Proposed Malewa dam in Kenya : Adequate adaptations to original design

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Contents : Proposed Malewa dam in Kenya

Part 1 : Adequate adaptations to the original 1990 Design

(Technical issues)

Part 2 : Water scarcity management & Stakeholders involvement

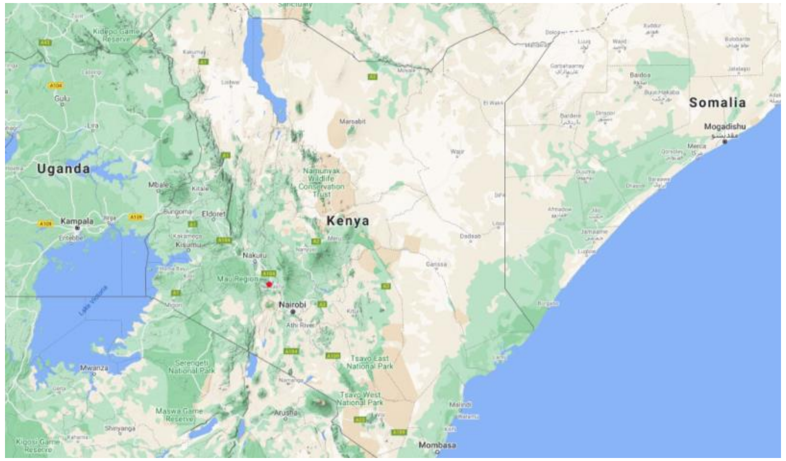
(Water Allocation Plan)

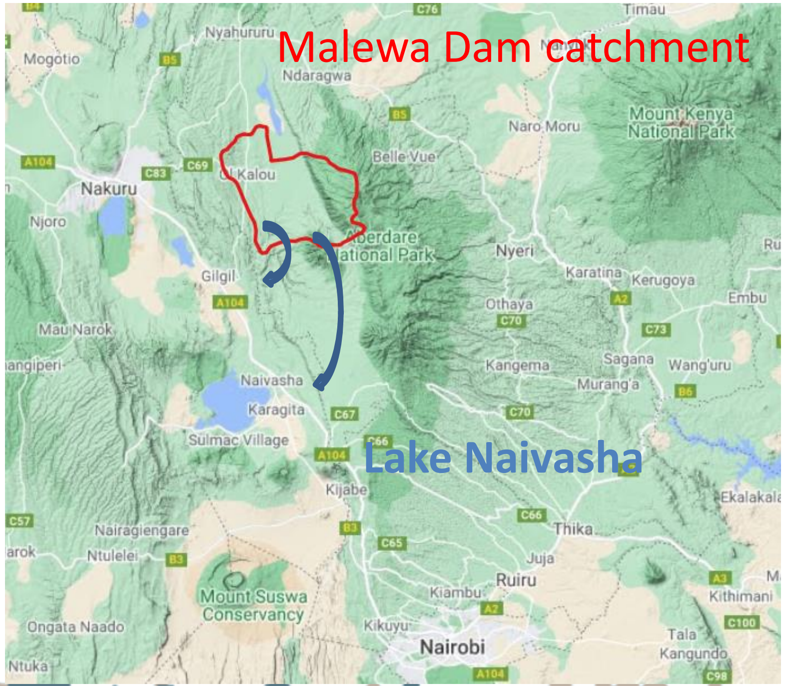
Project presentation

Water scarcity and poor quality of underground water (fluoride)

Urgent need to augment drinking water supply for Naivasha and Gilgil :

Malewa Dam Project





Contents : Adequate adaptations to the original 1990 design

- First study of Malewa Dam in 1990

Terms Of References :

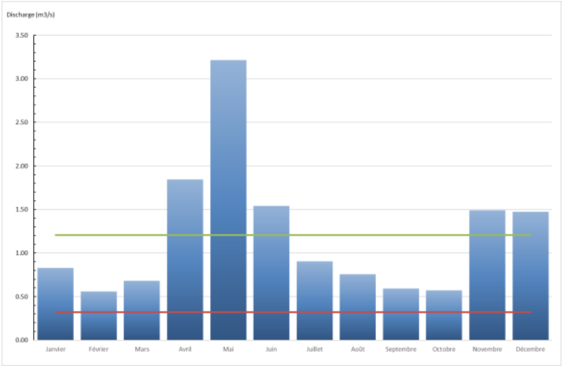
Study the environmental impact on downstream Lake Naivasha (Ramsar zone),
Climate change trends,
Project viability,
Water quality,
Sedimentation
Focus on affordability of operation and maintenance costs

