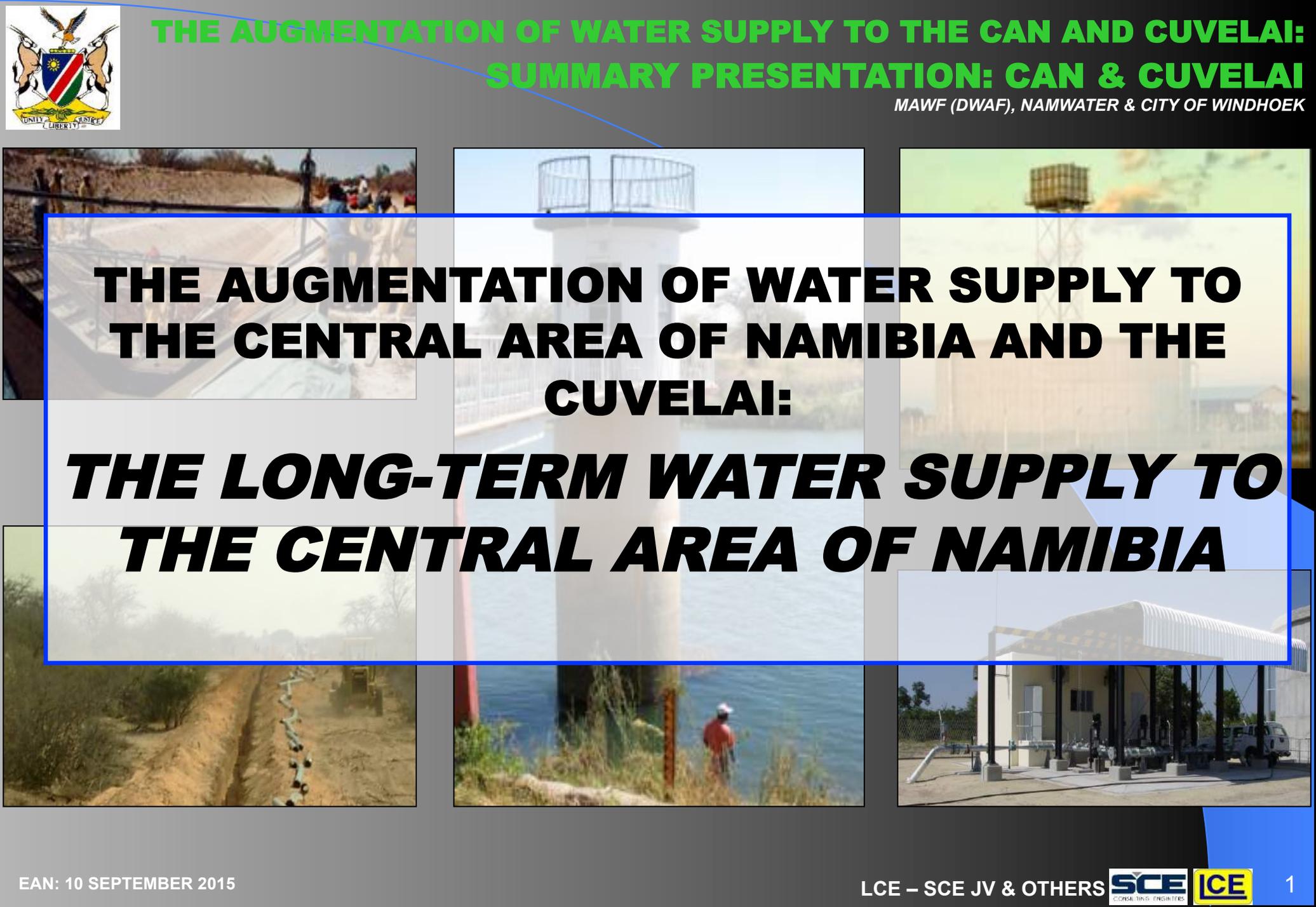




# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK



## THE AUGMENTATION OF WATER SUPPLY TO THE CENTRAL AREA OF NAMIBIA AND THE CUVELAI: *THE LONG-TERM WATER SUPPLY TO THE CENTRAL AREA OF NAMIBIA*



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## PRESENTATION

1. PROJECT BACKGROUND
2. THE CENTRAL AREA OF NAMIBIA
  1. Economic importance
  2. Water supply configuration
  3. Water supply sufficiency (current)
  4. Water supply sufficiency (future)
  5. Water supply options
  6. Supply / demand modelling
  7. Conclusions



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK



## 1. PROJECT BACKGROUND 1.1 PROJECT BACKGROUND

- ❖ Water Augmentation Study
- ❖ Separate consultancy teams
  - ❖ Engineering Component
  - ❖ Environmental & Social Component
- ❖ Client liaison via the Project Liaison Committee
- ❖ Desk study, pre-feasibility study
- ❖ Project details:

[www.namibiawateraugmentation.com](http://www.namibiawateraugmentation.com)



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## 1. PROJECT BACKGROUND 1.2 PROJECT OBJECTIVE



### ❖ Project objective:

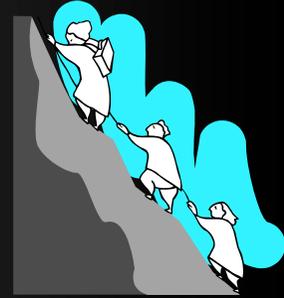
*“To examine all nominally feasible options for securing the long term... water supply to the Central Area of Namibia and the Cuvelai area of Namibia where existing sources might become inadequate in the near future”*



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## 1. PROJECT BACKGROUND 1.3 PROJECT TEAMS



- ❖ **Engineering Consultancy Team:**
  - ❖ **Lund Consulting Engineers CC & Seelenbinder Consulting Engineers CC (JV)**
  - ❖ **Environmental Engineering Services**
  - ❖ **Manfred Redecker Consulting Engineer**
  - ❖ **Pedro Maritz Civil Consultant**
  - ❖ **Professional Environmental Technologies**
  - ❖ **Dynamic Water Resources Management**
  - ❖ **The Maproom**
  - ❖ **AECOM**
- ❖ **Environmental & Social Consultancy Team:**
  - ❖ **Sustainable Solutions Trust & Others**
  - ❖ **Southern African Institute for Environmental Assessment**



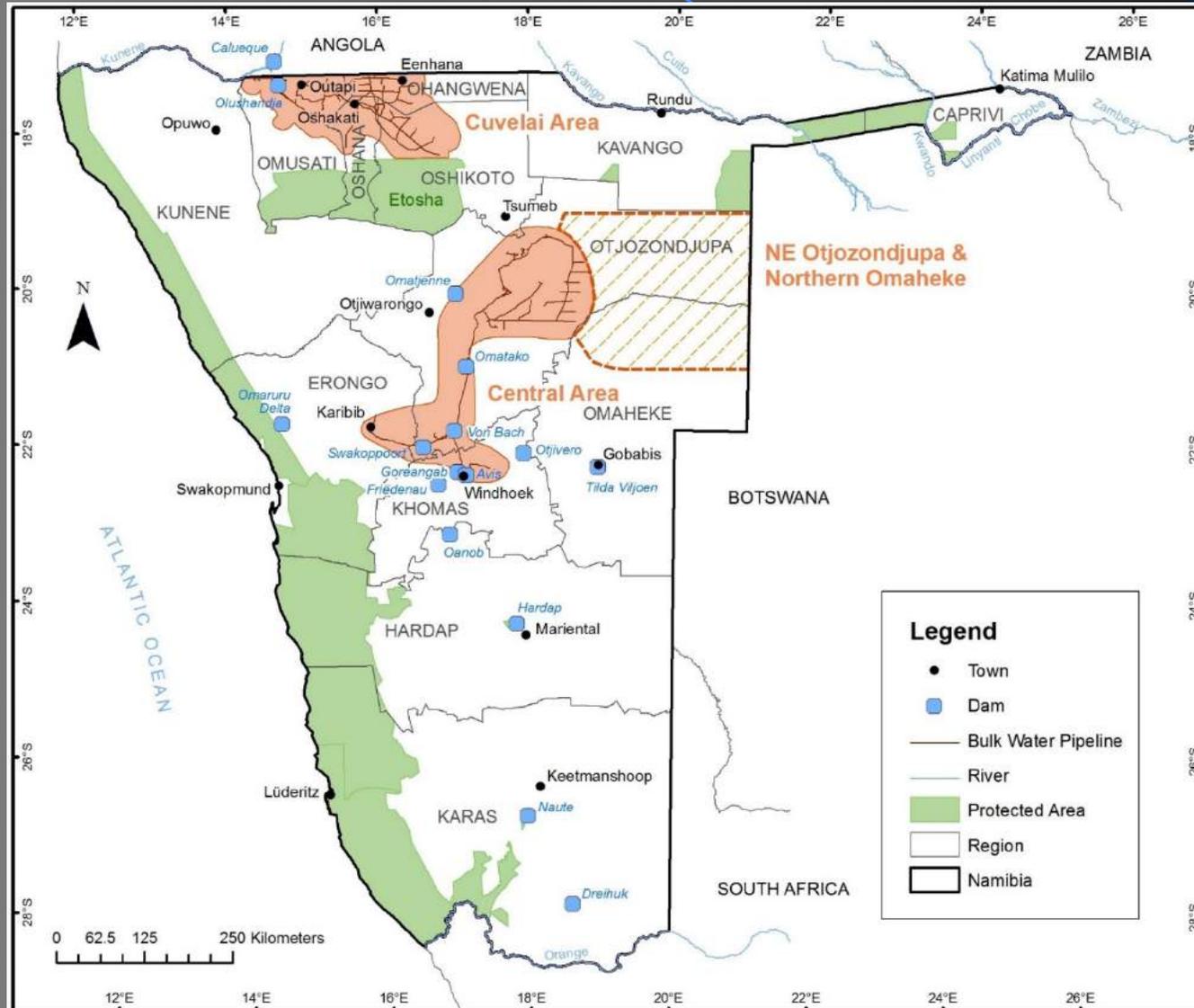
# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

1.

