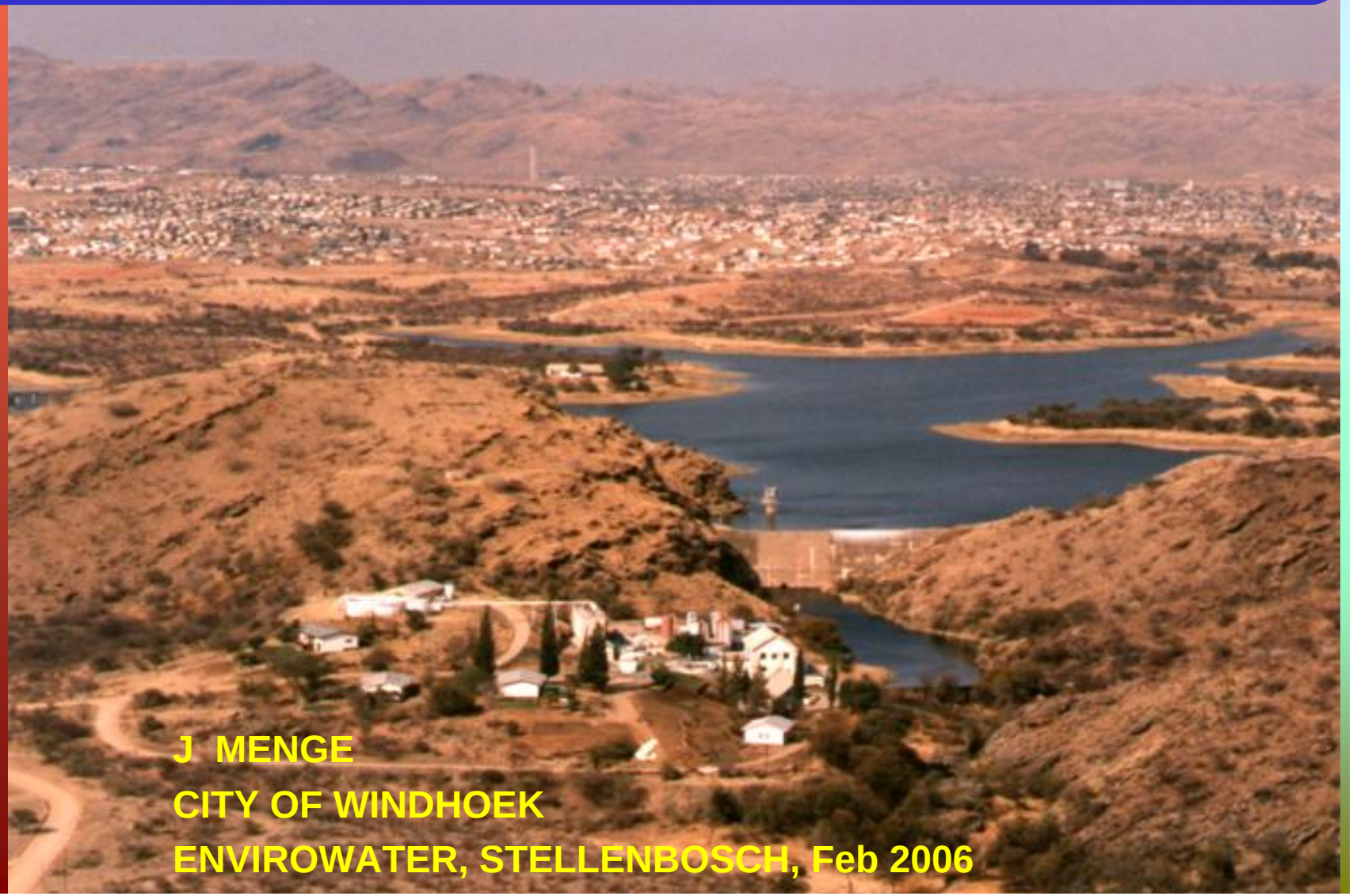
Treatment of Wastewater for re-use in the Drinking Water System of Windhoek



J MENGE
CITY OF WINDHOEK
ENVIROWATER, STELLENBOSCH, Feb 2006

City of Windhoek

CONTENTS

- Location and water supply
- Resource Management
- Reclamation in Windhoek
- Process performance
- Distribution

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LOCATION AND WATER SUPPLY

- Water situation in Windhoek
- Surface water supply to Windhoek
- Windhoek Water Cycle

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Water Situation in Windhoek

POPULATION

AREA = 825 000 square km

Namibia population = 1.8 million people

Population density = 2.2 persons per square km

PRECIPITATION (PP) AND RUN OFF (RO)

WORLD: 750mm PP & 205mm RO

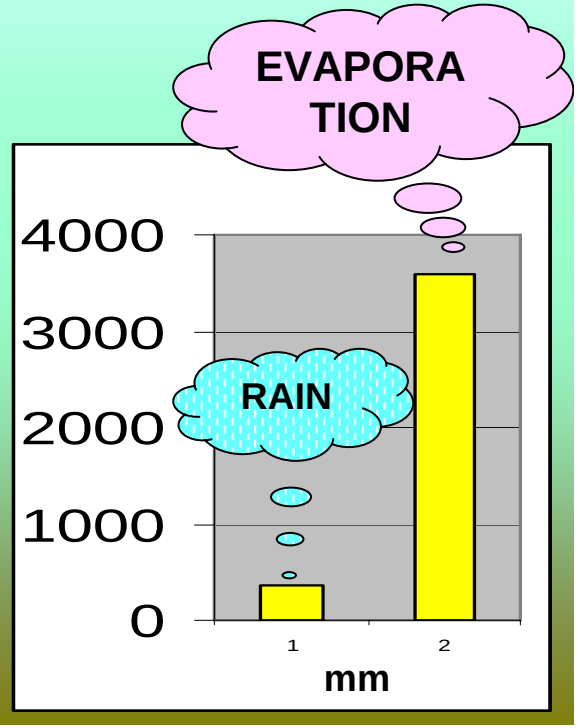
AFRICA: 686mm PP & 139mm RO

NAMIBIA: 280mm PP & 15mm RO

WINDHOEK: 366mm PP & 22mm RO

EVAPORATION (Windhoek)