- New study 2020

Evolution of design standards : Probable Maximum Flow (bulletin 170)

Most parts of Kenya experiences two rain seasons:

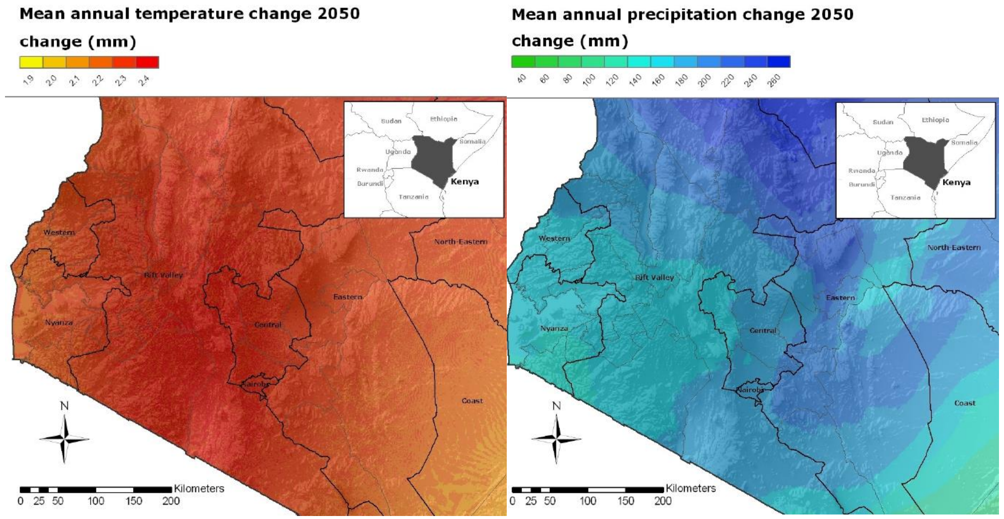
April to June's "long rains" and October to December's "short rains"



Need to store water produced during rainy seasons
for use during dry seasons
Dam reservoirs are particularly well suited

Evolution of design standards : Probable Maximum Flow (bulletin 170)

- Climate change in 2050 :
  - Temperature increase is 1.9 – 2.4 °C
  - Mean annual rainfall increase is 170 mm



Source : Climate change (CIAT– 2010)

- Update of hydrological studies

Particulars	Previous design 1990	Design 2020
Spillway		
Design discharge	1000-year probable flood	PMF
Dam safety flood	960 m^3/s	1,212 m^3/s

Evolution of design standards : Sedimentation (ICOLD Bulletin 182)

- Determining sediment inflow with the Modified Universal Soil Loss Equation : 430 000 m^3/year

  (instead of 120 000 m^3/year in the previous study)

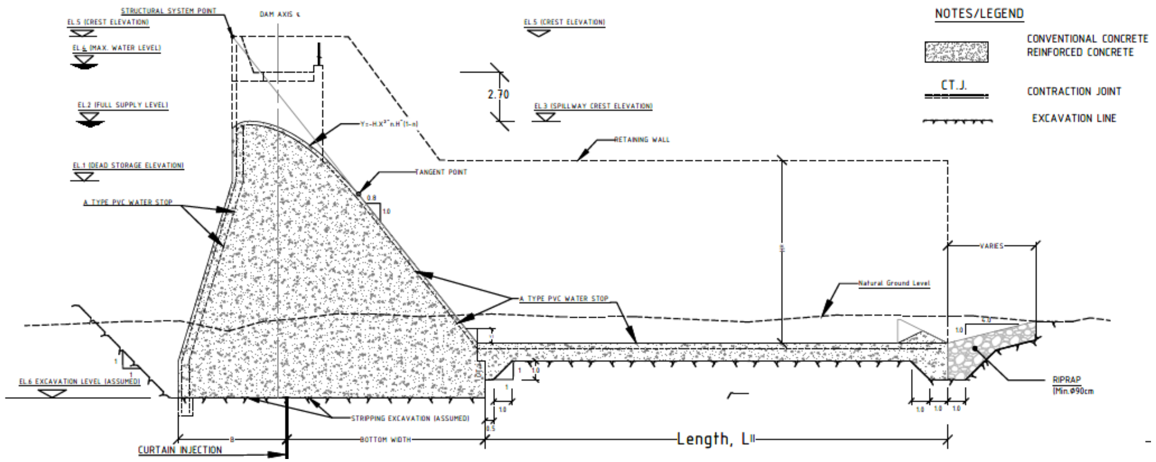
- New Sediment Management Strategy : 2 Check Dams