## PROJECT BACKGROUND

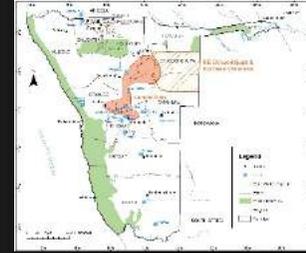
### 1.4 PROJECT AREA



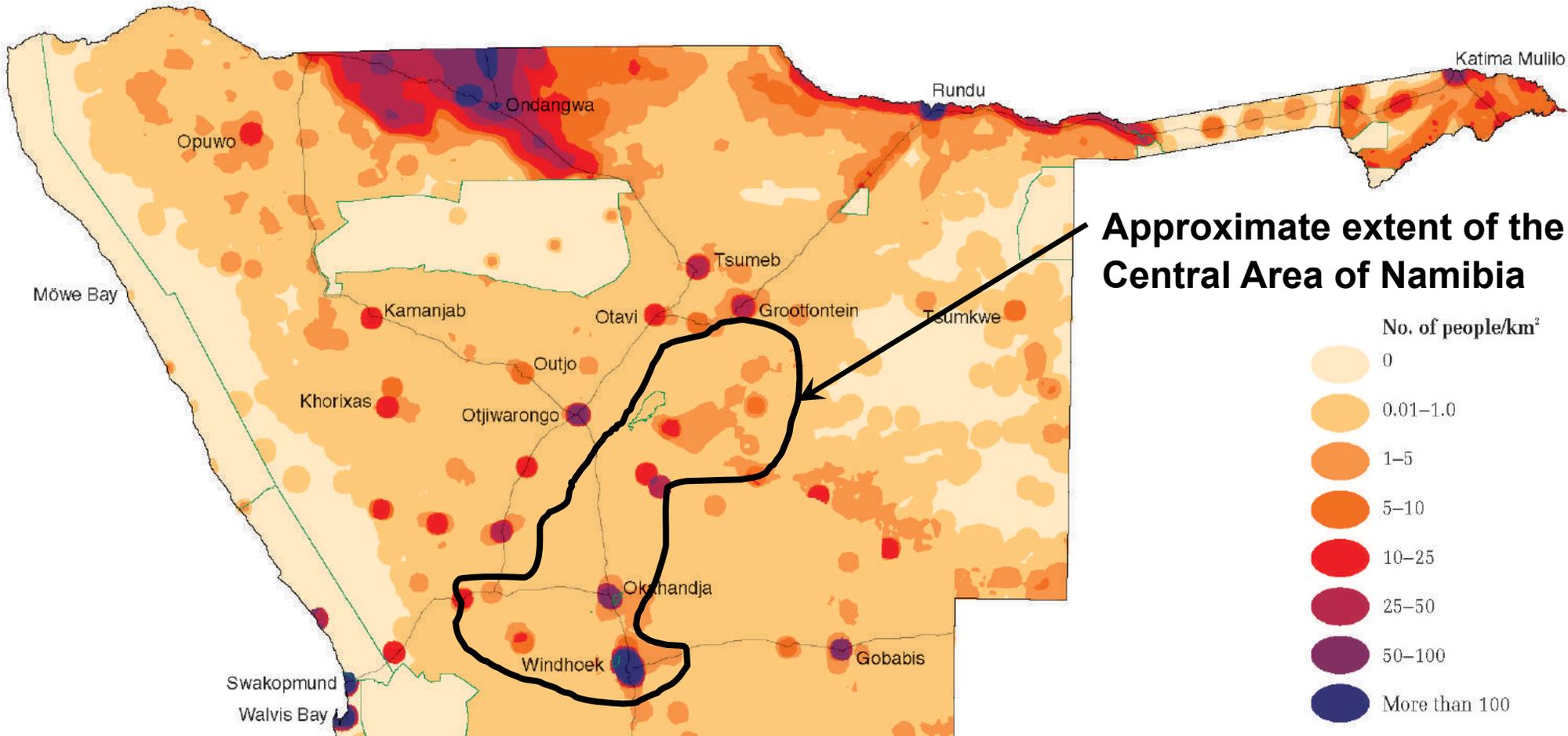


# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK



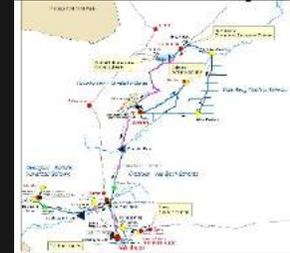
## 2. THE CENTRAL AREA OF NAMIBIA 2.1 THE CENTRAL AREA OF NAMIBIA





# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK



## 2.2

## ECONOMIC IMPORTANCE

### Khomas Region: Household Expenditure

Description		Expenditure	Households (No.)
Percentage of Total National Values	2003/04	37%	14%
	2009/10	37%	17%

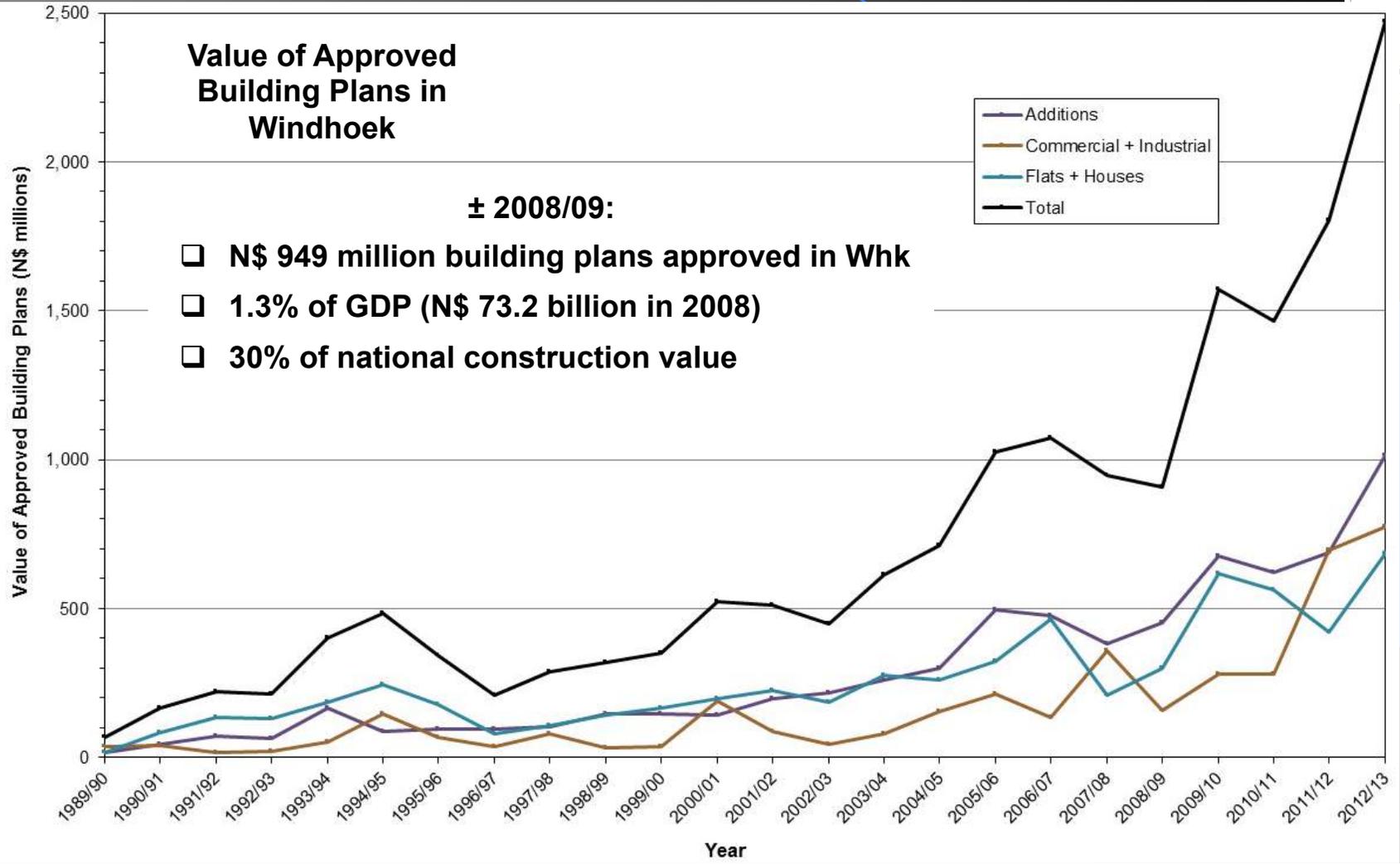
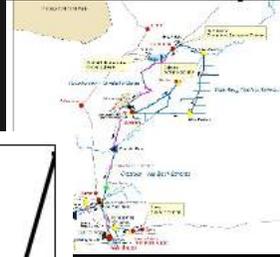


# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## 2.2

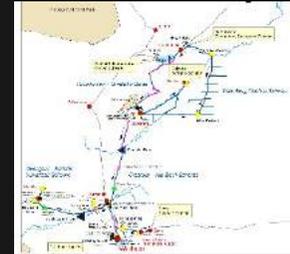
## ECONOMIC IMPORTANCE





# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK



## 2.2 ECONOMIC IMPORTANCE

### 2.2.1 Implications of Shortfalls

- ❖ Windhoek is the seat of Government
  - ❖ Entrance point for overseas tourists (Hosea Kutako)
  - ❖ Most of the building activities in the CAN (N\$ 2.5 billion in 2012/13)
  - ❖ Grave concern by water intensive users (unofficial losses if no water):
    - ❖ NamBrew, Coca-Cola & Meatco: N\$ 13.22 million per day
    - ❖ Navachab Mine: N\$ 2.53 million per day
    - ❖ CoW building: N\$ 6.85 million per day
  - ❖ Potentially major economic and job losses in the CAN
  - ❖ Need water to provide for people currently without full services (Mass Housing backlog)
- Severe water shortage could be catastrophic for the economy of Namibia



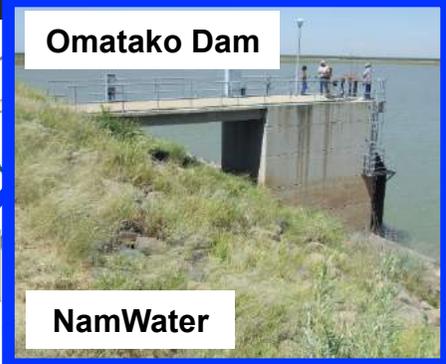
# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

