
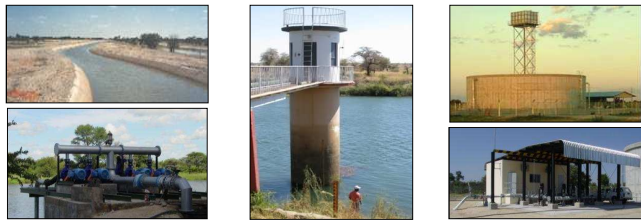



# Augmentation of Water Supply to the CAN and Cuvelai: Summary Presentation - Strategic Environmental Assessment of Options (MAWF, NAMWATER & City of Windhoek)



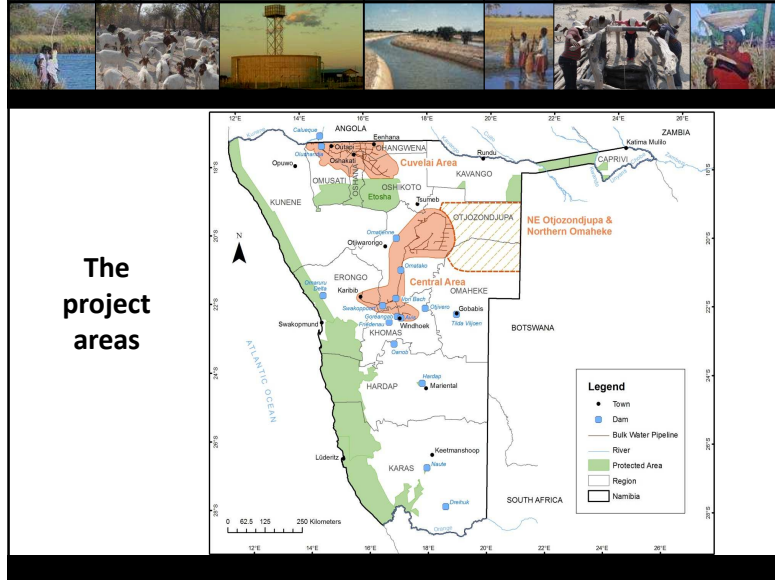
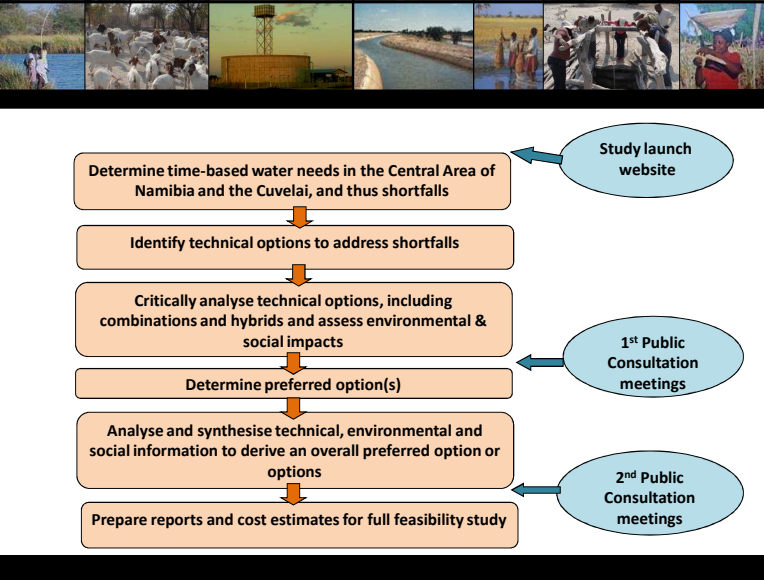
**A PRE-FEASIBILITY STUDY INTO:  
THE AUGMENTATION OF WATER SUPPLY TO THE CENTRAL  
AREA OF NAMIBIA AND THE CUELAI**

**Strategic environmental assessment of options**

### This presentation

- The process
- The project area
- The Cuvelai
  - Strategic considerations
  - Summary
  - Recommendations
- The Central Area
  - Short- to medium-term options
    - Strategic considerations
      - Abenab & Karst 3
    - Recommendations
  - Long-term options
    - Strategic considerations
      - Okavango abstraction
      - Desalination
  - Conclusions