3600mm per year



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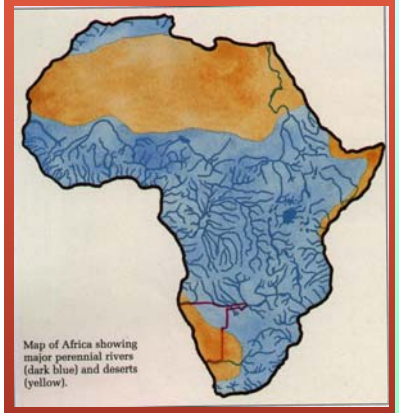
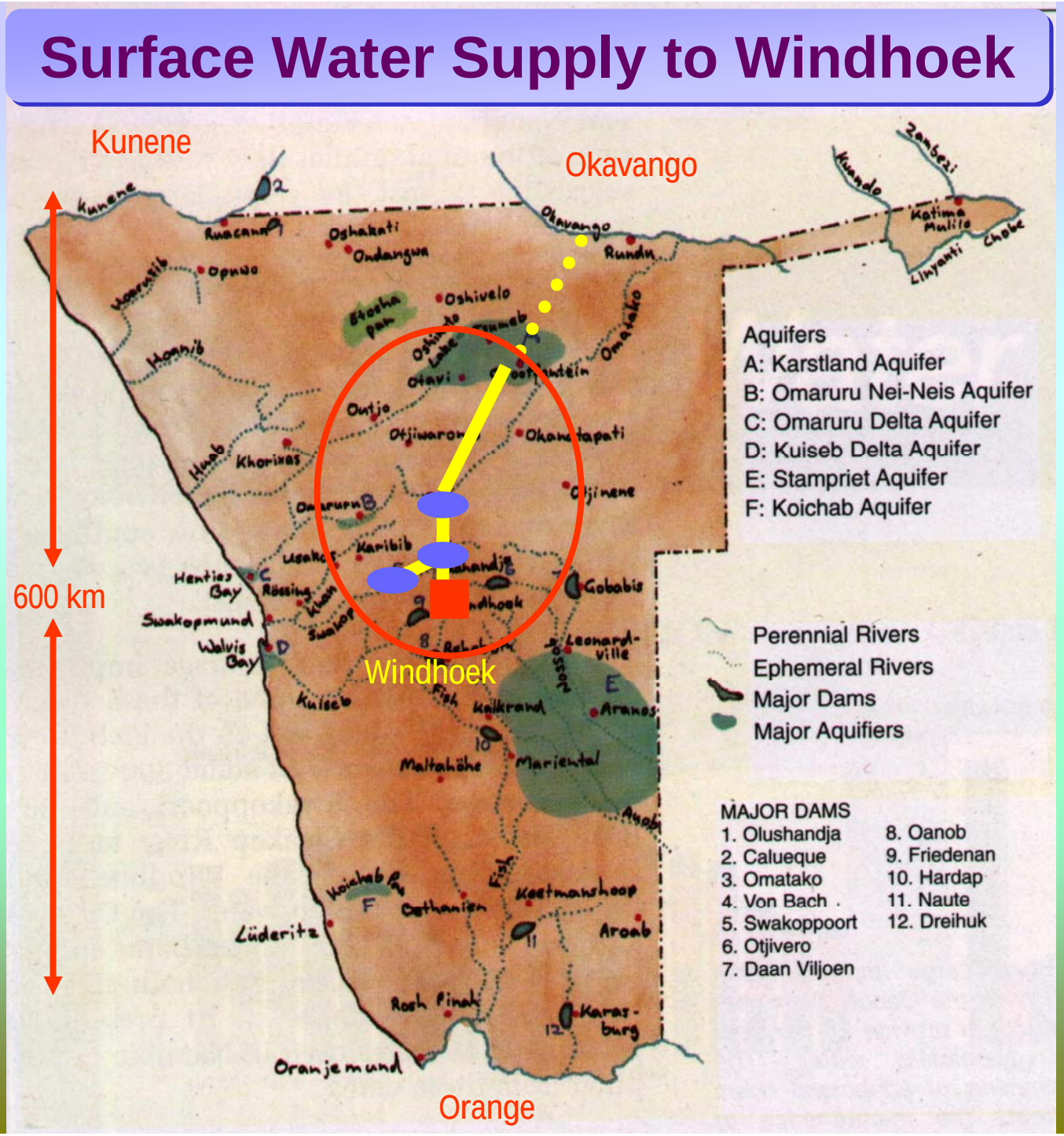
Surface Water Supply to Windhoek





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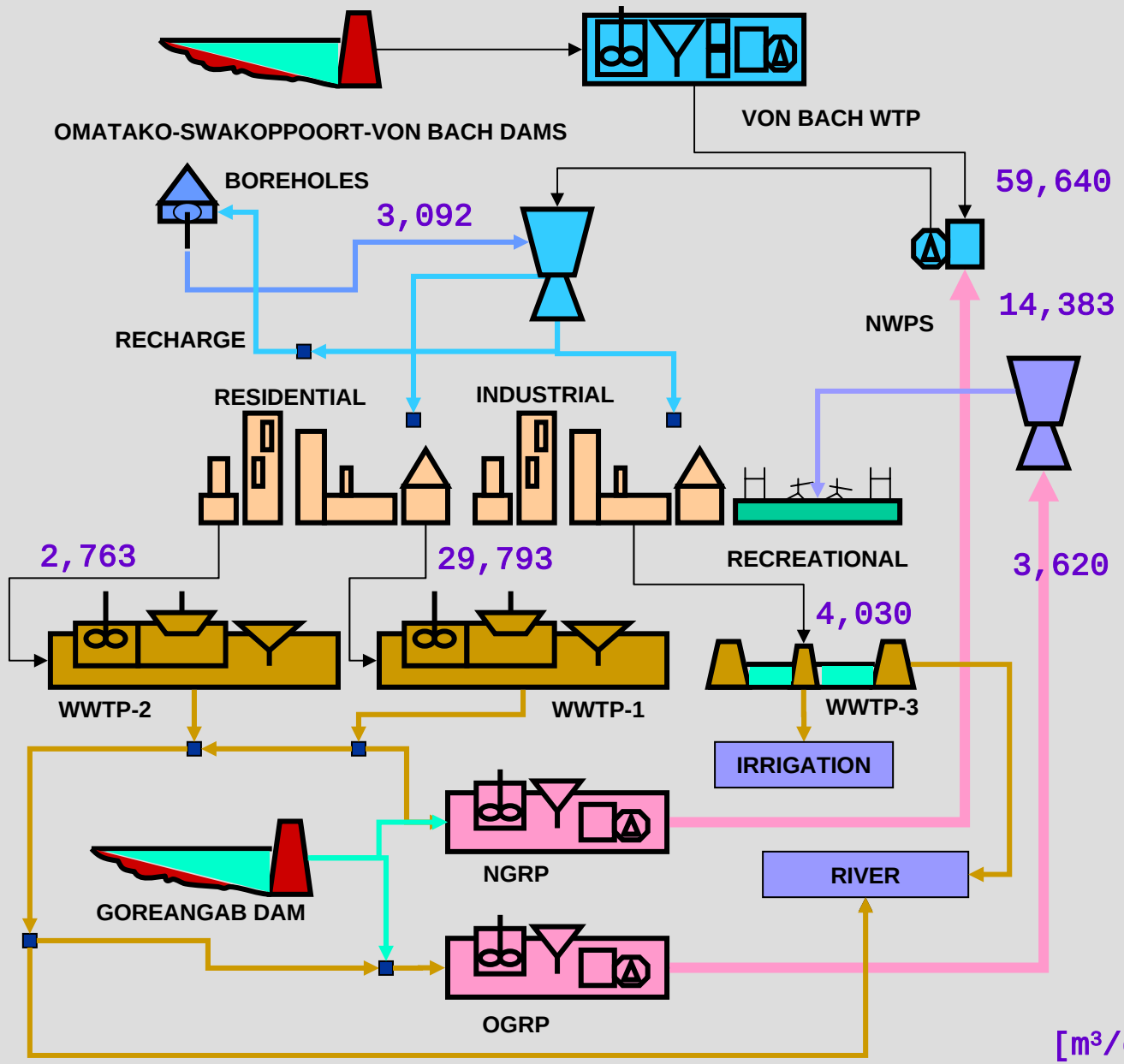
Windhoek Water Cycle