## CONFIGURATION OF INFRASTRUCTURE & WATER SOURCES IN THE CENTRAL AREA OF NAMIBIA (CAN)



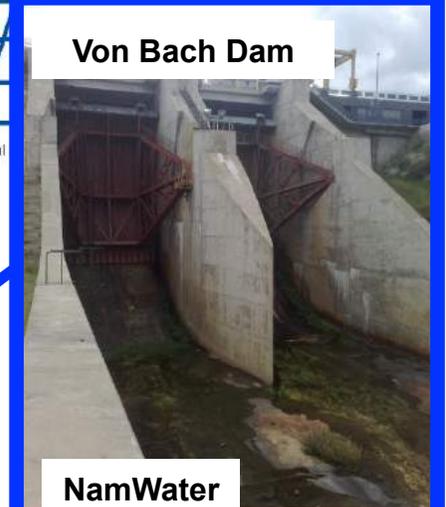
Karst GW

NamWater



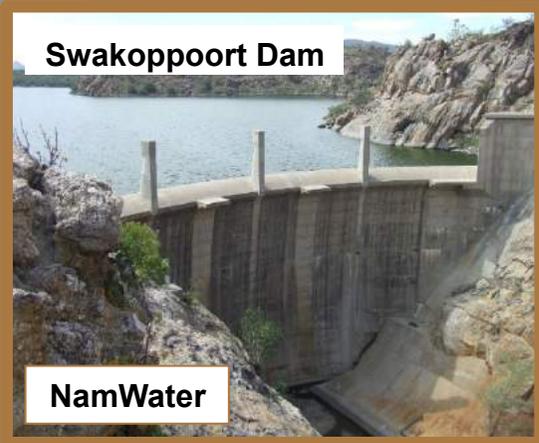
Omatako Dam

NamWater



Von Bach Dam

NamWater



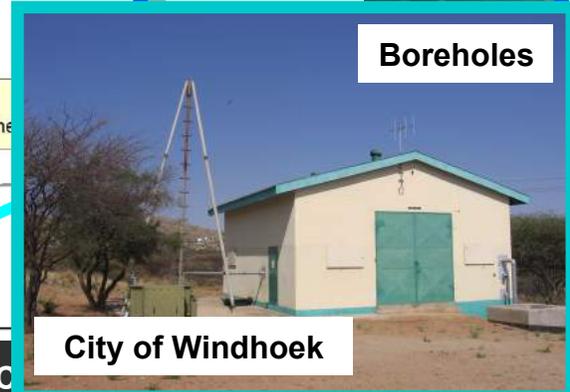
Swakoppoort Dam

NamWater



Reclaimed

WINGOC



Boreholes

City of Windhoek



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

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## 2.3 CURRENT WATER SUPPLY SUFFICIENCY 2.3.1 Supply: Water Resources in the CAN

Water Resource	Yield Value	Yield (Mm <sup>3</sup> /a) Current CAN Normal Period
Combined 3 Dams	95% Safe Yield	20.00
Total Groundwater	Normal Period	4.84
Direct Reclamation (Whk)	Full capacity	5.00 (7.66)
Semi-purified Irrigation (Whk)		1.61
<b>Total</b>		<b>31.45 (34.11)</b>

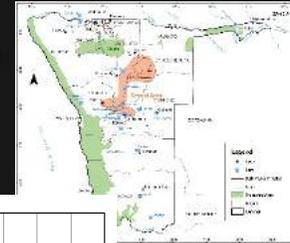
31.45 Mm<sup>3</sup>/a until April 2017,  
34.11 Mm<sup>3</sup>/a thereafter



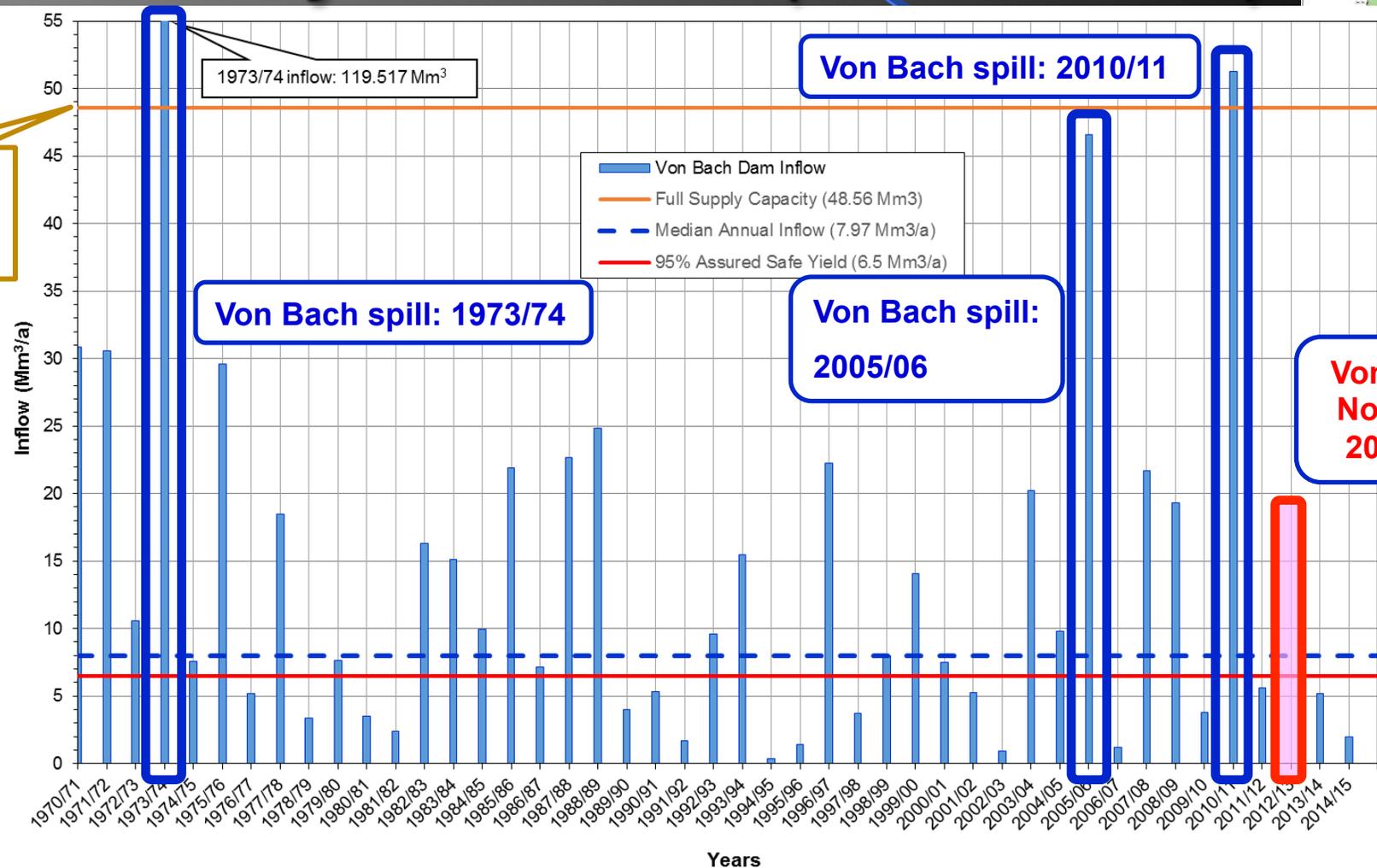
# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## 2.3 CURRENT WATER SUPPLY SUFFICIENCY 2.3.2 Variability of Resources (Von Bach Dam)



Full Supply Level:  
48.56 Mm<sup>3</sup>



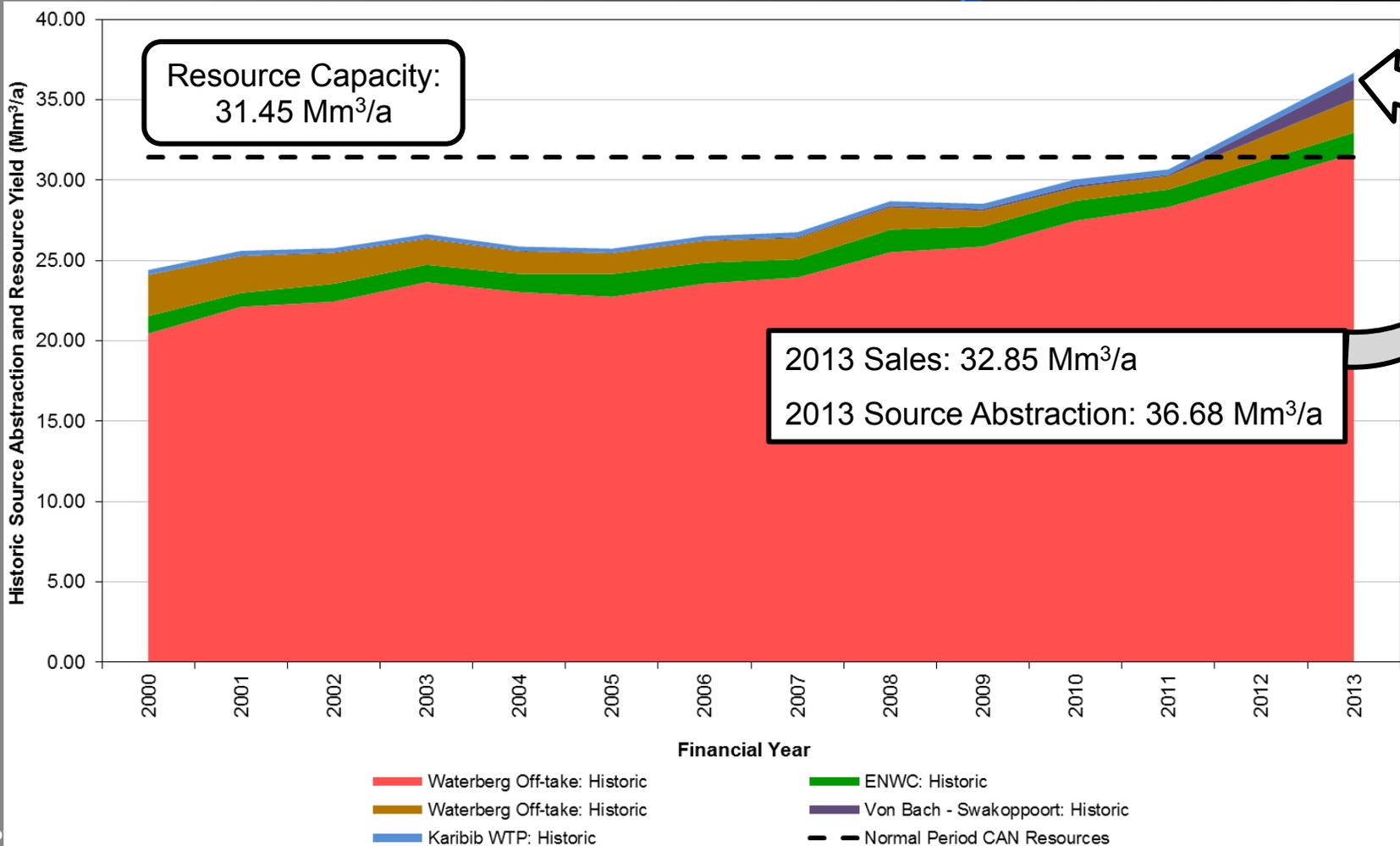
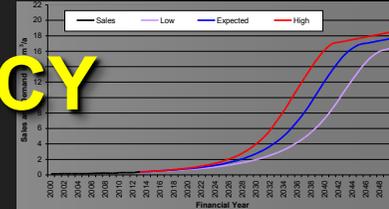
Von Bach:  
No inflow  
2012/13!



