NILE BASIN INITIATIVE
INITIATIVE DU BASSIN DU NIL

Strategic Water Resources Analysis (SWRA)

Nile Basin Development Forum

BRIEFING

October 2023

Objective of the SWRA

a) To quantify water demands, availability and the likely water deficit by 2030 and 2050 time horizons

b) Quantify the contributions of various options identified by member countries towards alleviating the likely imbalance between water availability and water demand.

c) Identify those options that have high return in term of filling the gap between water demand and water supply.

ESTIMATED SAVINGS FROM DIFFERENT OPTIONS

Best Water use technology [BCM/a]	Conjunctive Use [BCM/a]	Demand Management [BCM/a]	Cooperation / Coordination [BCM/a]
35	Recharge based	11	2

Two phase approach

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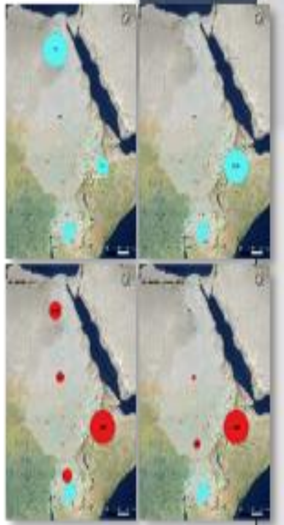
SWRA

- Develop projections of water demands in the Nile Basin
- Estimate projected future water availability under historical climate and climate change
- Quantify likely water deficits
- Explore strategic options for balancing water supply and demand

Phase 1

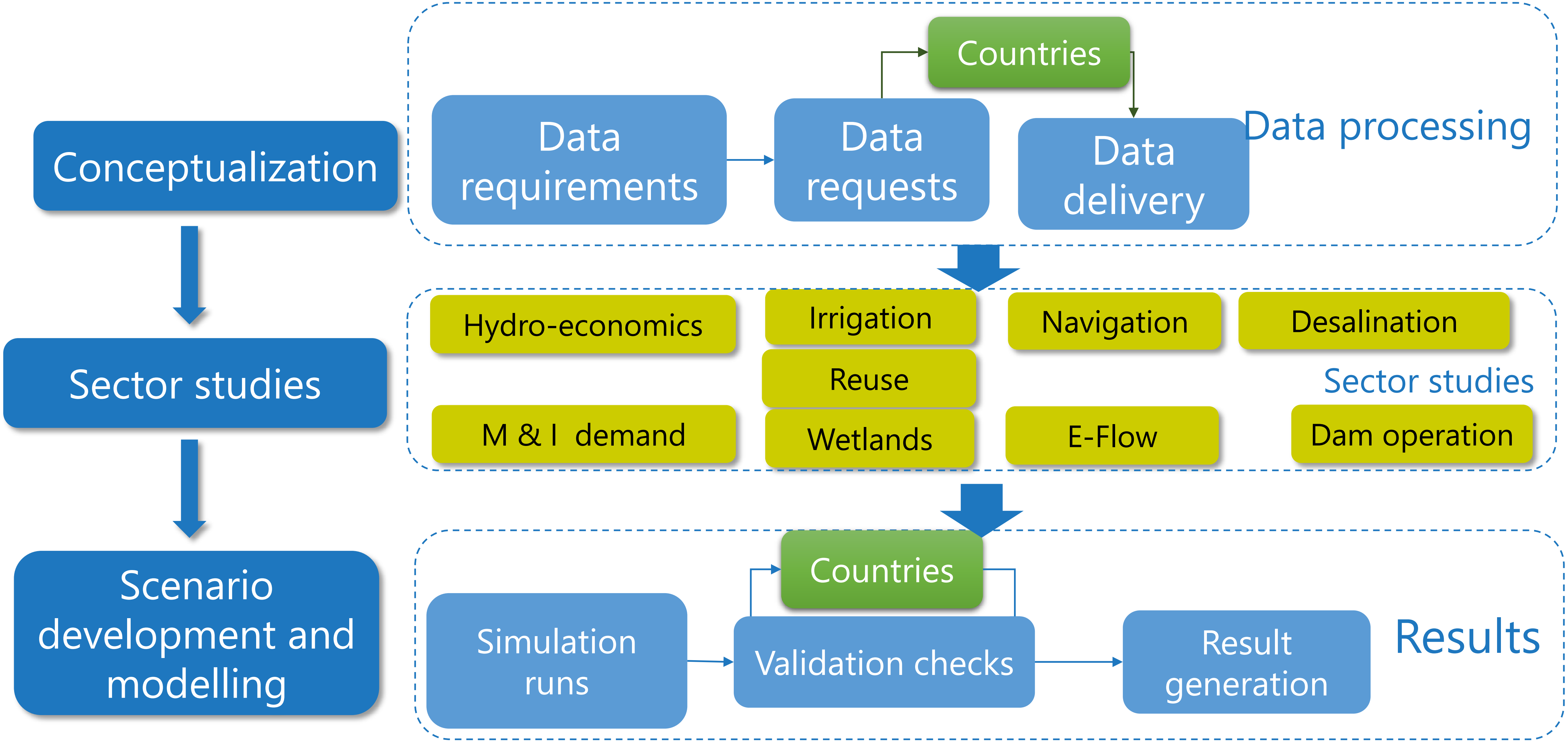
Baseline
- hydrology
- water use
- collect country plans
- Climate data acquisition