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## A strategic environmental assessment of options

- At a pre-feasibility study phase
- Looking at options at a concept level
- There is no “project” with details to assess
- Focus is on screening the various options to ensure that there are no key issues or critical factors that would make them ineligible for further investigation



## The Cuvelai Area

- The current water use in the Cuvelai Area from the Kunene River (about 80 Mm<sup>3</sup>/a) is just 42% of Namibia’s allocation
- By 2050 the “high likely” demand (about 145 Mm<sup>3</sup>/a) will be about 77% of Namibia’s allowable off-take
- Thus the Kunene River should be able to supply the Cuvelai Area for at least the next 50 years



## The Cuvelai Area – **strategic considerations**

1. Currently, almost 70% of the water abstracted from the Kunene is unaccounted for:
  - leakage
  - evaporation (65% of losses)
  - billing inefficiencies

Addressing these issues will significantly improve water management and demand. This in turn will secure the supply further into the future – therefore a priority.
2. Currently, there is no water recycling in the Cuvelai. Water reclamation and reuse should be considered in the larger urban areas of the Cuvelai basin – grey water for irrigation.

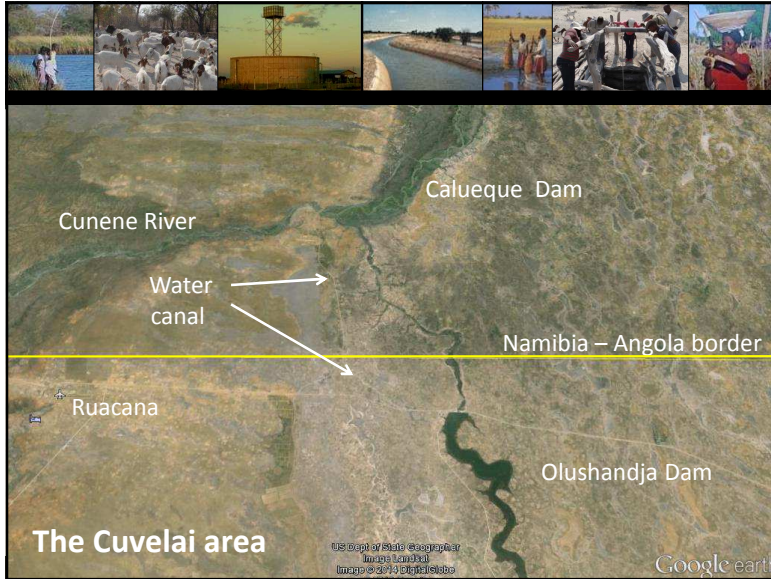


## The Cuvelai Area – **strategic considerations**

3. The Kunene River water is currently drawn off at Calueque Dam in Angola, and brought by canal into Namibia. This poses the following risks:
  - single source supply
  - dependent on Angola’s goodwill
  - dependent on Angola protecting an adequate rate of flow, throughout each year, to meet Namibia’s needs without compromising on environmental flow requirements (environmental flows for Kunene River still to be determined)
  - dependent on Angola to retain water quality

These risks present serious geo-political considerations for the medium-term.

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## The Cuvelai Area – **strategic considerations**

### 4. Three potential medium to longer terms solutions:

- i. Pump water up from the Kunene River below Ruacana Falls on Namibian territory
  - investigation underway
  - but constraints remain (e.g. single source, water quality and quantity)
  - high cost of lifting (pumping) water up escarpment (400 m)
  - main impacts are:
    - (a) downstream riverine environment (socio-economic and ecological - this applies to wherever water is abstracted), and
    - (b) pipeline infrastructure and logistics



## The Cuvelai Area – **strategic considerations**

- ii. Ohangwena II Aquifer
  - investigation underway – recharge not confirmed
  - aquifer 235 – 305 m deep thus below level of having a botanical impact
  - saline aquifer above – thus sealing of shaft essential to prevent contamination
  - impacts of aquifer development mainly linked to above-ground infrastructure and logistics
- iii. Okavango River
  - see later
  - cumulative impact with off-take for Central Area



## **Summary of strategic considerations for the Cuvelai Area**

From an environmental perspective, (i) pumping water up from below Ruacana and (ii) developing the Ohangwena II Aquifer to addressing the single source risk of Calueque do not present any serious constraints or raise any critical issues at a strategic level that could not be addressed in the planning, assessment and mitigation process.