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RESOURCE MANAGEMENT

- Actual and potential savings
- Integrated resource management
- Water demand management

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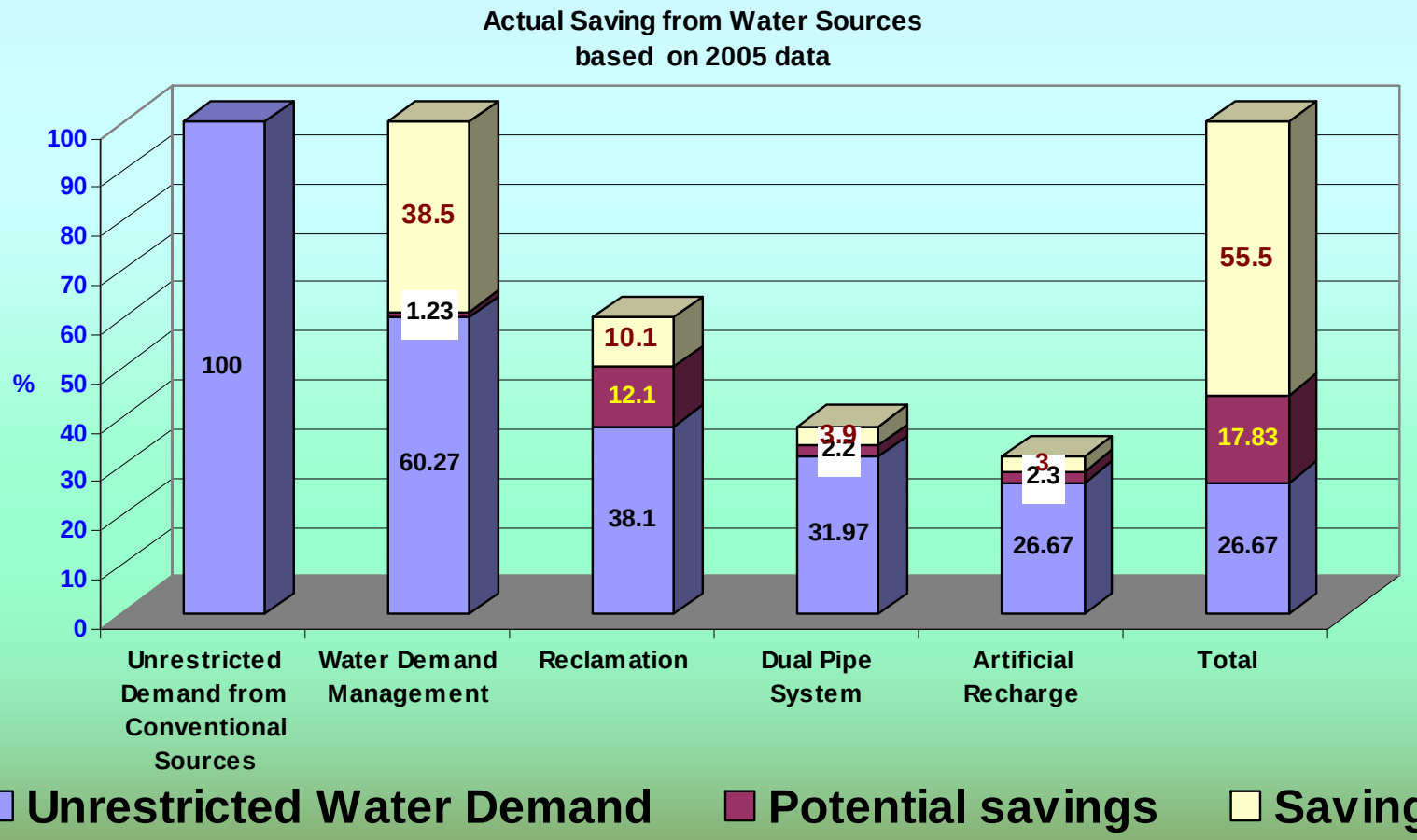
Actual and potential savings



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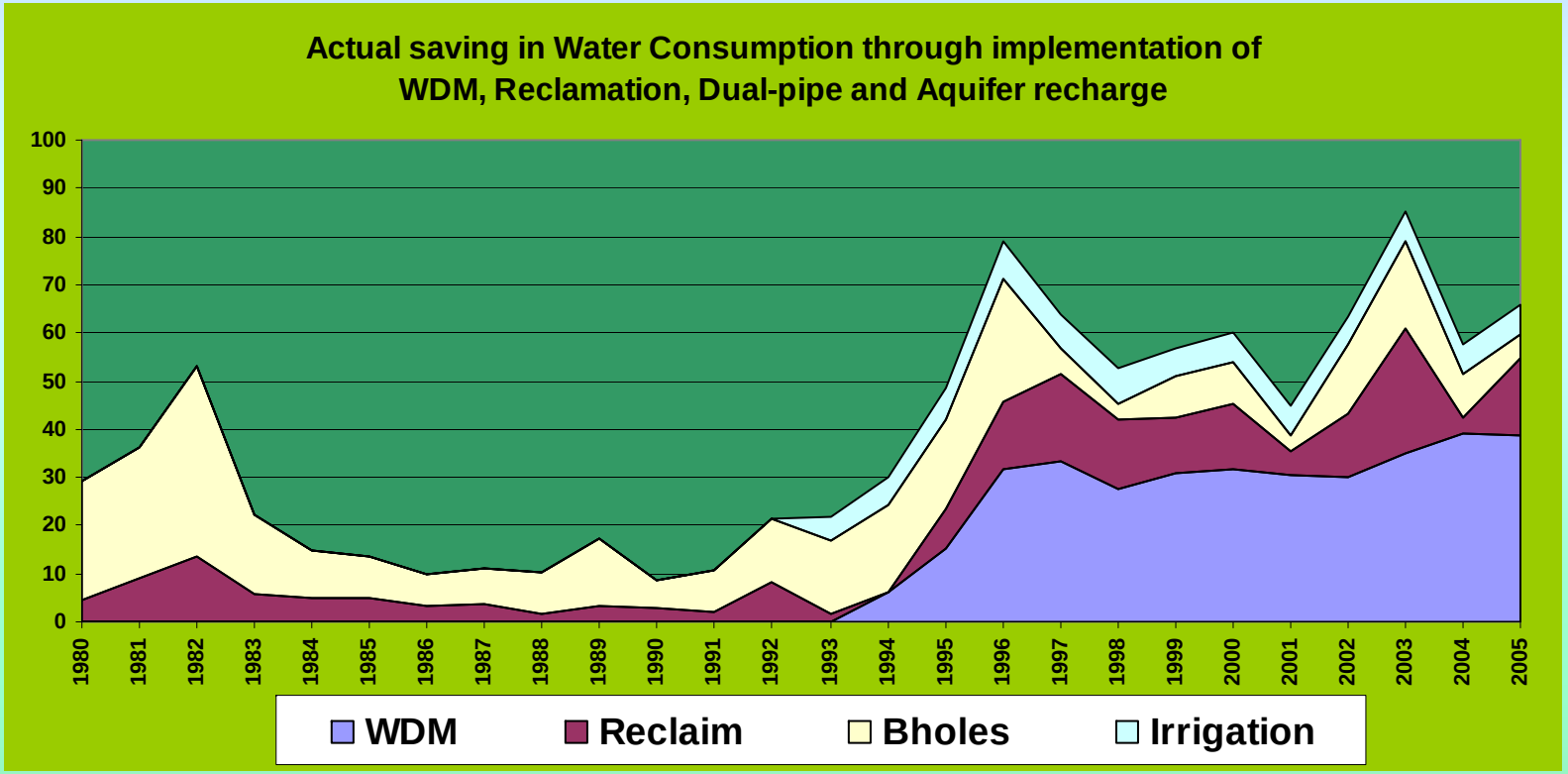
Integrated Resource Management