Evolution of design standards : Sedimentation (ICOLD Bulletin 182)

- Check Dam = Concrete gravity dam and ogee spillway

similar to the 'Sand dams' commonly built in Kenya by communities

Check Dam storage capacity	Rumathi checkdam	Kiambaga checkdam
Catchment area	423 km²	431 km²
Storage height	14 m	14 m
Average 5 year sedimentation storage	670 000 m^3	228 000 m^3
Efficiency from year 1 to year 5	77 – 45 %	50 – 25%



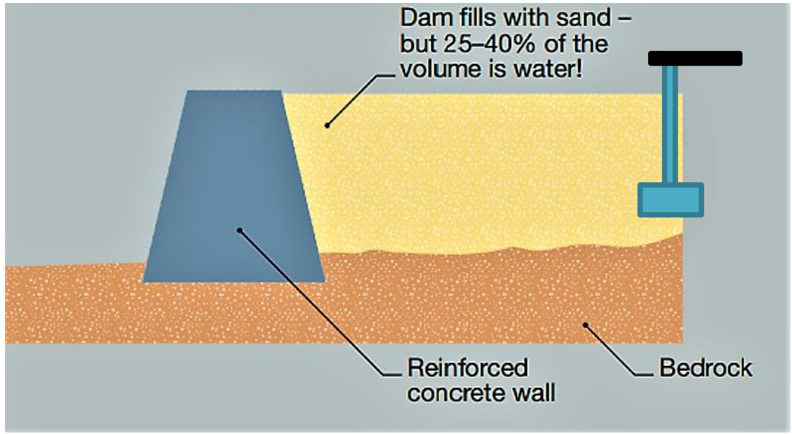
Evolution of design standards : Sedimentation (ICOLD Bulletin 182)

- 'Sand dams' commonly built in Kenya by communities :

Affordable and available water upstream for communities

The quality of the water is protected against evaporation and contamination.

Water quality is even improved through natural filtration in the soil

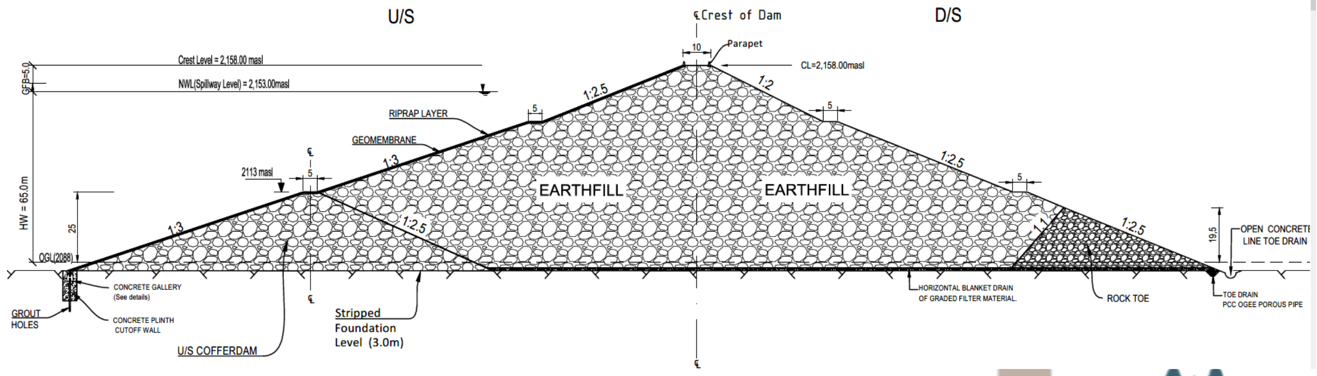


Source : Sustainable Sanitation and Water Management Toolbox

Environmental issues : Use of materials from site (Bulletin 135)

- Previous Design : Earthfill dam with a clay core
- New field investigation (geophysics) : No clayey material, soils on top of the bedrock are thin

-> New Design : Geomembrane Face Earthfill Dam



Environmental issues : Environmental flow & hydropower

- The Environmental Flow Requirement (EFR) is the water required to meet the ecosystem needs of a river basin