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## 2.3 CURRENT WATER SUPPLY SUFFICIENCY 2.3.3 Historic Source Abstraction

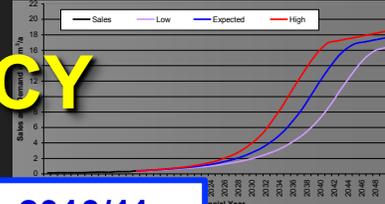




# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## 2.3 CURRENT WATER SUPPLY SUFFICIENCY 2.3.4 Von Bach Dam Levels

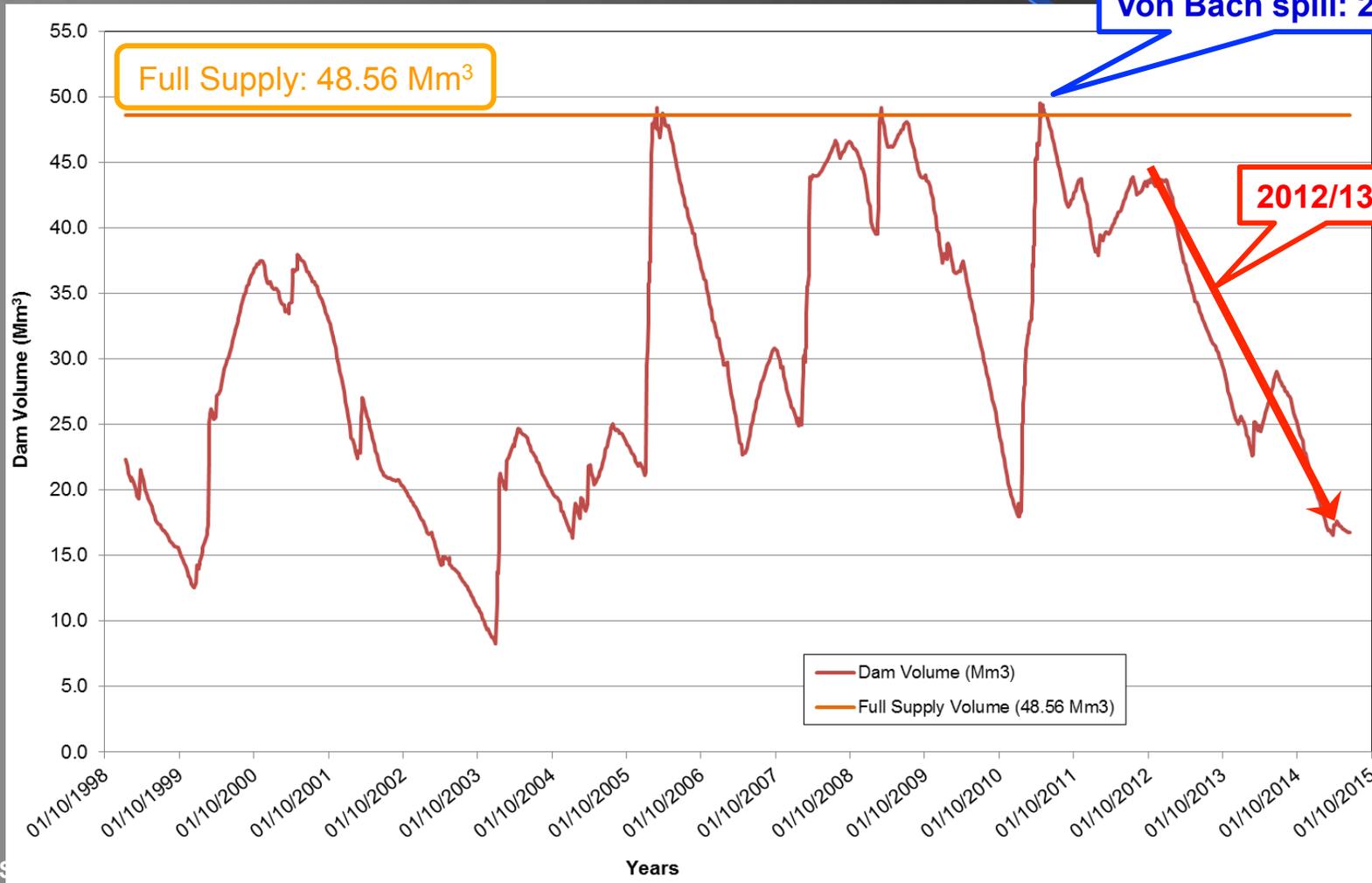


Von Bach spill: 2010/11

Full Supply: 48.56 Mm<sup>3</sup>

2012/13 →

07 Sept 2015:  
15.58 Mm<sup>3</sup>/a  
(32.1%)



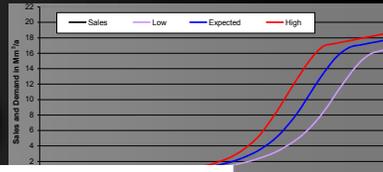


# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

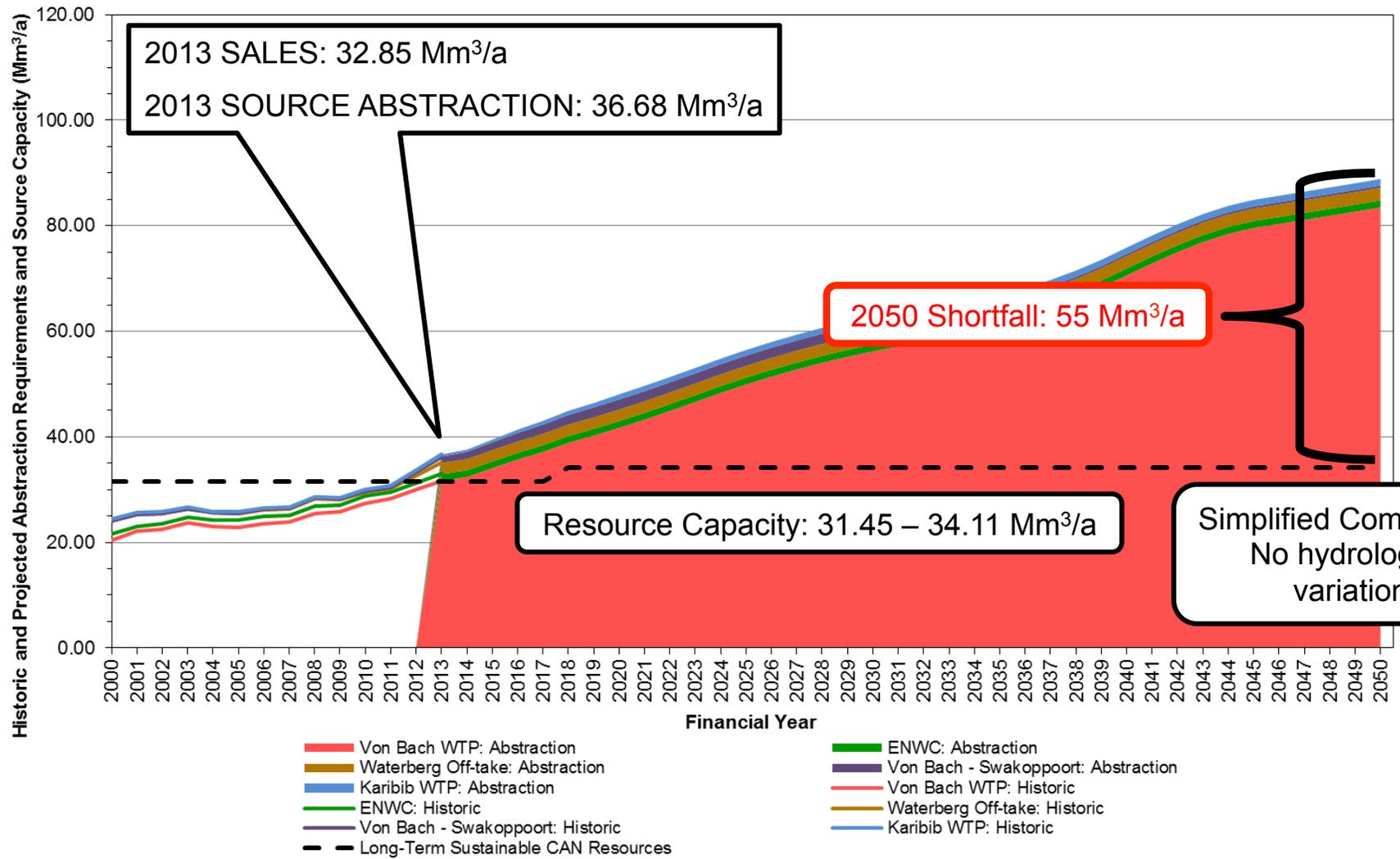
MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## 2.4 FUTURE SUPPLY