ARTIFICIAL RECHARGE

Natural recharge :	1.7 Mm^3/a
Artificial recharge :	1.8 Mm^3/a
Supply during drought :	3x 11 Mm^3/a

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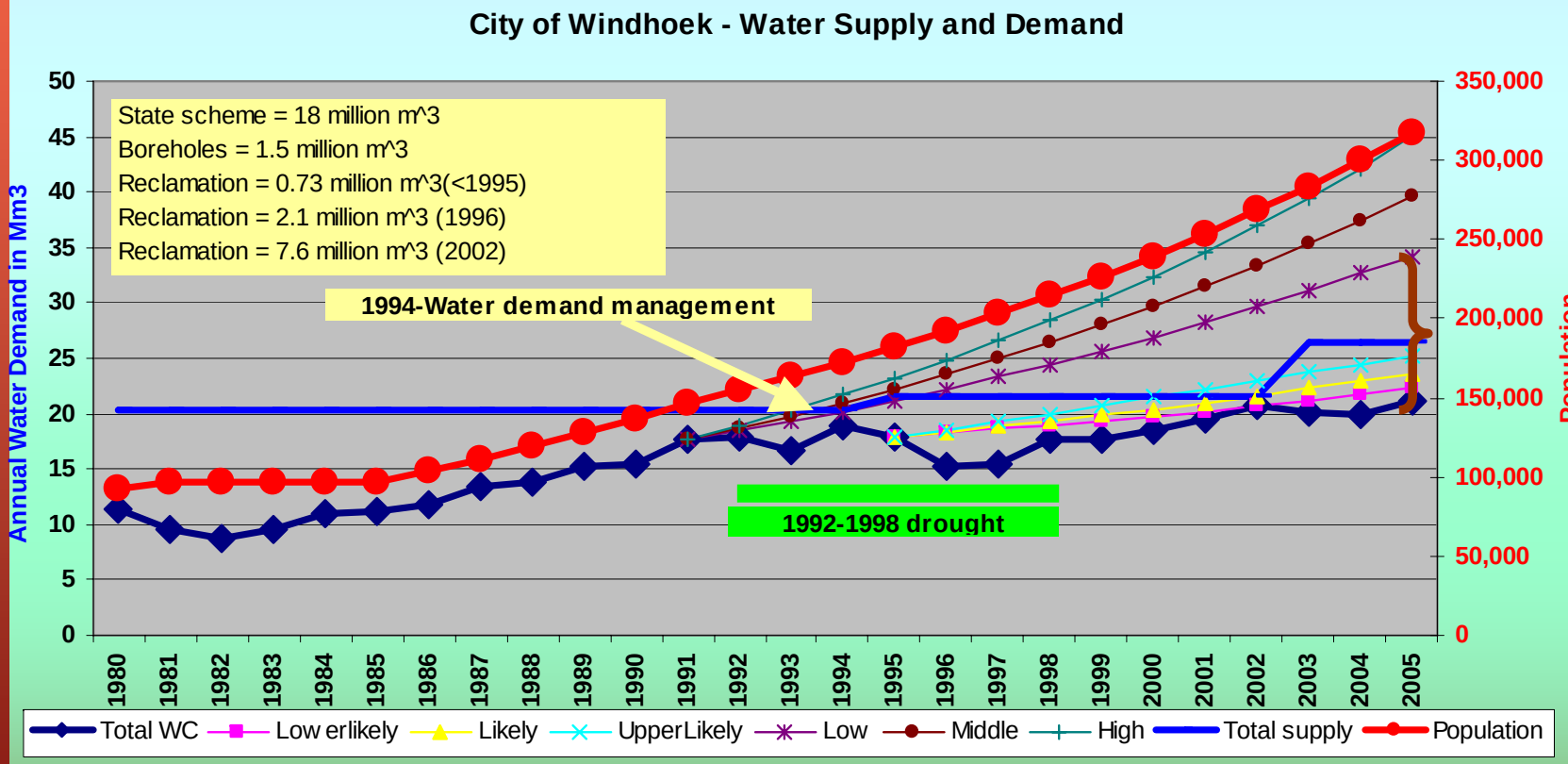
Water demand management



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RECLAMATION IN WINDHOEK

- Process Selection Objectives
- Gammams Wastewater Treatment Plant
- New Goreangab Reclamation Plant

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Process Selection Objectives

Treatment objective	Required barriers		Required/proposed Process steps P = partial, C = complete
	Partial	Complete	
Aesthetic		2	1.C> CD+DAF+SF 2.C>UF 1.P> GAC
Microbiology and Virus	1	3	1.P> ASP-BNR-MP for TC, TN and TP 2.P> CD+DAF+SF 1.C> O_3 2.C>UF 3.C> Breakpoint chlorination
Protozoa: *Giardia* + *Cryptosporidium*		3	1.P> MP 1.C> CD+DAF+SF 2.C> O_3 3.C> UF
Organics	2		1.P> CD+DAF+SF 2.P> O_3+BAC+GAC 3.P> PAC
DBPs	2		• Enhanced coagulation • Delay chlorination in process train & reduce dosage
Residuals: Fe, Mn	2		1.P> NaOH+MnO_4+SF 2.P> O_3+BAC+GAC
Stability		1	1.C> NaOH
Nitrogenous and organic constituents	1		1.P> ASP-BNR-MP for TC, TN and TP