Phase 2



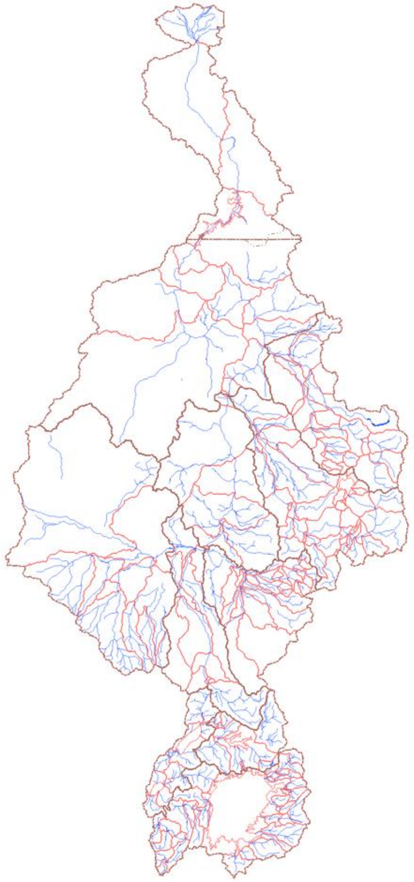
- Sector studies (building blocks)
- Develop the modelling parameter
- Scenario development