### 2.4.1 Simplified Future Demand Scenario (1)



Likely Scenario Demands



# ADDITIONAL AREAS

NE Otjozondjupa

Otjiwarongo  
(±2040)

Okondjatu

Otjinene  
(±2041)

NE Otjozondjupa  
& N Omaheke

Omaruru  
(±2021)

## Legend:

- Local resources may become insufficient
- Areas not currently served

Windhoek

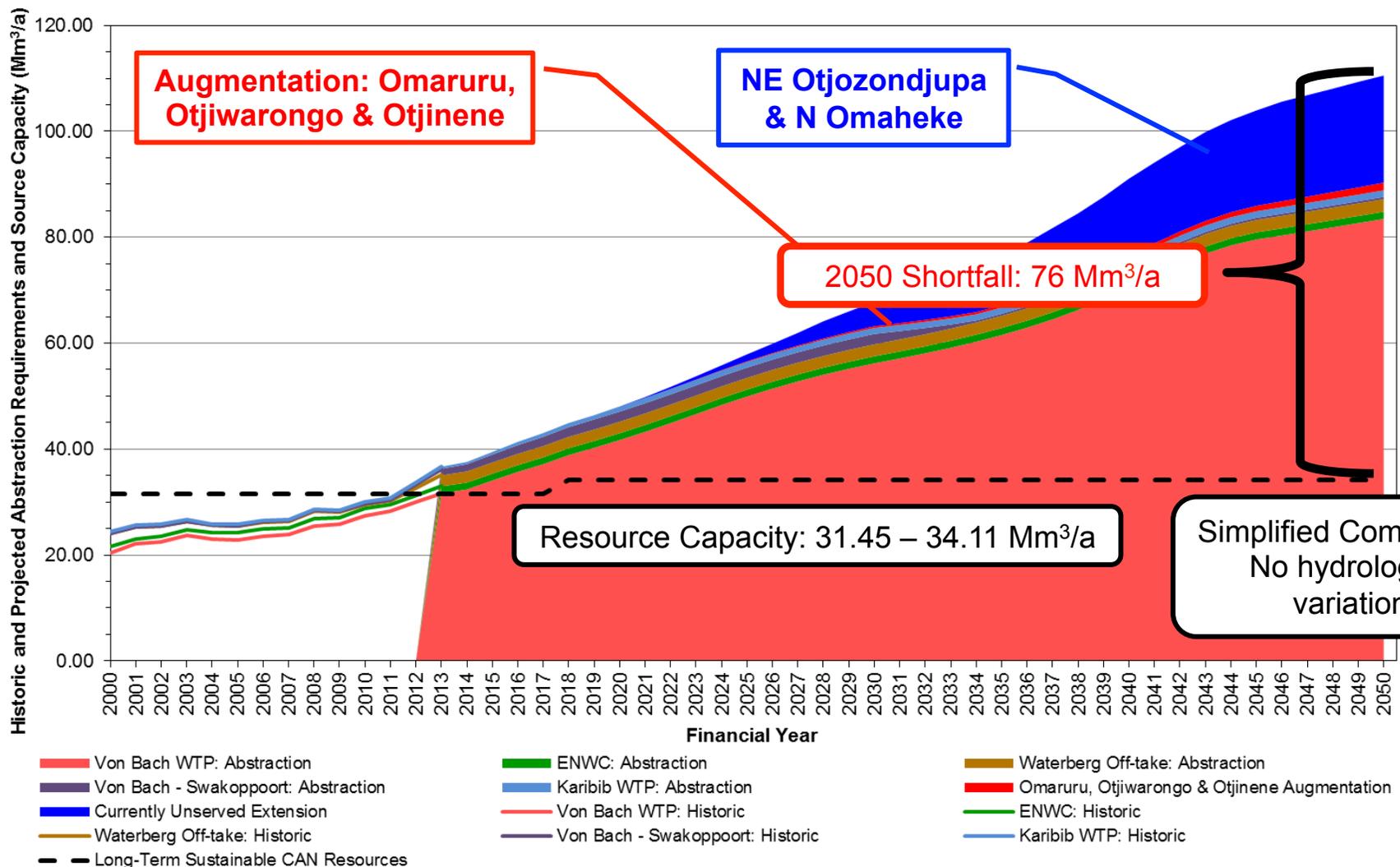
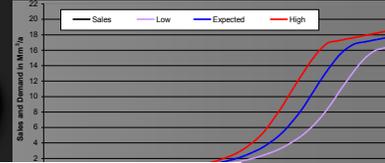
Talismanis-  
Lister-  
Rietfontein



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

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## 2.4.2 Simplified Future Demand Scenario (2)



Likely Scenario Demands



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

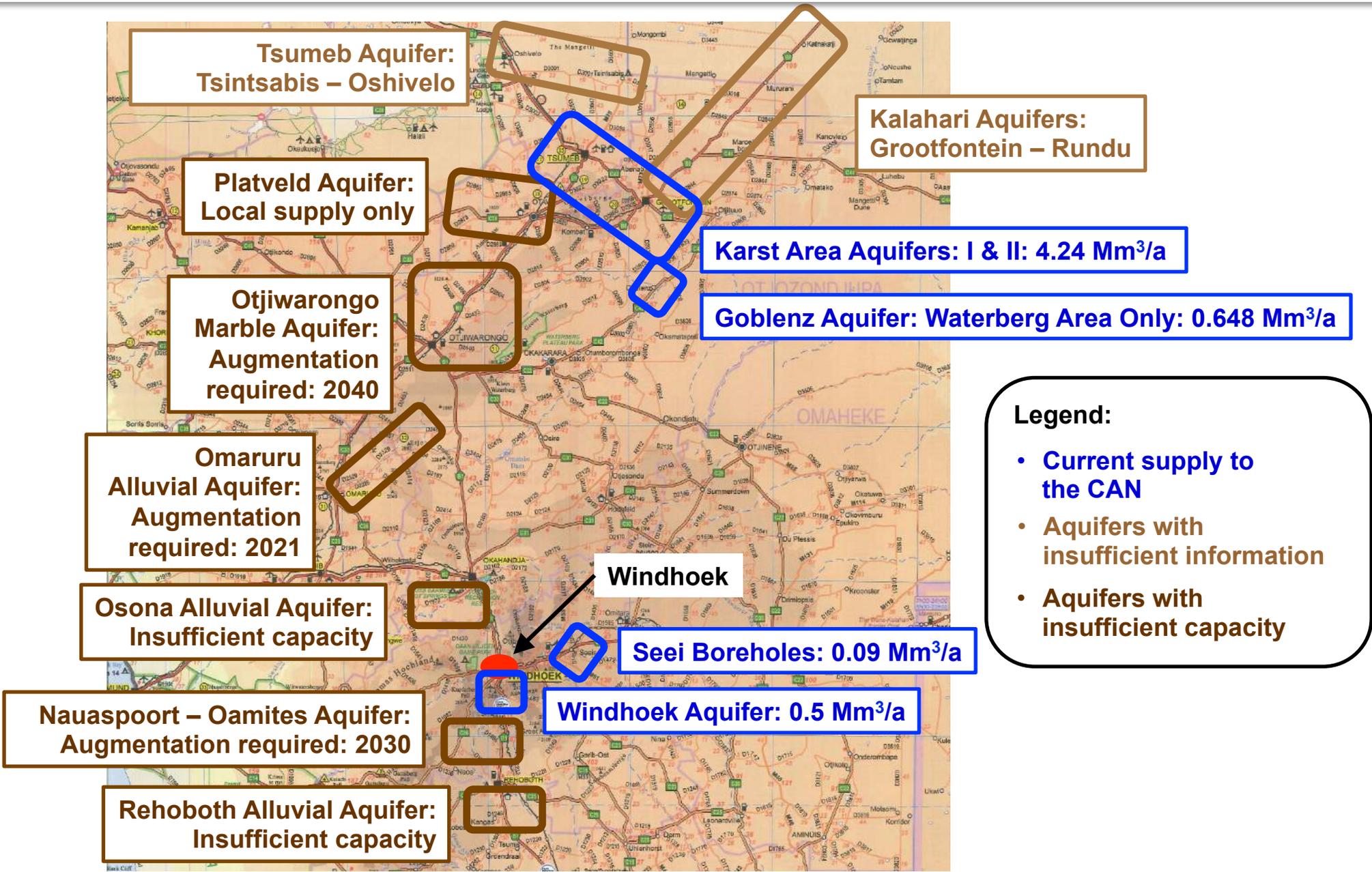
MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## 2.5 WATER SUPPLY OPTIONS