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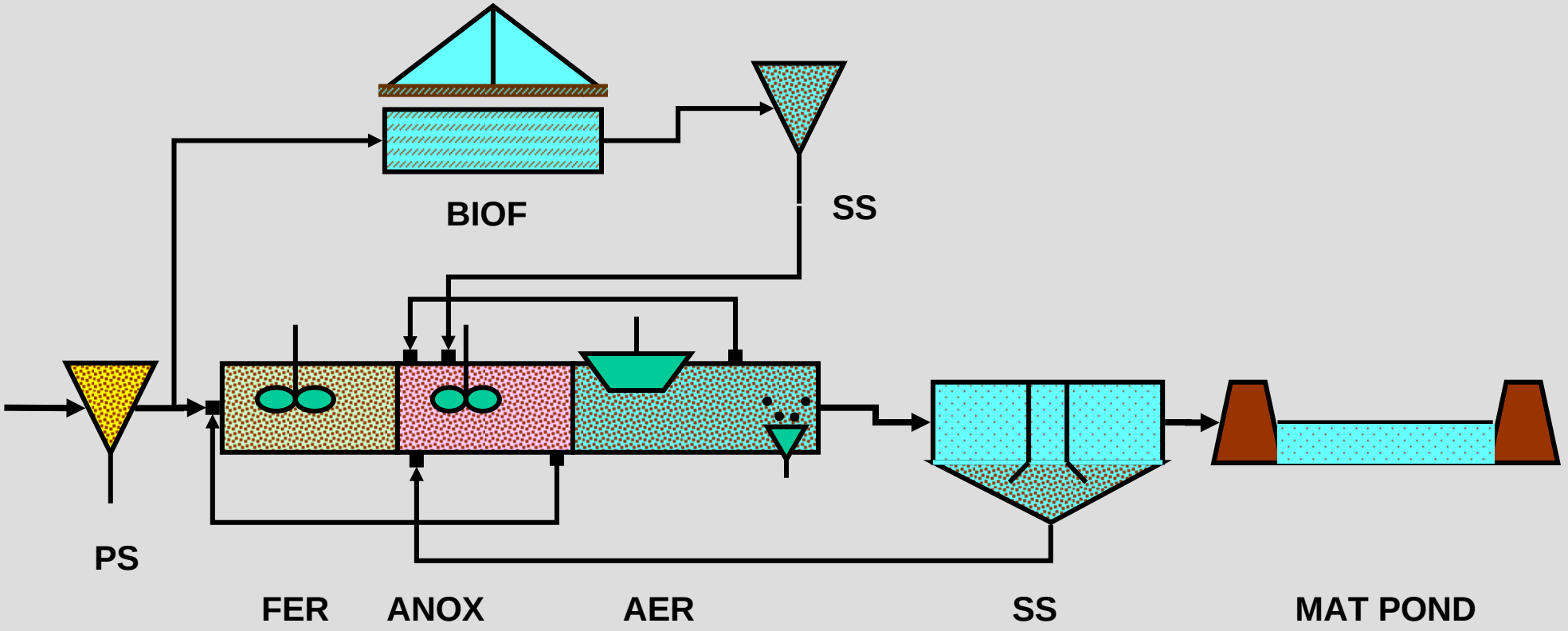
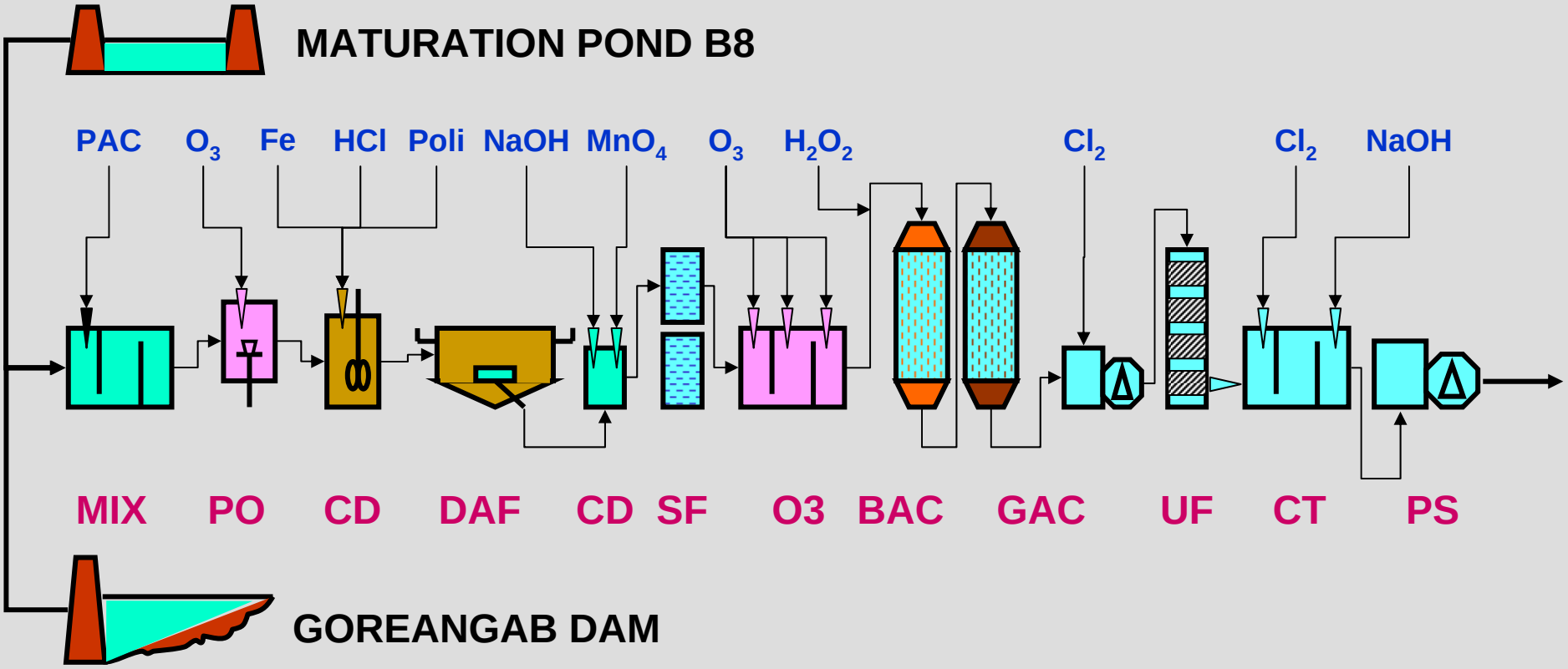
Gammams Wastewater Treatment Plant