Appropriate environmental assessment and management plans would be required and issues would be dealt with at this level.

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## Summary of strategic considerations for the Cuvelai Area

Abstraction from the Okavango River has two main impacts:

- (a) downstream riverine environment (socio-economic and ecological, and
- (b) pipeline infrastructure and logistics

Based on previous studies, issues around the downstream riverine environment are the more significant, particularly when considered cumulatively with possible off-take for the Central Area.

Further consideration is needed of this option.



## Summary of strategic considerations for the Cuvelai Area

### Recommendations

1. Address leakages, evaporation and billing challenges in the Cuvelai Area water supply system to improve efficiency of water management and use
2. Investigate water reclamation and reuse in the larger urban centres in the Cuvelai basin
3. Undertake a study of environmental flow requirements of the Kunene River and factor results into country abstraction allowances.



## The Central Area

- The current water supply in the Central Area (3 dams, groundwater, reclamation, semi-purified) is about 31.45 Mm<sup>3</sup>/a
- Current water demand is about 33 Mm<sup>3</sup>/a, over 80% used within the City of Windhoek.
- By 2050 the estimated water demand will be about 84 Mm<sup>3</sup>/a (2.5% increase per year).
- Including NE Otjozondjupa & N Omaheke, the 2050 estimated water demand will be about 110 Mm<sup>3</sup>/a, a shortfall of the equivalent of 11 x Von Bach Dams/year



## The Central Area

### The viable short to medium term solutions / options

1. Upgrade Von Bach Water Treatment Plant to deal with Swakoppoort Dam poor water quality resulting from algae, due to pollution and perhaps other causes.
2. Reduce losses at Von Bach Water Treatment Plant from 15% to 1%
3. Complete the Windhoek Managed Aquifer Recharge or water banking System (WMARS) which is located to the S & E of Windhoek (70-110 m deep)
4. Upgrade Gammams & additional reclamation plant
5. **Emergency supply from Abenab & Karst Area 3 aquifers**

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 of Options (MAWF, NAMWATER & City of Windhoek)



**The Central Area – Strategic considerations**

1. The 1<sup>st</sup> 4 options all already exist – the actions focus on increasing efficiency and/or up-scaling.
2. These 4 options are all in zones designated for their respective land-uses, i.e. municipal areas, water reservoir and treatment areas, mining areas.
3. There is no proposed change in land use.
4. In the case of the Windhoek aquifer abstraction, water is below the level at which abstraction would impact on vegetation.
5. The above ground “footprint” is small and easily manageable.



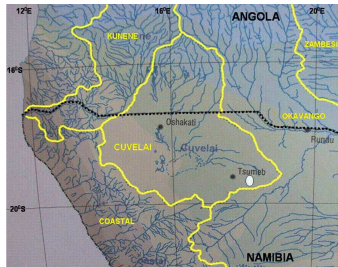
**The Central Area – Strategic considerations**

6. In all cases, there are no perceived “critical factors” or “fatal flaws” for any of the 4 options. Specific environmental assessments and/or EMPs would serve to minimise and mitigate any impacts and optimise benefits.
7. Not to proceed swiftly with these 4 options would have a significant socio-economic impact on the Central Area of Namibia.
8. Negative socio-economic conditions are known to impact negatively on the environment
9. Thus not developing these options would likely be more environmentally detrimental than developing them!



**Emergency supply from Abenab & Karst Area 3 aquifers**

- Limited info on basic hydrological issues as well as environmental implications.
- AfriDev Associates (2004) study based on TGWS (2000-2003) estimated groundwater reserves at 43Mm<sup>3</sup>/a of which about 18 Mm<sup>3</sup>/a can be abstracted.
- But recharge factor not fully understood and broader impact on Cuvelai/Etoshia basin not known.



- Local abstraction already exceeds recommended volume.