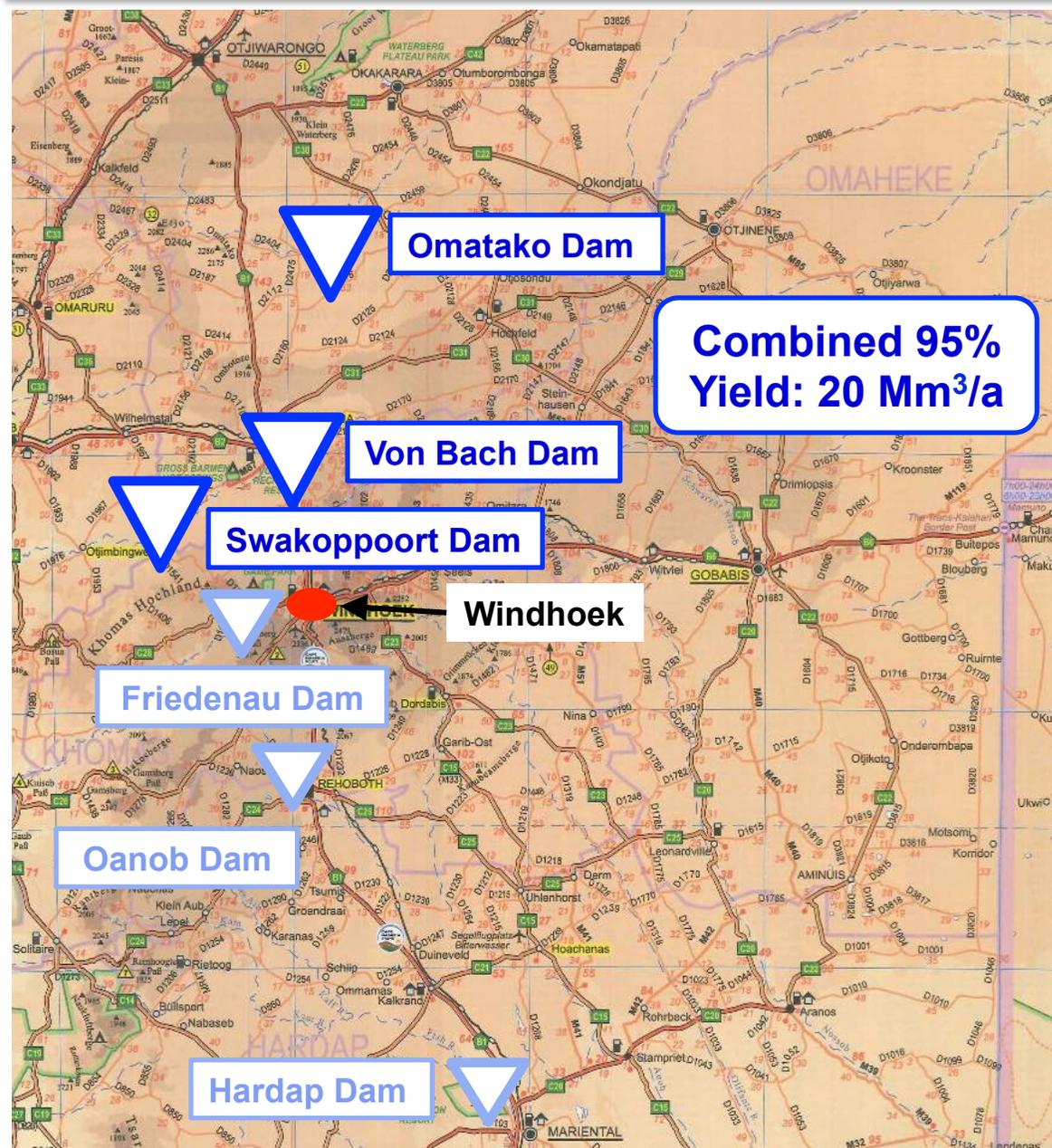


1. Previous assessments:
  - ❖ Covering the ENWC, abstraction from the Kunene / Orange Rivers
2. Not considered:
  - ❖ Eiseb & Gobabis Aquifers, Zambezi River
3. Groundwater sources
4. Surface water sources

# 2.5.3 Groundwater Sources



## 2.5.4 Surface Sources



- Legend:**
- Current supply to the CAN
  - Dams with insufficient capacity



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK



## 2.5 WATER SUPPLY OPTIONS

- ❖ Previous assessments:
  - ❖ Covering the ENWC, abstraction from the Kunene / Orange Rivers
- ❖ Not considered:
  - ❖ Eiseb & Gobabis Aquifers, Zambezi River
- ❖ Groundwater sources:
  - ❖ Aquifers with insufficient information: Tsumeb & Kalahari Aquifers
  - ❖ Aquifers with insufficient capacity: Platveld, Otjiwarongo, Omaruru, Osona, Rehoboth, Nauaspoort - Oamites
- ❖ Surface water sources:
  - ❖ Friedenau, Oanob & Hardap Dams have insufficient capacity
- ❖ **Okavango River, Desalination**



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK



## 2.6 SUPPLY / DEMAND MODELLING

### 2.6.1 Modelling and Basic Inputs

- ❖ Computer modelling: “*CA-Model*”, as used by NamWater
  - ❖ 500 simulations: Statistical probability of supply
  - ❖ Modelling workshop: October 2014, follow-up Nov / Dec 2014 and again in Jan / Feb 2015
  - ❖ Basic Inputs:
    - ❖ Likely scenario water demands (Phase 1)
    - ❖ Source capacities
    - ❖ Operating rules, transfer capacities, losses
    - ❖ Water supply scenarios
- Security of supply in terms of statistical probabilities



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK



## 2.6 SUPPLY / DEMAND MODELLING

### 2.6.2 Scenario Overview

**Scenario 1**  
Baseline  
(do nothing)

**Scenario 2**  
Swakoppoort  
Water Quality  
Concerns

**Scenario 3**  
Reduction in  
Von Bach Water  
Treatment Plant

**Scenario 4**  
Windhoek  
Aquifer  
Improvements

**Scenario 5**  
Abenab Mine  
Groundwater  
Abstraction

**Scenario 6**  
Additional  
Reclamation

- ❖ **Medium Term: up to 2023/24:**
- ❖ **Improvements to existing supply sources**
- ❖ **To “buy” time to implement the long-term strategy(ies)**



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## 2.6 SUPPLY / DEMAND MODELLING



### 2.6.3 Scenario Overview

- ❖ Long-term: up to 2050:
- ❖ Augmentation
- ❖ Additional supply requirements

**Scenario 6**  
Reclamation Supply Increase

**Scenario 7**  
Okavango Augmentation

**Scenario 8**  
Desalination

**Scenario 9**  
Incorporate Omaruru, Otjinene and Otjiwarongo demands  
Incorporate climate change, growing demands, additional demands areas etc.

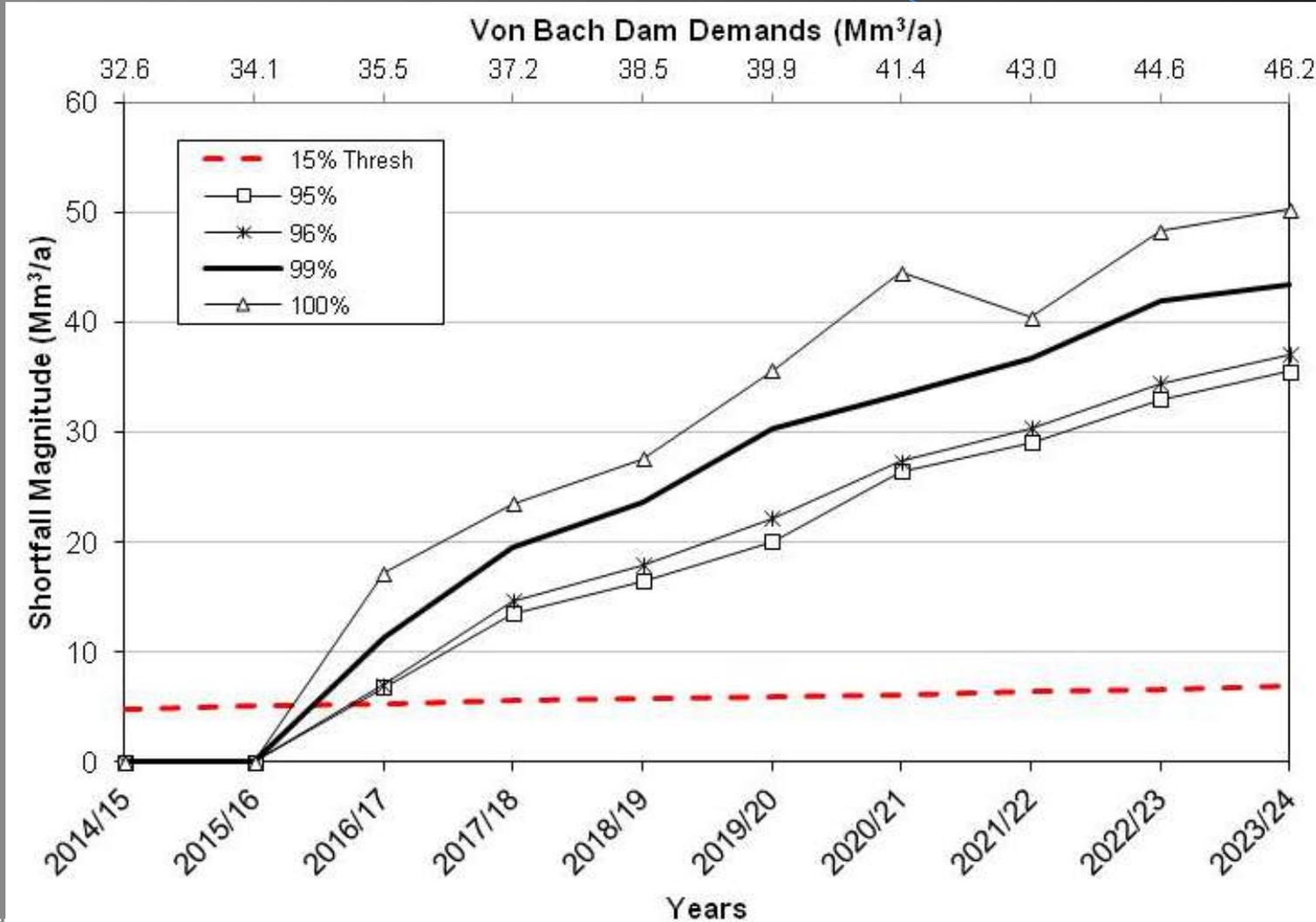


# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWF), NAMWATER & CITY OF WINDHOEK

## 2.6.4

## Results: Baseline Scenario



Likely Scenario Demands

- Computer modelling
- Statistical probability of supply
- Baseline scenario (do nothing)
- **Assuming inflow into the dams!**



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## 2.6.5 Results: Medium-Term Scenario