New Goreangab Reclamation Plant

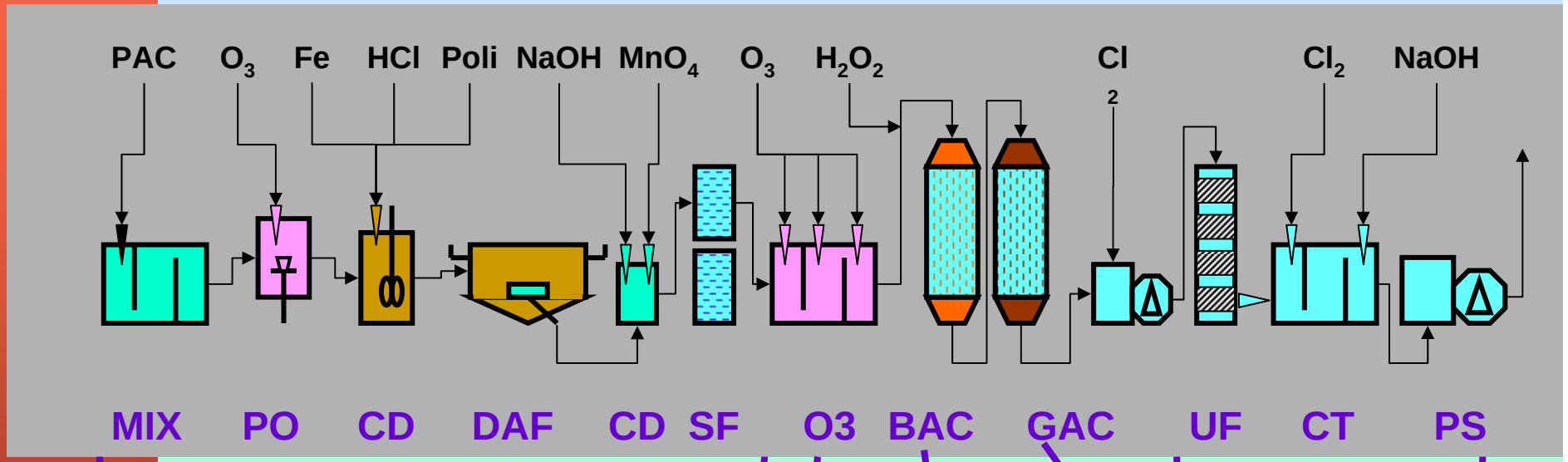


PROCESS PERFORMANCE

- % Removal of organic surrogates
- Actual removal of DOC, COD, UV_{254}
- Removal of Turbidity and Faecal Coliform

City of Windhoek

% Removal of Organic Surrogates



	CD-DAF-SF	O3	BAC	GAC	UF+CL2
DOC	47	0	31	32	7
COD	49	0	29	13	15
UV254	56	36	26	43	0
TURBIDITY	99	-	-	12	68

95%P	DOC mg/l	COD mg/l	UV254 abs/cm
IN	12	41.2	0.225
OUT	2.82	11	0.027

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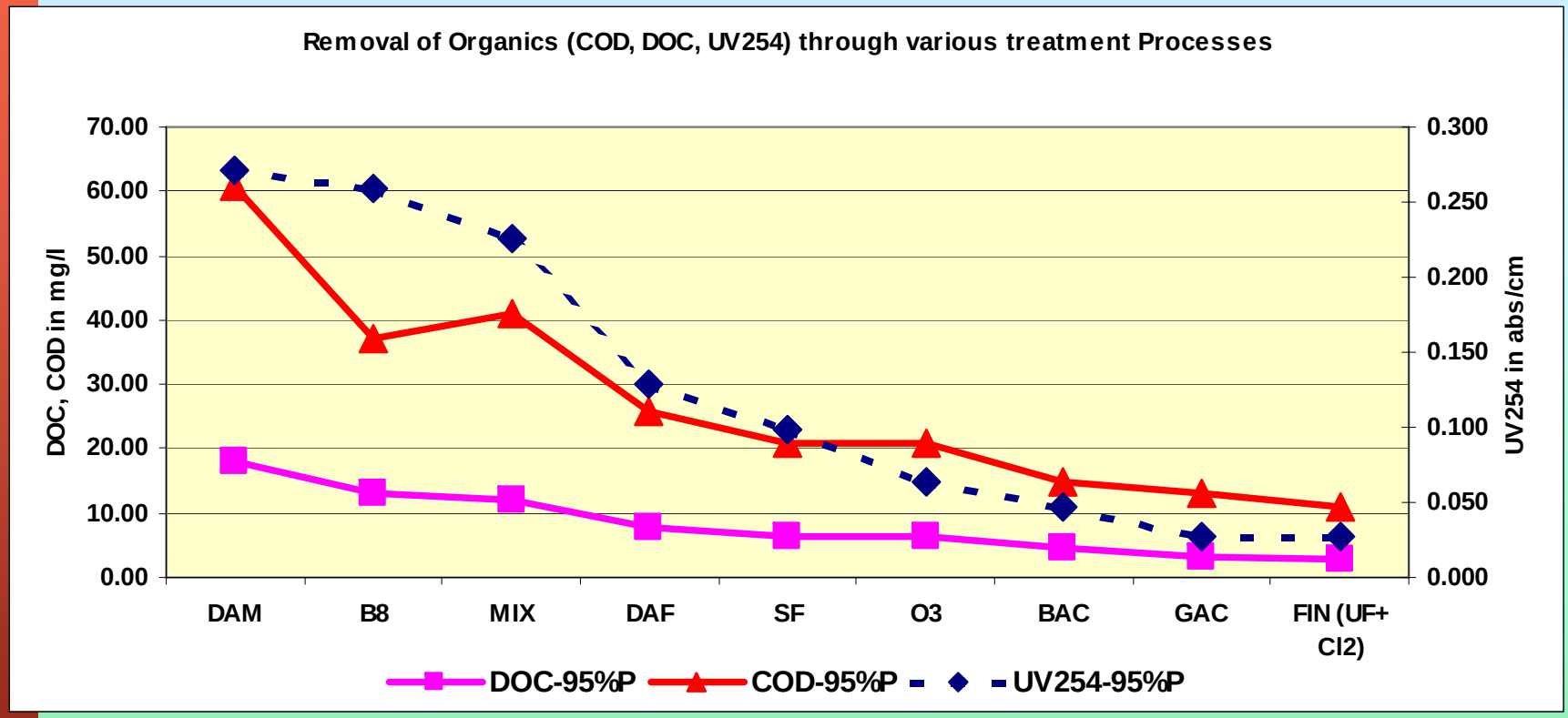
Actual removal of DOC, COD, UV_{254}