**Emergency supply from Abenab & Karst Area 3 aquifers**

- A. Local impacts
  - Abenab water at 48-60 m deep – below root level
    - Springs are “perched” – not linked to aquifer
    - Modeled abstraction of 12Mm<sup>3</sup>/a for 3 years, draw-down cones 60-100 m deep with max radius of ± 5 km
    - Main impact on farmer’s boreholes
  - Karst Area 3 water 10-15 m deep or less
    - Impacts vegetation
    - Impacts springs
    - Impacts wetland habitat and species
    - Impacts farmer’s boreholes

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**Emergency supply from Abenab & Karst Area 3 aquifers**

- B. Regional (Tsumeb Aquifer) impacts**
  - No reliable depth to groundwater contour maps = unreliable predictions
  - Best estimate 2-5 m temporary drop in water table. After 12 years rest, 1-3 m recovery (if average rains occur)
  - Potential impacts
    - Cave fauna
    - Loss of spring & wetland habitat
    - Impact on spring/wetland vegetation and fauna



**Emergency supply from Abenab & Karst Area 3 aquifers**

- C. Cuvelai / Etosha catchment impacts**
  - Over past 100 years about 27% of volume of groundwater had been abstracted by early 2000s
  - Loss of vegetation (large trees) – Omuramba Owambo
  - Reduced flooding in Omuramba Owambo, reduced inflow to Fischer’s Pan with potential impact on wetland habitat & species, both in and outside Etosha (e.g. cranes, flamingos)
  - Cumulative impacts
  - Conflicts with local users
  - Implications of climate change
  - Need better information – many uncertainties



**The Central Area - Recommendations**

1. Clean up catchment of Swakoppoort Dam
2. Tighten up water demand in Windhoek – particularly leaks in GRN buildings
3. Consider dual pipe system for all new developments
4. Better protect the Windhoek aquifer:
  - prevent urban expansion in area of aquifer,
  - prevent inappropriate land use (e.g. prospecting & mining, polluting industry),
  - ensure that land management optimises vegetation cover for maximum recharge and avoids overgrazing,
  - move potentially polluting industries out of aquifer catchment,
  - regularly inspect (e.g. sewage pipes, fuel stations, airport), and
  - enforce regulations.



**The Central Area - Recommendations**

5. At a high strategic level, undertake Central Area “Hub” Strategic Assessment in which the Windhoek-Okahandja development node is demarked as a centre for:
  - services
  - government
  - light industry
  - low water-use economic activities

(this is in accordance with V2030)
6. Undertake an Integrated Strategic Water Assessment for Namibia.

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 of Options (MAWF, NAMWATER & City of Windhoek)



### The Central Area Long term solutions / options

1. The four (4) short to medium term solutions / options, if implemented now, will provide the Central Area with about 8 years of water in which to plan and implement a longer term solution.
2. Just two (2) options seem viable:
  - Abstraction from the Okavango River, and
  - Desalinated Sea Water from the Coast



### The Central Area: long term solutions / options

#### Abstraction from the Okavango River

1. Modeled to be activated only when shortfalls are expected from other sources (dams, aquifers, reclamation)
2. On commissioning (2023) would withdraw about 25 Mm<sup>3</sup>/a
3. The maximum abstraction by 2050 for the Windhoek area would be about 61 Mm<sup>3</sup>/a
4. Additional demands from Otjiwarongo, Otjinene, Omaruru, contingencies of 21% and development needs of NE Otjozondjupa & N Omaheke mean the abstraction from the Okavango River by 2050 would be about 82 (possibly 105) Mm<sup>3</sup>/a
5. This does not include any other branching lines or impacts of climate change.



### Abstraction Okavango River – Strategic considerations

1. Mahango area of Bwabwata is a RAMSAR site. Okavango Delta in Botswana is a RAMSAR site (largest in the world) and a World Heritage site. Thus:
  - High ecological importance
  - High international profile
  - High levels of attention & scrutiny
2. The Okavango Delta is also Botswana's prime tourism destination – of high economic importance to the country
3. Previous feasibility study (1997) concluded that the two main environmental impacts (socio-economic and ecological) were:
  - Pipeline impacts, and
  - Riverine environment downstream of off-take.
4. Off-take at Rundu and pipeline along main road corridor (within 100-200 m) – no key issues, provided no branch lines.