Study process of the SWRA

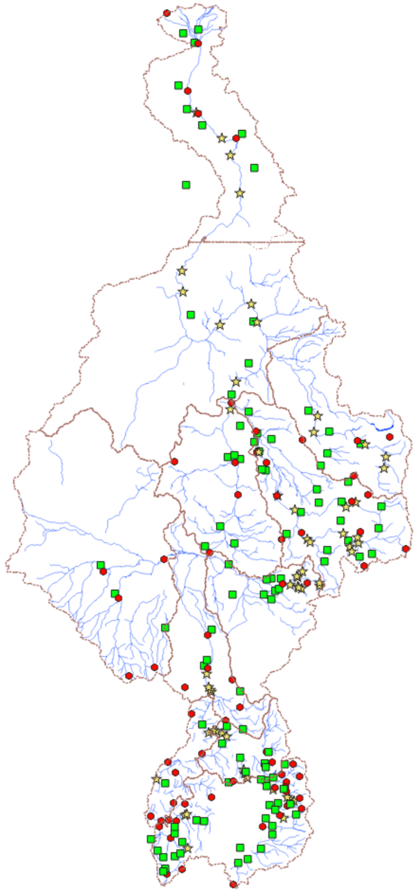


2.2 Model Elements

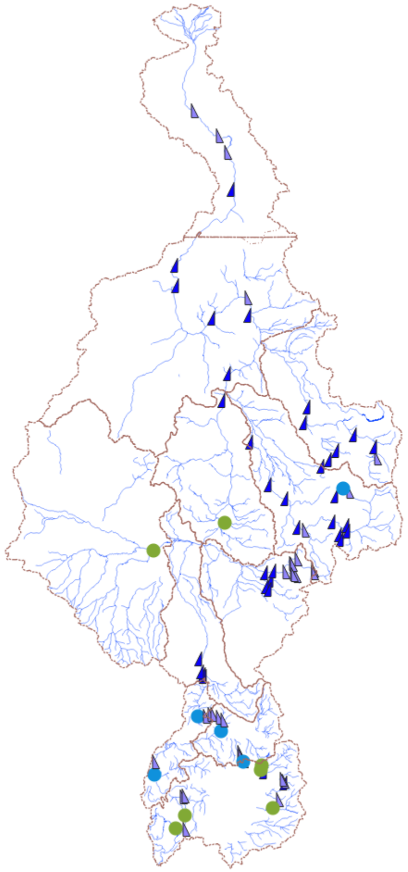
208 catchments



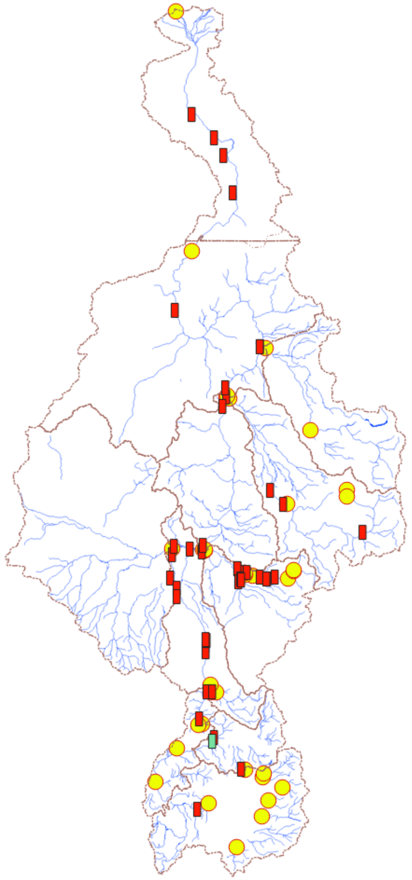
>300 water users



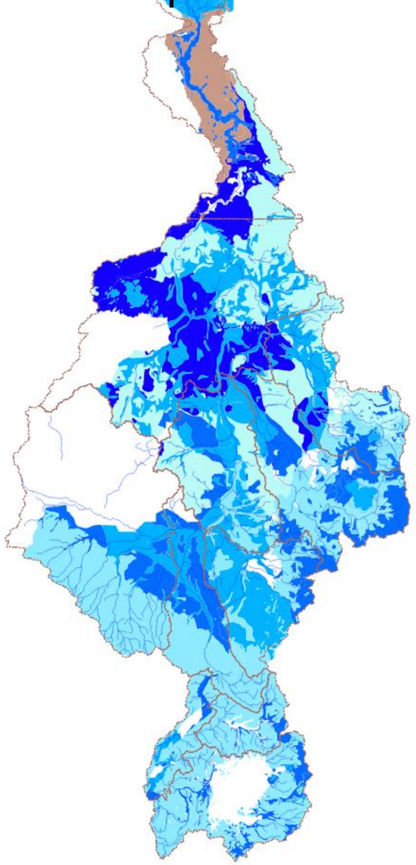
78 reservoirs



36 calibration points

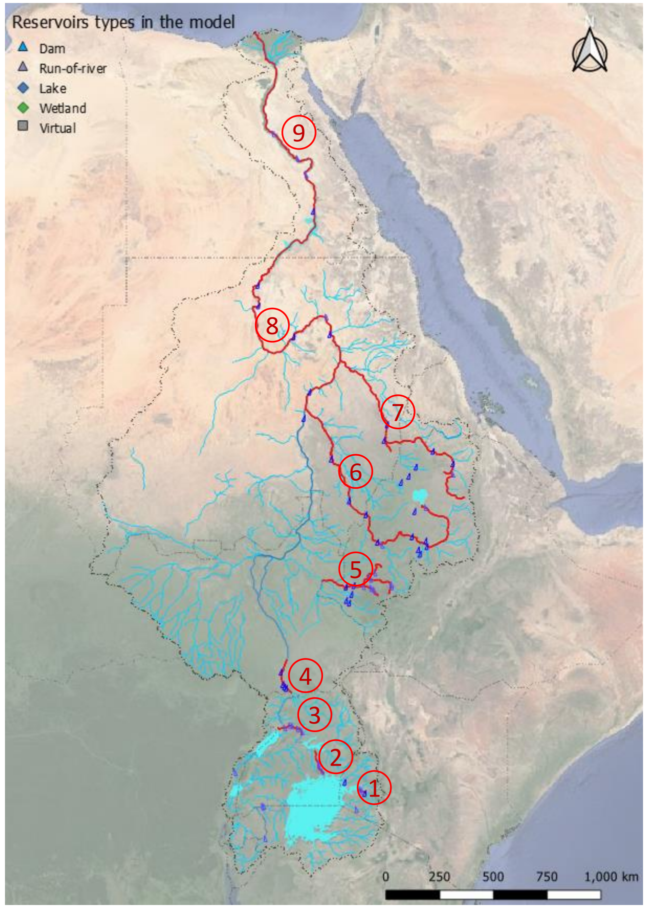


65 groundwater aquifers

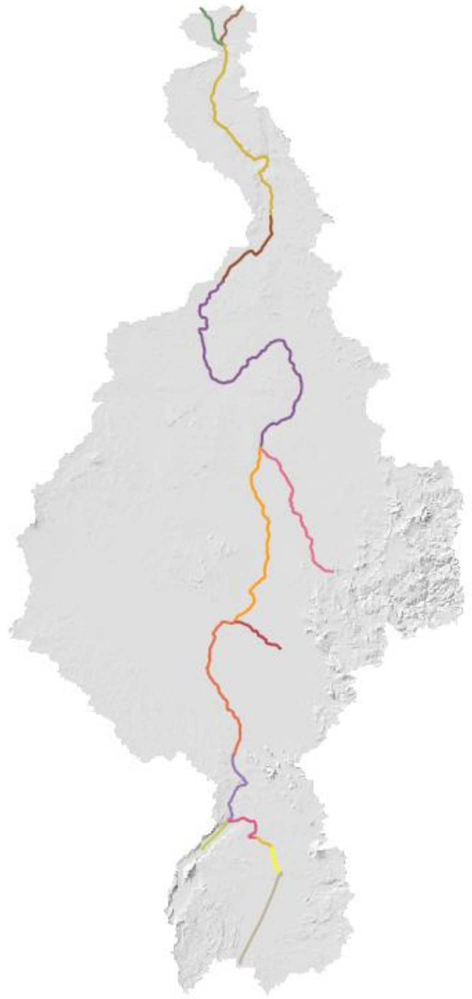


3.1 Sectoral Studies: Hydropower /Dam cascades

- There are 9 dam cascade systems in the Nile Basin each with more than 2 dams or run-of-river plants under full development conditions.
- The 9 dam cascade systems consist of 45 dams or run-of-river plants with a total storage volume of 395 BCM out of 425 BCM in the entire Nile system.
- A dam cascade can alter the flow regime depending on its storage volume.
- Carry over storage can compensate a dry season, to accommodate flood events and is generally more robust against climate variability.