- EFR has been set as $Q_{80\%}$ instead of $Q_{95\%}$ but variable to simulate dry and wet season

	Previous design 1990	Design 2020
Environmental Flow Requirement (EFR)	0.22 m^3/s	Variable: 0.3 m^3/s - 1.2 m^3/s

Environmental issues : Environmental flow & hydropower

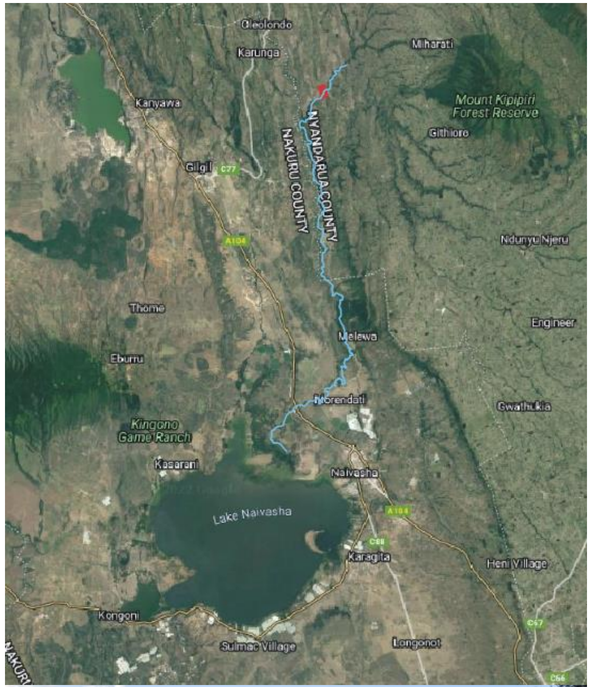
- This increase in EFR has made it possible to reconsider a hydroelectric production solution
- Nominal electrical power : 300 to 400 kW
- The investment return period is less than 5 years

Water scarcity management & Stakeholders involvement

Lake Naivasha – upstream of the dam project:

- Huge socio-economic and conservational benefits
- Ramsar site and a unique wetland
- Wide range of rapidly intensifying pressures
  - Reduction of lake level
  - Deterioration of lake and river water quality
  - Increased lake sedimentation
  - Increasing population and water demand (500 000 people)
  - Poor wastewater management

➡ **Conflicting demands on the basin's natural resources**



Water scarcity management & Stakeholders involvement

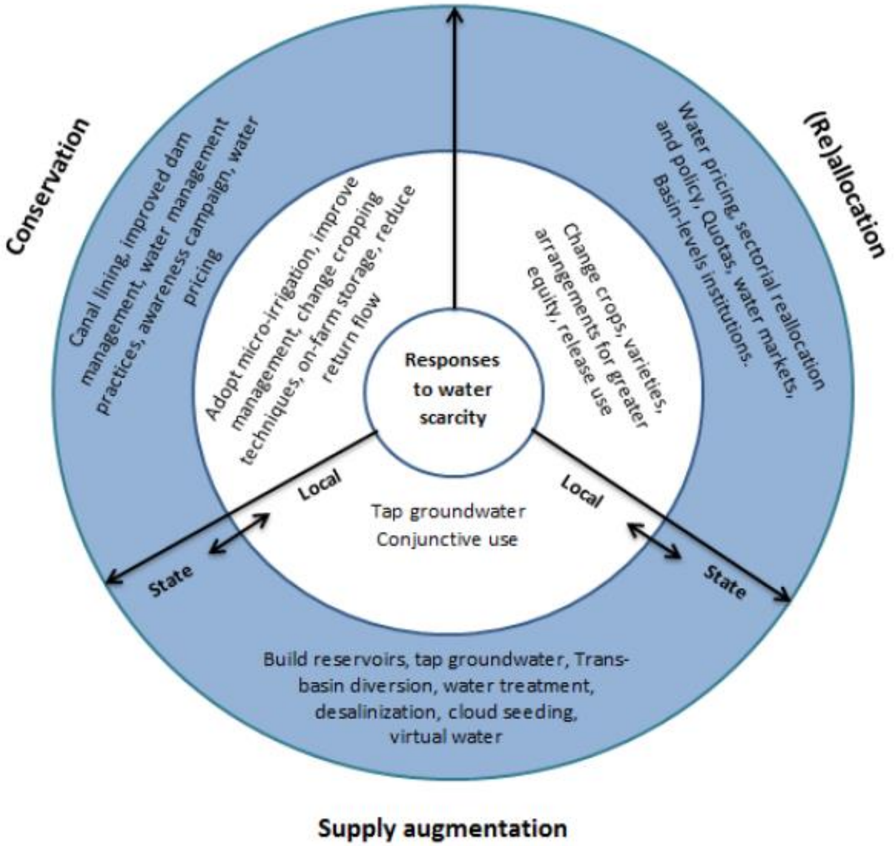
Challenge in the management of the Lake and the water abstraction by following the principe of a Water Allocation Plan (adopted by stakeholders 2010-2012 – WRMA & WWF):