**Scenario 2: Upgrade Von Bach Water Treatment Plant: N\$ 40 million (40)**

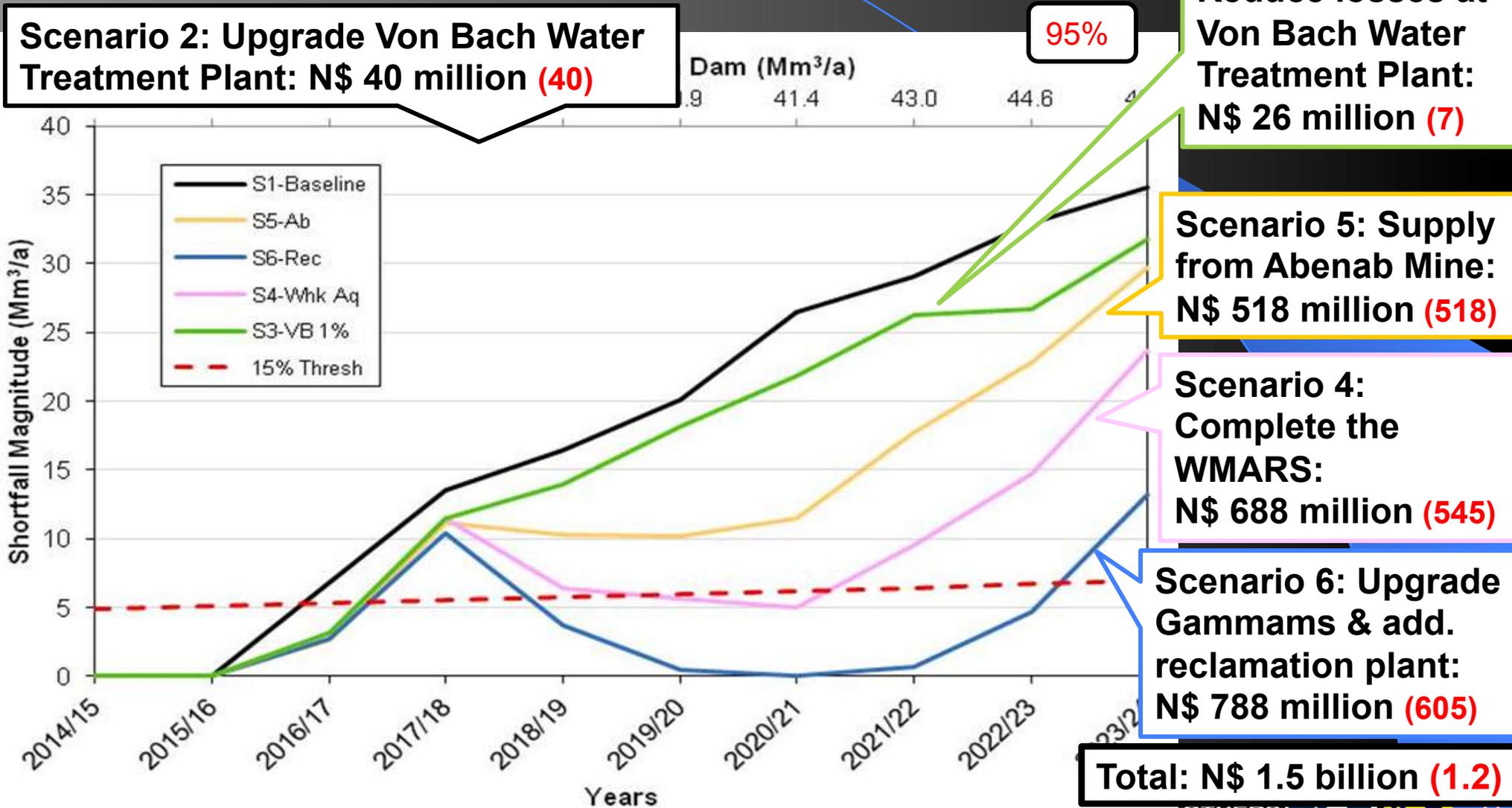
**Scenario 3: Reduce losses at Von Bach Water Treatment Plant: N\$ 26 million (7)**

**Scenario 5: Supply from Abenab Mine: N\$ 518 million (518)**

**Scenario 4: Complete the WMARS: N\$ 688 million (545)**

**Scenario 6: Upgrade Gammams & add. reclamation plant: N\$ 788 million (605)**

**Total: N\$ 1.5 billion (1.2)**



95%

Dam (Mm³/a)  
39 41.4 43.0 44.6 46.2

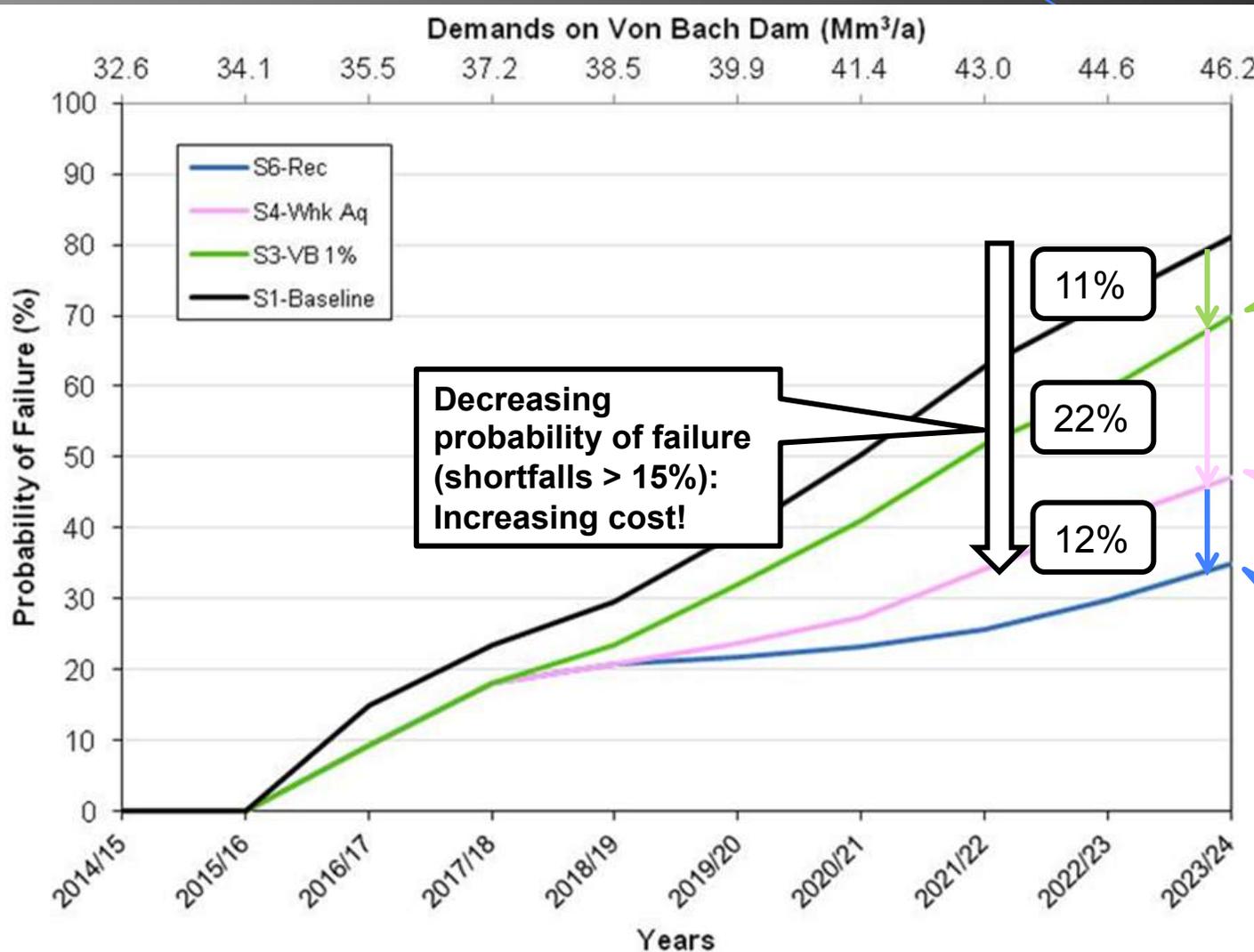
— S1-Baseline  
 — S5-Ab  
 — S6-Rec  
 — S4-Whk Aq  
 — S3-VB 1%  
 - - - 15% Thresh



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CIVILAI: SUMMARY PRESENTATION: C

MAWF (DWAf),

## 2.6.5 Results: Medium-Term Scenarios



**Scenario 2:**  
Upgrade Von Bach Water Treatment Plant:  
N\$ 40 million (40)

**Scenario 3:**  
Reduce losses at Von Bach Water Treatment Plant:  
N\$ 26 million (7)

**Scenario 4:**  
Complete the WMARS:  
N\$ 688 million (545)

**Scenario 6:** Upgrade Gammams & add. reclamation plant:  
N\$ 788 million (605)

**Total: N\$ 1.5 billion (1.2)**



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK



## 2.6 SUPPLY / DEMAND MODELLING

### 2.6.6 Long-Term Supply Options

1. No other water resources large enough within the CAN
2. Only two supply options identified:
  - a. Okavango River abstraction
  - b. Desalinated sea water from the coast
3. Can either option be fully implemented in less than 8 – 10 years...?
4. Shortfalls can be expected until full implementation of one of these sources