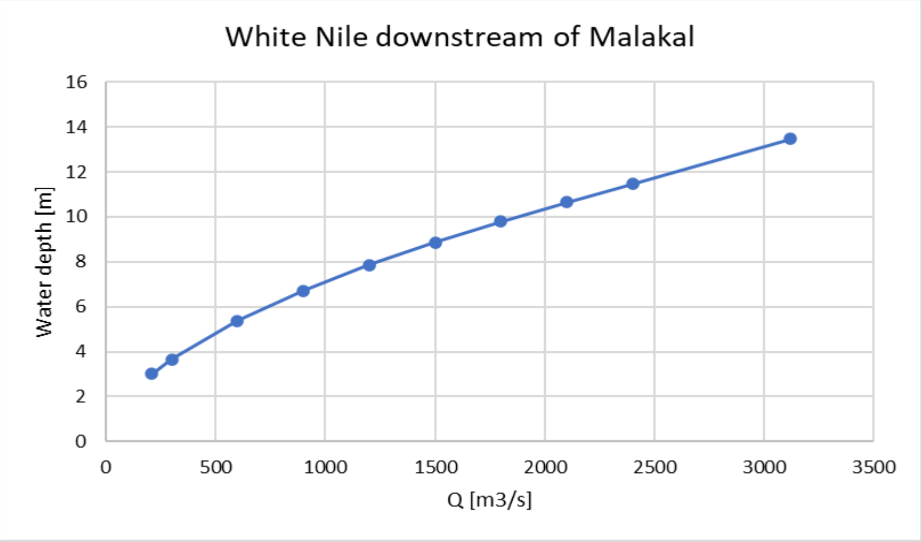
3.3 Sectoral Studies: Navigation -9 river stretches



1: Main Nile – Nile Delta to Aswan
2: Lake Nasser – Aswan to Wadi Halfa
3: Main Nile – Wadi Halfa to Khartoum
4: Blue Nile – Khartoum to Renaissance Dam
5: White Nile – Khartoum to Malakal
6: Sobat River
7: Bahr el Jebel – Malakal to Juba
8: Bahr el Jebel and Albert Nile – Juba to Lake Albert
9: Lake Albert
10: Kyoga Nile
11: Lake Kyoga
12: Victoria Nile
13: Lake Victoria

- Minimum flow requirements provided for navigation
- Used to assess the days per year when navigation is possible

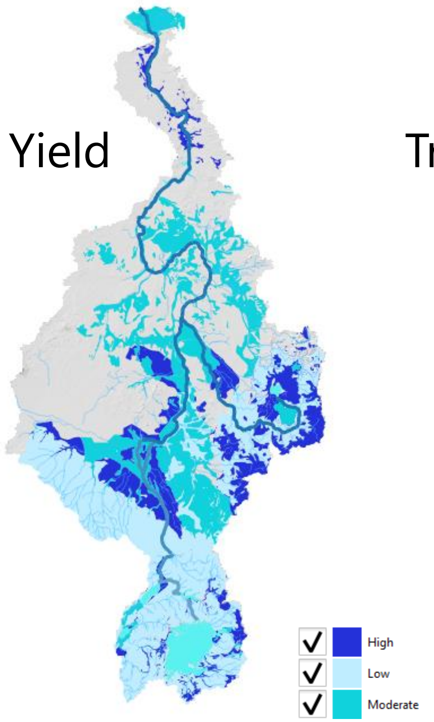
Scenario	Discharge (m3/s)	Water Surface Elevation (m)	Water Depth (m)	Velocity (m/s)
1	266	344.25	1.05	0.44
2	380	344.51	1.29	0.48
3	1754.29	346.53	3.23	0.78
4	3128.57	347.91	4.57	0.95
5	4502.86	349.07	5.69	1.08
6	5877.14	350.10	6.68	1.19
7	7251.43	351.04	7.59	1.29
8	8625.71	351.94	8.45	1.38
9	10000	352.83	9.30	1.45
10	13000	354.47	10.87	1.60