- Finite and valuable water resources
- Equity : fair balance between
  - Environmental
  - Livelihood, drinking water supply
  - Commercial benefits (agriculture, horticultural production)

Water scarcity management & Stakeholders involvement

Responses to scare water resource (Molle, IRD – 2013)

Conservation :
Improving the efficient of already operational water resources without increasing the quantity



Reallocation :
Arrangement for greater equity

Development :
Augment the existing resources + new sources

Water scarcity management & Stakeholders involvement

Discussions and debates for a new water distribution

No increasing of the total present abstractions =
No increasing of the water scarcity stress

Drinking water demand :

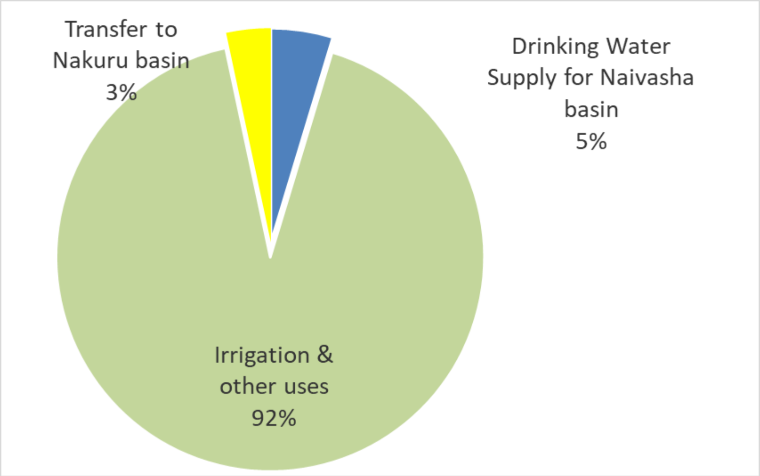
TOTAL Demand + 55 000 m^3/d

Compensation :
Partial return inter basin from Nakuru = - 11 000 m^3/d
Waste treatment return flow (50%) = - 27 000 m^3/d
Water management of current lake & rivers abstractions = - 17 000 m^3/d (-5 % of total present abstraction)

TOTAL compensation = - 55 000 m^3/d

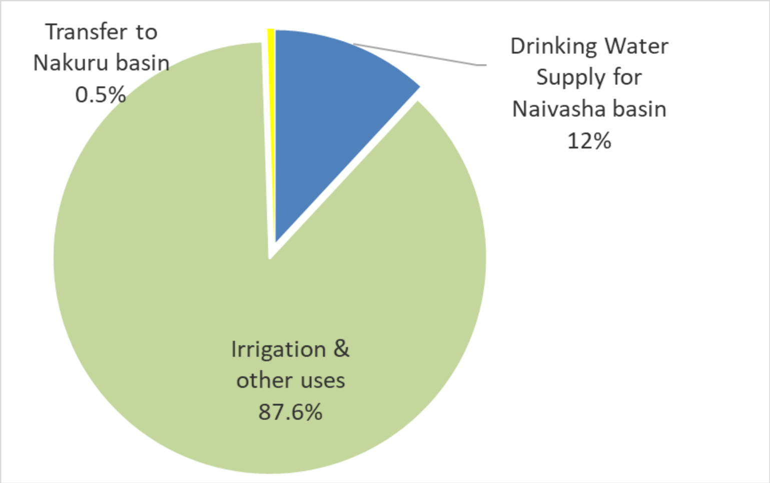
Water scarcity management & Stakeholders involvement

Curent abstraction :



Improve the equity between
drinking water uses
and other uses

New distribution proposal :



Summary

More than just an update on technical issues,

it is the **involvement** of **stakeholders** and **common agreements** on **resource management** upstream of the project that can lead to a **sustainable water sharing project.**

Our profession as technicians must also evolve to integrate stakeholders into the design process for a sharing design.

Contact

Thank you!

Merci !

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