95%P	DOC mg/l	COD mg/l	UV254 abs/cm
IN	12	41.2	0.225
OUT	2.82	11	0.027

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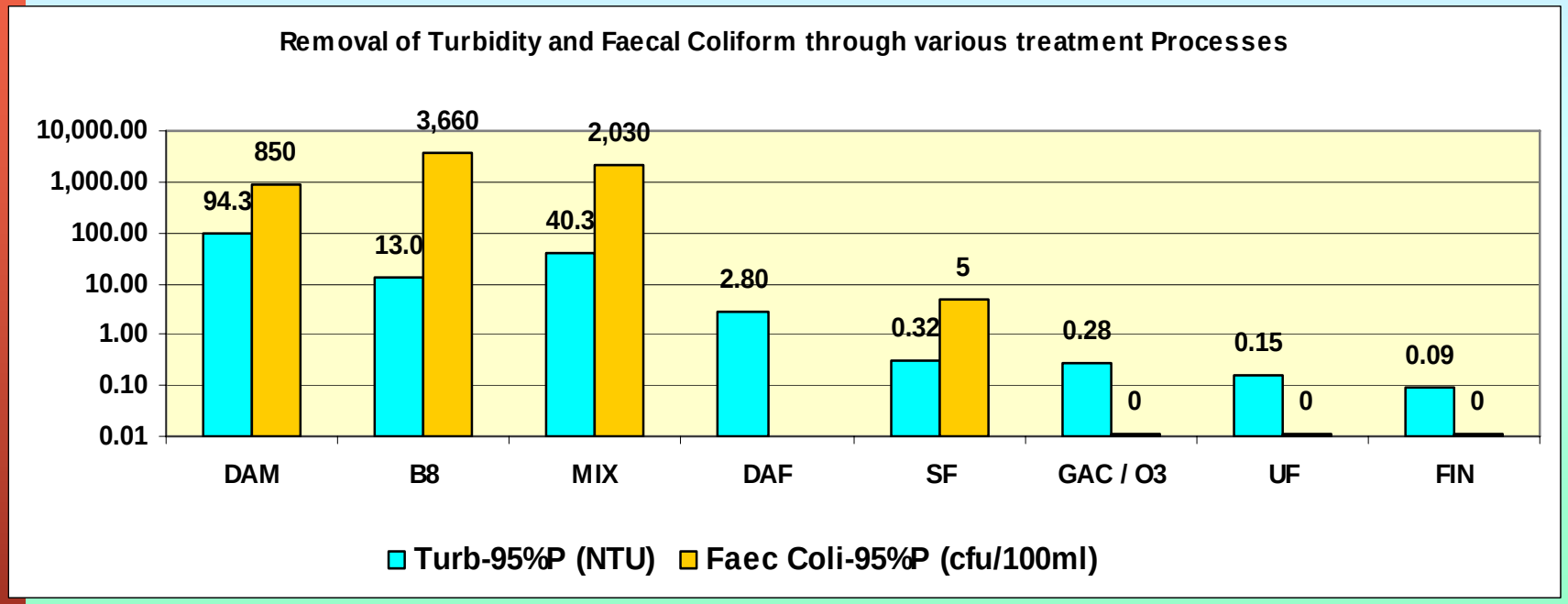
Removal of Turbidity and Faecal coliform



95%P	TURBIDITY NTU	Faecal coliform cfu/100ml
IN	40.3	2030
OUT	0.09	0

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DISTRIBUTION

- Guidelines
- Distribution system – Blending
- Quality in the distribution system
- Public awareness

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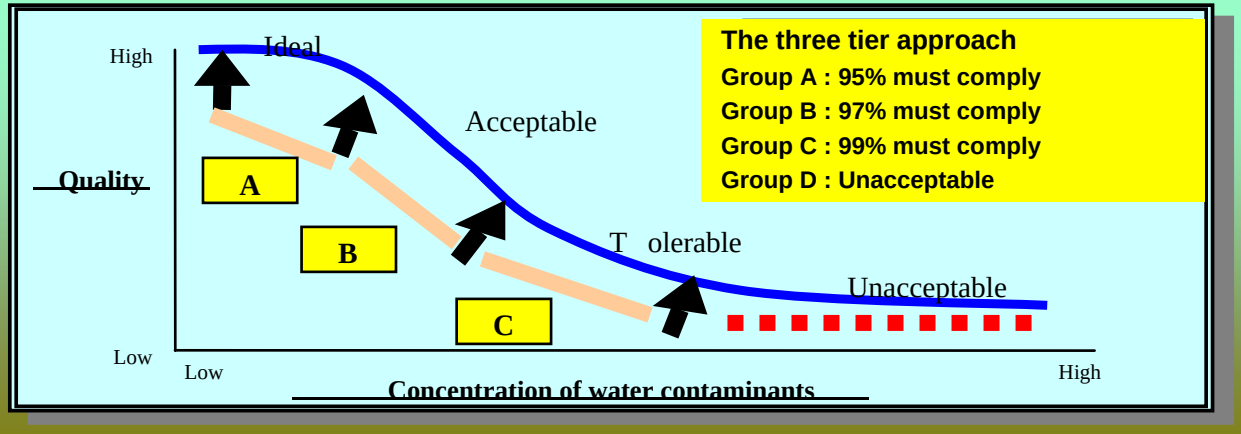
GUIDELINES

National and International:

- **WHO, Namibia, Rand Water, EPA, EU**

In-house :

- **Reclamation Plant - special guidelines**
- **In-house guidelines for different processes**
- **Industrial effluents**



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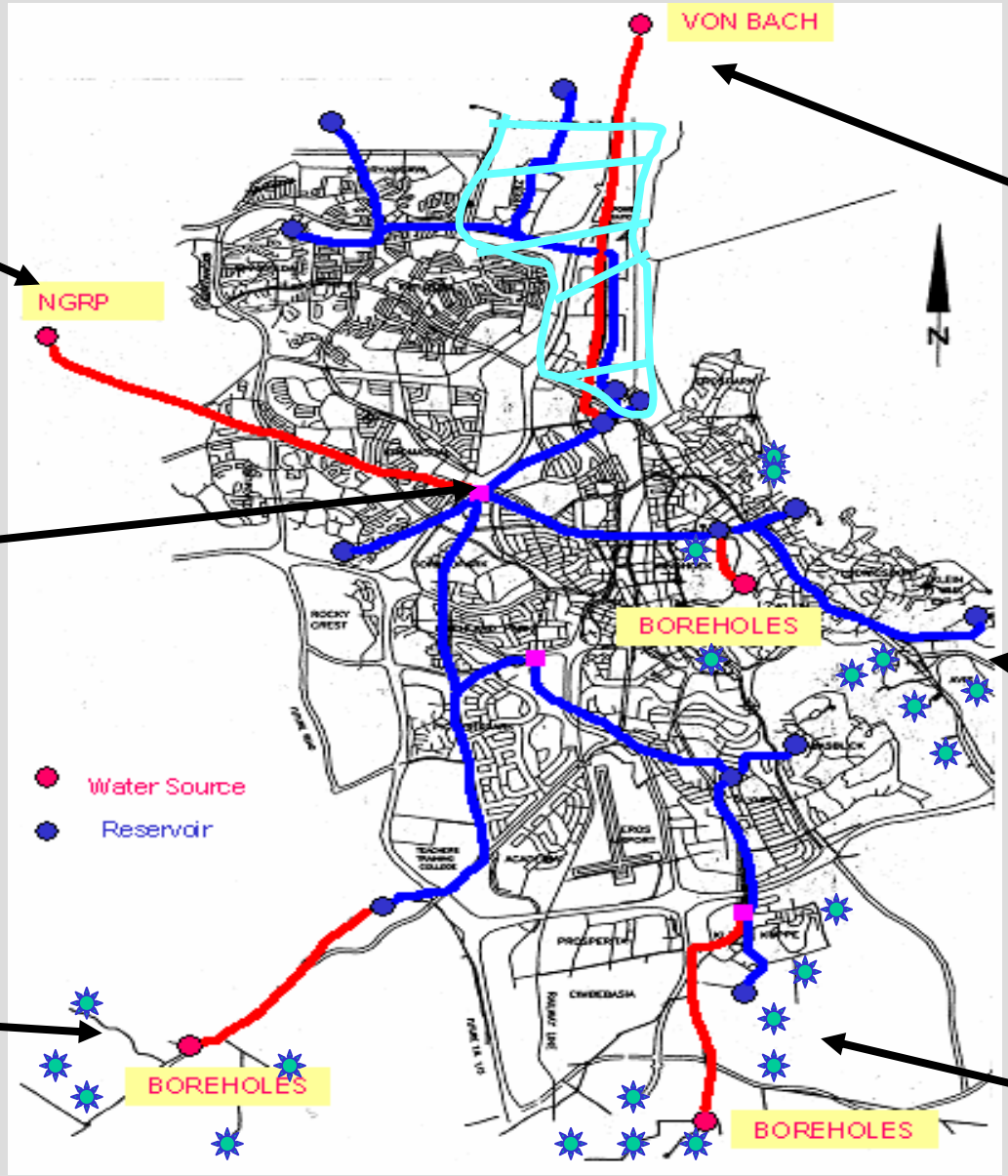
Distribution System – Blending