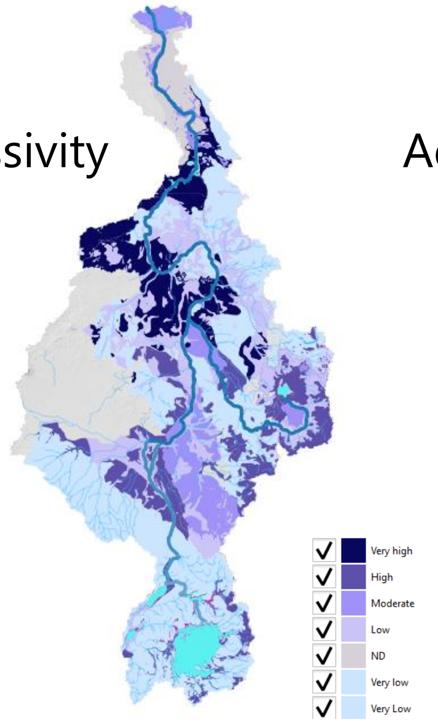
3.4 Sectoral Studies: Groundwater

- Taken from rapid groundwater assessment
  (Prof. Seifu Kebede, Associate Professor, Hydrology, University of Kwazulu Natal and Center for Water Resources Research, Pietermaritzburg, South Africa)