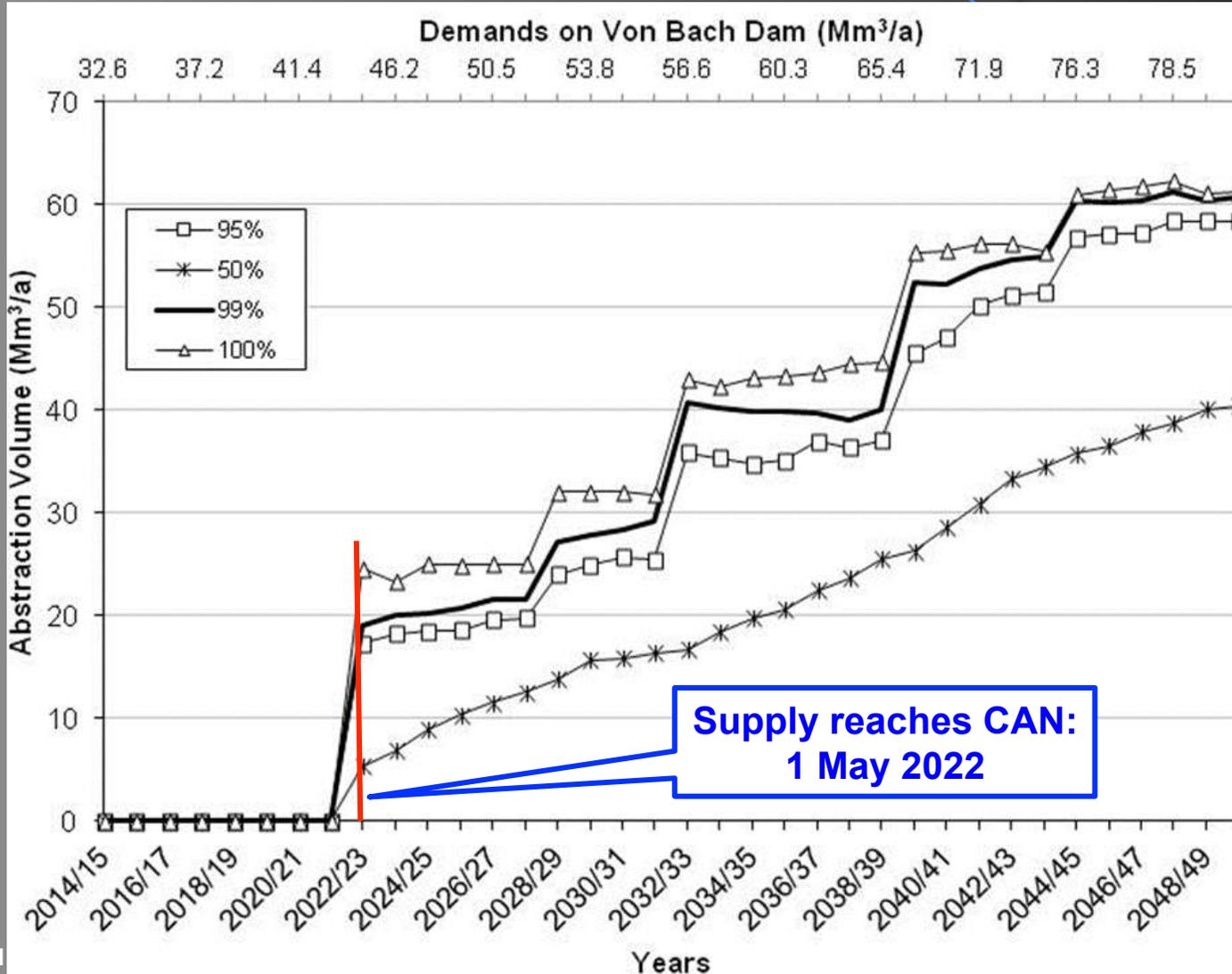


# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## CAN

### 2.6.7 Results: Scenario 7 (Okavango)



**99% Percentile (Design Values) Okavango River Abstraction: 64.05 Mm<sup>3</sup>/a**

**2.44 m<sup>3</sup>/s (20 hrs)**

**50% Percentile (Median Values) Okavango River Abstraction: 40.35 Mm<sup>3</sup>/a**

**1.54 m<sup>3</sup>/s (20 hrs)**



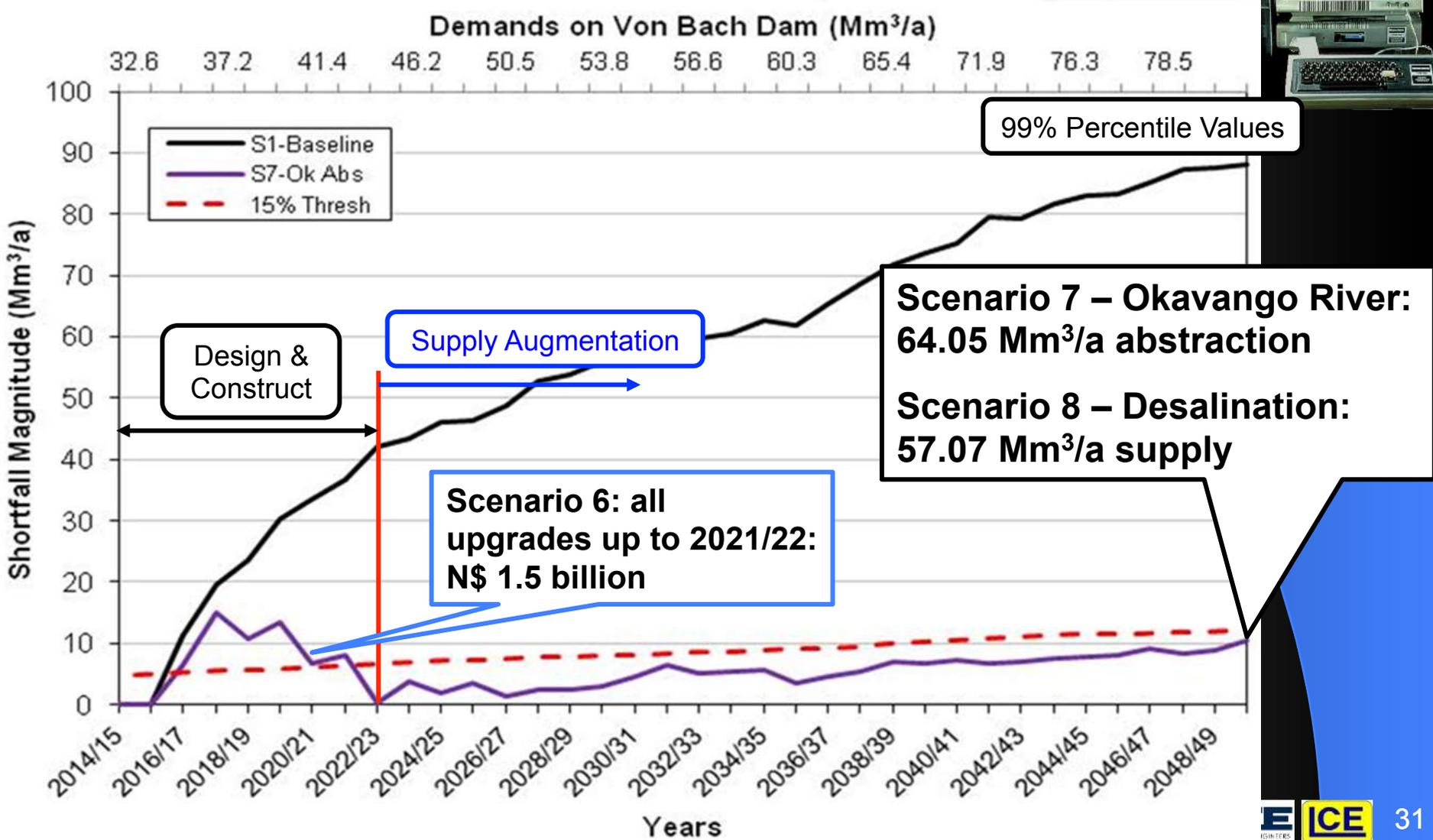
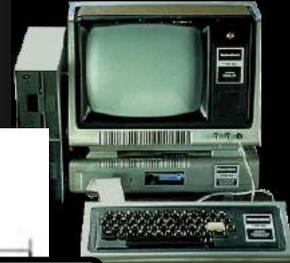
# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## CAN

### 2.6.7

### Results: Scenario 7 (Okavango)





# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## 2.6.8 Possible Abstraction from the Okavango



Source Supply (99%) and Scenario Explanation	Okavango River				Scenario 8 (Desal)
	Scenario 7	Scenario 9a	Scenario 9b	Scenario 9c	
	"Normal" Demands	+ Omaruru, Otjiwarongo & Otjinene	Other CAN + Whk Demand + 10%	Other CAN + Whk Demand + 21%	"Normal" Demands
<b>Volume: 2049/50 (Mm<sup>3</sup>/a)</b>	<b>64.05</b>	<b>65.00</b>	<b>72.98</b>	<b>81.18</b>	57.07
Rundu (MAR: 5,464 Mm <sup>3</sup> /a)	1.2%	1.2%	1.3%	1.5%	---
Mukwe (MAR: 9,773 Mm <sup>3</sup> /a)	0.7%	0.7%	0.7%	0.8%	---
<b>Flow Rate: 2049/50 (m<sup>3</sup>/s) {20 hrs}</b>	<b>2.44</b>	<b>2.47</b>	<b>2.78</b>	<b>3.09</b>	2.17
Rundu (Median: 109.76 m <sup>3</sup> /s)	2.2%	2.3%	2.5%	2.8%	---
Mukwe (Median: 248.49 m <sup>3</sup> /s)	1.0%	1.0%	1.1%	1.2%	---
Rundu (Min: 11.12 m <sup>3</sup> /s)	21.9%	22.2%	25.0%	27.8%	---
Mukwe (Min: 74.73 m <sup>3</sup> /s)	3.3%	3.3%	3.7%	4.1%	---



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAF), NAMWATER & CITY OF WINDHOEK

## 2.7

## CONCLUSIONS



- ❖ Water demands in the CAN already exceed the long-term sustainable supply capacity of existing resources
- ❖ The CAN faces a major water supply problem:
  - ❖ No inflow in 2015/16: Run-dry date: Mid-2016 (?)
  - ❖ Even with normal rainfall / runoff: Crippling water shortages are to be expected in future
- ❖ Medium-Term Strategy:
  - ❖ Reducing the shortfalls up to 2022/23: N\$ 1.5 billion
- ❖ Long-Term Strategy:
  - ❖ Plan, Design & Construct long-term augmentation scheme to have water reach the CAN by May 2022
- ❖ Severe water shortages could be catastrophic for the economy of Namibia



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## FINAL THOUGHT

***“When the well is dry, we know the worth of water.”***

- Benjamin Franklin (1706 – 1790), *Poor Richard’s Almanack*, 1746



# THE AUGMENTATION OF WATER SUPPLY TO THE CAN AND CUVELAI: SUMMARY PRESENTATION: CAN & CUVELAI

MAWF (DWAf), NAMWATER & CITY OF WINDHOEK

## THANK YOU!