New Goreangab Reclamation Plant

SURFACE VON BACH

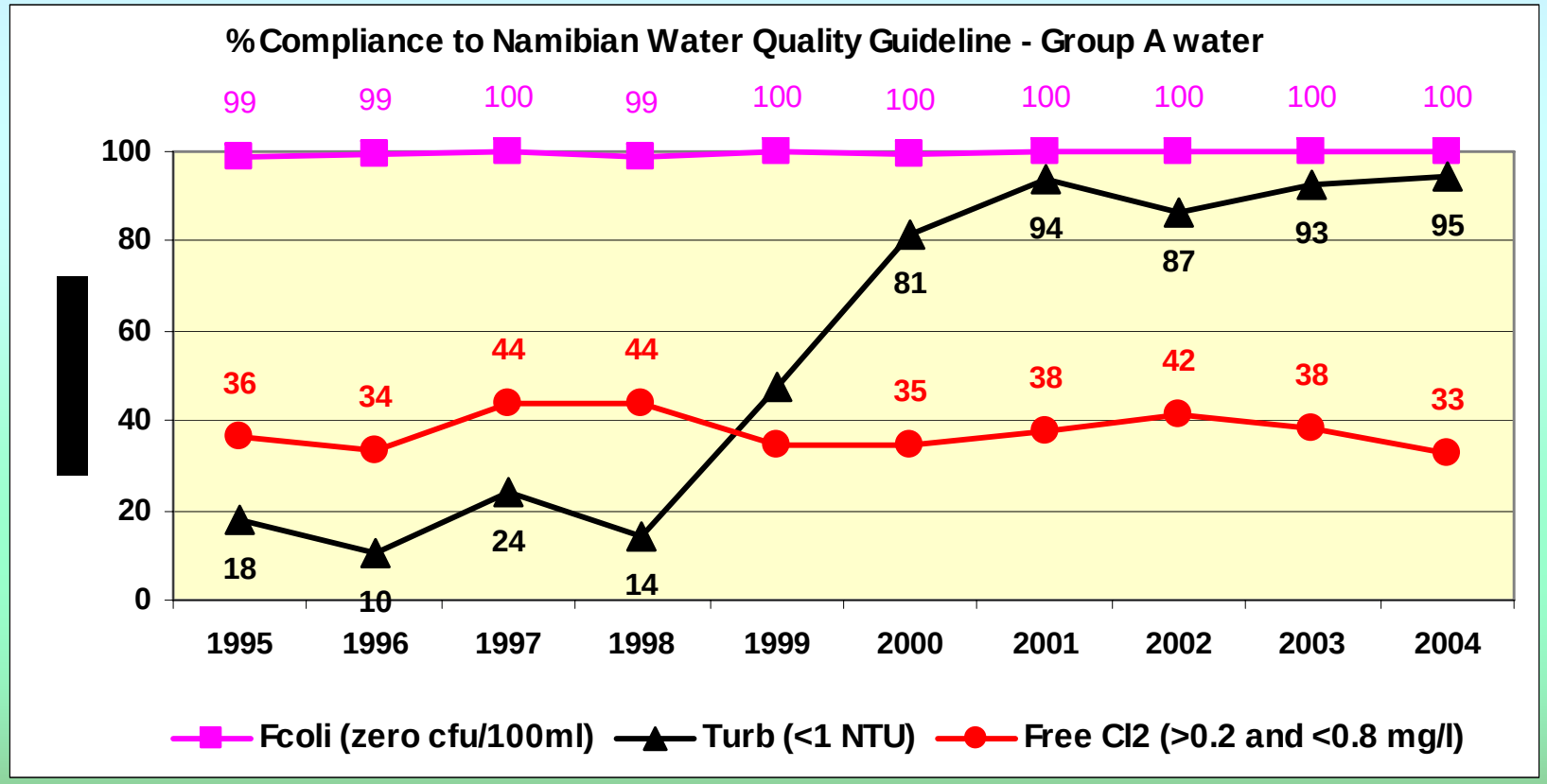
BLENDING

BOREHOLE A

BOREHOLE C

BOREHOLE B

Quality in the Distribution System



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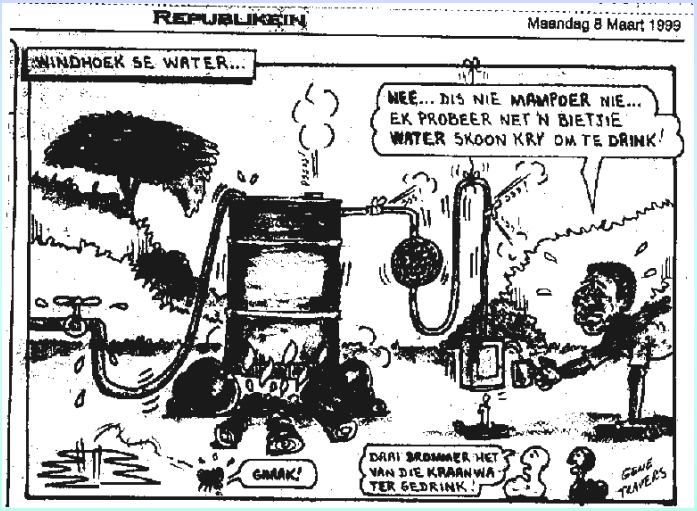
PUBLIC AWARENESS



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“Water should not be judged by its history, but by its quality”

Dr Lucas van Vuuren , one of the pioneers of the Windhoek reclamation system.

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