### Abstraction Okavango River – Strategic considerations

5. The 1997 study worked on an off-take of 17 Mm<sup>3</sup>/a, not the 82 (up to 105) Mm<sup>3</sup>/a determined in the current study.
6. Off-take by 2050 at Rundu = 1.6% of average annual flow and 3.6% of minimum annual flow (but there is a discrepancy as the 1997 study gives the off-take as 5% of minimum flow)
7. Below Cuito confluence off-take = 0.85% of average annual flow and 1.5% of minimum annual flow.
8. At time of absolute minimum flow at Rundu (11.1 m<sup>3</sup>/s) the abstraction at Rundu (12 h/day) would be 5.2 m<sup>3</sup>/s – 47% of the flow.

Annual runoff in million cubic metres (Mm <sup>3</sup> /a)			
Place	Average	Minimum	Maximum
Rundu	5,207	2,260	9,810
Mukwe	9,594	5,607	15,354

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Summary Presentation - Strategic Environmental Assessment  
of Options (MAWF, NAMWATER & City of Windhoek)



**Abstraction Okavango River – Strategic considerations**

- 9. If Angola took off the same amount of water then the Okavango upstream of the Cuito may be dry in the lowest flow years.
- 9. The following issues need to be considered:
  - What will the demand be on the Okavango River after 2050 – it surely will not be capped at the 2050 projection. Namibia is then “locked into” the Okavango scenario.
  - There will be huge and growing demands for branches off the main pipeline – future governments will surely not be able to resist pressure to creating a branched network supplying water from the Okavango pipeline – unstructured “project creep” with unplanned consequences for the river and delta.



**Abstraction Okavango River – Strategic considerations**

- The 1997 study avoided these difficult considerations. It also avoided the cumulative impact of Angola abstracting water, (as an independent action or on the back of Namibia’s possible precedence).
- The 1997 study did not assess the cost of the loss of ecosystem services. This is an essential aspect when making trade-offs and comparing options.
- The 1997 study suggested a limited abstraction period after peak floods and on the falling hydrograph – to limit impacts on the Delta. However, if NE Otjozondjupa & N Omaheke are to be supplied from the Okavango pipeline, and as they have no storage, the pipeline would have to be pumped throughout the year. This places limitations on the establishment of operating rules.



**Abstraction Okavango River – Strategic considerations**

- The projected and likely longer-term levels of abstraction could jeopardise the evolving “Vision” for the Okavango basin across the three basin states.
- And in the long-term, Namibia will always be dependent on Angola (water quality & quantity) and how it chooses to use water from the upstream Okavango.
- There are thus a number of important questions and challenges around abstraction from the Okavango River, and if another solution was available, that would be worth serious investigation ....



**Desalinated Sea Water from the Coast**

- Not seriously considered before because of cost of pumping water up 1,600 m
- And because Namibia does not have enough energy
- Volumes of desalinated water to Windhoek - about 17 Mm<sup>3</sup>/a in 2023 and 57 Mm<sup>3</sup>/a by 2050 – less than via the Okavango because of fewer losses along the transfer system
- If the international community would be prepared to invest with Namibia in avoiding abstraction from the Okavango River, then could be feasible.



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## Desalinated Sea Water from the Coast

- Major strategic advantages are:
  - No upstream concerns on water quantity and quality
  - No limits on volumes desalinated
  - No risk of degrading ecosystems
  - No international complexity
- Made potentially possible by the Green Climate Fund
- Involves establishing a large dedicated solar energy system to run both desalination and pumping. Modular units to grow with demand
- Would create water self-sufficiency for Namibia.



## Conclusion

- The four Central Area short-to-medium term solutions to optimise local water supply are immediate priorities and pose no significant environmental concerns.
- Emergency abstraction from the Abenab & Karst Area 3 aquifers require further consideration, including:
  - Current and future local water demand
  - Broader impacts on the area and catchment
- Both the Okavango link and the desalination of sea water be carefully considered and investigated to determine the most secure, reliable and sustainable long-term option for Namibia, to 2050 and beyond. This involves investigating:



## Conclusion

- Current and future water demands in the Kavango region (Green schemes, towns, local use)
- Current and possible future water demands in Angola
- Likely downstream impacts of proposed abstraction levels, particularly on the Okavango Delta
- A thorough understanding of all the costs and benefits, including ecosystem services that would be lost.

Thank you