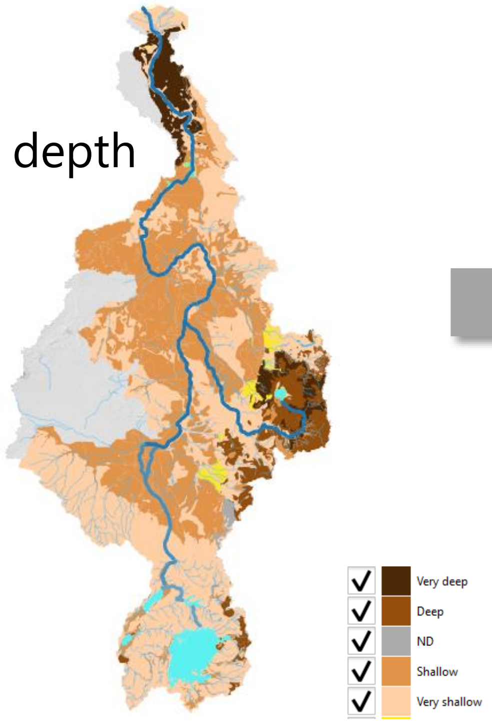
Yield



Transmissivity

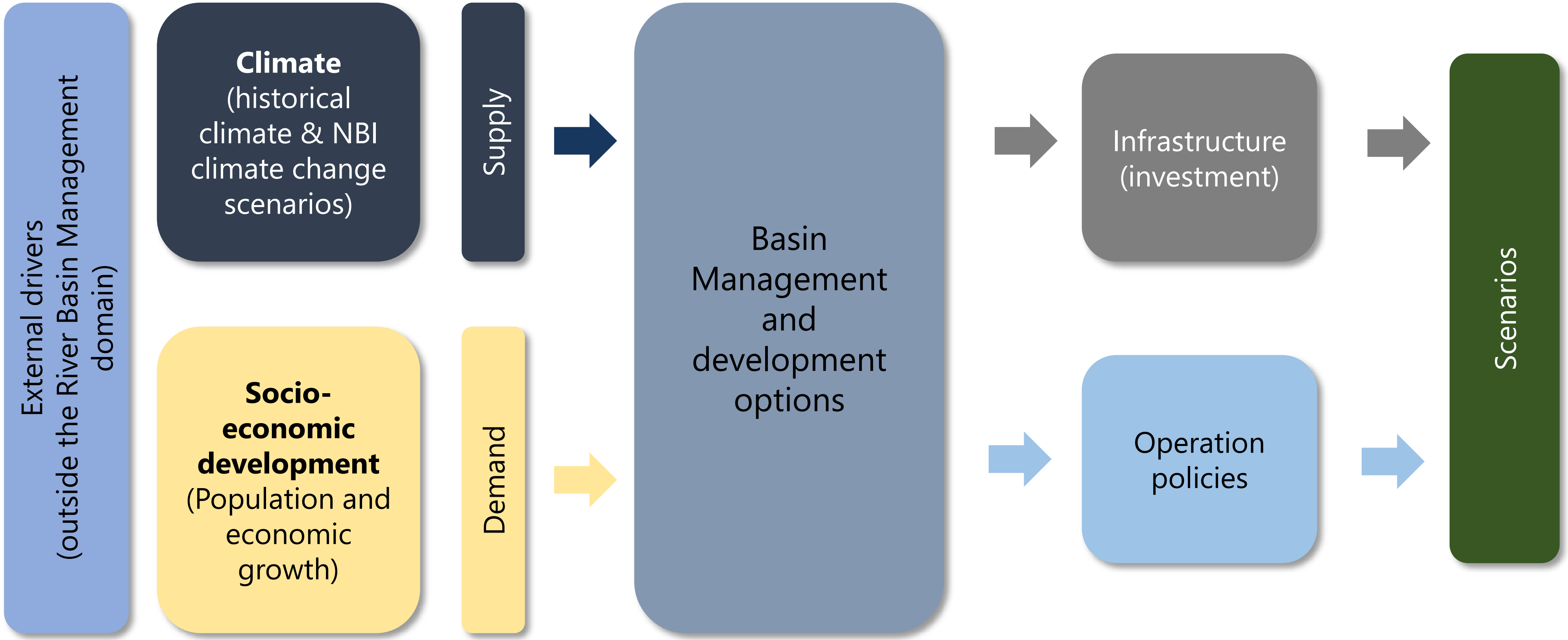


Aquifer depth



Aquifers are conceptualized for modelling

4.1 Scenario Development



4.6 Scenarios were developed

THE FOLLOWING CONSISTENT SCENARIOS WERE AGREED UPON BY THE COUNTRIES

1) Current conditions
2) Current technology
3) Full development
4) Best technology

4.5 How do we determine Scenario performance?

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Indicator	Definition	Unit
Supply rate M&I	Supply rate: Water delivered/Gross water demand	[-]
Supply rate irrigation	Supply rate: Water delivered /Gross water demand to irrigation sites.	[-]
Irrigated area	Actual supplied area / Available irrigated area.	[ha]
Water stress	Total water withdrawals /accumulated streamflow along network	[-]
Hydropower rate	Hydropower actually generated /Target power.	[-]
Navigation	Cumulative distribution of water depth for a particular river stretch.	Distribution function
Dam & RoR, Lake water balance	Gains and losses through precipitation and evaporation.	[mm]
Flood mitigation	Reduction of peak flows versus uncontrolled flood peaks.	[%], [m3/s]
Sudd areal extent	Mean Extent of the Sudd swamps	[ha]

ESTIMATED SAVINGS FROM DIFFERENT OPTIONS

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5. Key observations

- Best technology & full development scenarios cannot compensate the supply gap.
- Saving approximately 35 BCM/a is possible with best available technology to improve water use efficiency.
- Optimization of crop water requirements are constraint in that relocation of crops to other irrigation sites is limited and has to bridge regulatory, coordinative, administrative and infrastructure related hurdles.
- Conjunctive use can shorten the gap subject to recharge capacity

5. Key observations

- Coordinated operation & a pool-based operation rule at the GERD brought a average benefit of 2 BCM/a downstream at the expense of a reduced hydropower performance.
- Although, coordination has limited capacities in closing the supply gap, coordination, communication and information sharing within a dam cascade is a must to ensure dam safety.

7. Summary

- A supply gap will remain even if all options come into play, if we go for full development.
- The supply gap increases as one goes downstream but other regions also face a turn from low water stress to medium/high water stress under full development.
- Groundwater is an option but must be considered with renewable recharge in mind as upper boundary for sustainable use.
- The increase of storage capacities cannot cope with the increase in demand.

7. Other future Consideration

Setting/harmonization of priorities for utilization of the shared water resources by sector

- Domestic & Municipal use
- Agriculture & stock raising
- Hydropower generation
- Industrial uses
- Navigation
- Fishing
- Other beneficial uses

8. Other important issues under consideration

- Flood control.
- Data exchange and monitoring.
- Dam operation and construction.
- Drought management.
- Channel preservation.
- Salinity control.
- Ground water resources & conjunctive use.