Technical Meeting on Improved Water Allocation
Egypt Draft Concept Note

Cairo, League of Arab States
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Ministry of Agriculture

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Cairo University
Water Resources

Nile water
>97% of renewable water resources

Rainfall
Extremely scarce
2% of renewable water resources
ARIDITY

PRECIPITATION / ET

MIDDLE EAST AND NORTH AFRICA

ARIDITY ZONING

PRECIPITATION DIVIDED BY REFERENCE EVAPOTRANSPIRATION

< 0.05

HYPER-ARID

0.05-0.1

ARID

0.1-0.2

ARID

0.2-0.5

SEMI-ARID

0.5-0.65

DRY-SUBHUMID

> 0.65

HUMID

KILOMETERS

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## Egypt’s Water Resources

<table>
<thead>
<tr>
<th>Renewable Water Resources</th>
<th>BCM</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nile (HAD)</td>
<td>55.50</td>
<td>97.1</td>
</tr>
<tr>
<td>Rainfall &amp; Flash Floods</td>
<td>1.30</td>
<td>2.3</td>
</tr>
<tr>
<td>Desalination</td>
<td>0.35</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>57.15</strong></td>
<td></td>
</tr>
</tbody>
</table>

![Pie chart showing water resources distribution](chart.png)
Egypt’s water demanding sectors

- Agriculture (main water consumer)
- Drinking (population just passed 100 Million)
- Industries
- Fisheries and aquaculture
- Hydropower
- Inland navigation
Agricultural Production in Egypt

• Employs 26% of the population
• Contributes 11% to the GDP
• Products include grains, vegetables, sugar crops, fruits, fish, livestock
• Total agricultural area in 2015:
  • 6.16 Million feddan old lands
  • 2.94 Million feddan new lands
  • 9.10 Million feddan total area
Agricultural Lands of Egypt

4% of total land area
almost total dependence on Nile water
some agriculture based on groundwater in desert areas
Geology of the Nile Valley
Groundwater use for Agriculture

The Nile Aquifer
A form of water reuse

The Coastal Aquifer

Deep groundwater
A non-renewable resource
Groundwater Use for Agriculture

Western Nile Delta
Partly Nile water – Partly Groundwater
Modern irrigation mandatory

Western Desert Oases
East Oweinat Developments
Mostly Center Pivot irrigation
One Center Pivot per well
About 125 feddan per Center Pivot
Major water infrastructure in Egypt

• Dams and Barrages
### High Aswan Dam

<table>
<thead>
<tr>
<th>Storage zone</th>
<th>Level (masl)</th>
<th>Volume (BCM)</th>
<th>Cum. volume (BCM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead storage</td>
<td>&lt;147</td>
<td>31.6</td>
<td>31.6</td>
</tr>
<tr>
<td>Active storage</td>
<td>147 – 175</td>
<td>89.7</td>
<td>121.3</td>
</tr>
<tr>
<td>Flood control storage</td>
<td>175 – 178</td>
<td>16.2</td>
<td>137.5</td>
</tr>
<tr>
<td>Maximum surcharge storage</td>
<td>178 – 183</td>
<td>31.4</td>
<td>168.9</td>
</tr>
</tbody>
</table>
Aswan High Dam – Flood Control
Main Irrigation Canals in the Nile Delta

Total length of Nile River and its branches within Egypt 1530 km
Total length of canal network 33,000 km
Nile Delta Barrage
Barrages along the Nile

Esna Barrage
Water allocation planned and managed by the Ministry of Water Resources and Irrigation (MWRI)

• The MWRI has a central organization in (and around) Cairo.
• Annual plans at national and governorate levels are prepared based on historic data and indicative projections of cropping pattern
• Release from the High Aswan Dam and operation of Nile Barrages managed at the central level
• At the operational level managed by the decentral management structure
Decentral water management

• 22 irrigation Directorates, subdivided into 62 Inspectorates and about 206 Districts.
• An inspectorate covers about 4 districts.
• The area of an irrigation district is between 20,000 and 60,000 feddan (about 40,000 – 100,000 farmers).
• Other organisation units used in the management of irrigation are:
  • Feeder Canal level (between 10,000 – 100,000 feddan / 15,000 – 150,000 farmers)
  • Branch Canal level (between 1,000 – 12,000 feddan / 1,000 – 15,000 farmers)
  • Mesqa level (between 10 – 100 feddan / less than 100 farmers)
Water management at the operational level in the old lands is limited by:

• Administrative and hydrologic boundaries don’t match
• Supply side data:
  • The actual flows are not measured directly. However, a telemetry system has been installed which measures continuously water levels which can be converted to flow rates at major hydraulic structures along the Nile and main canals.
  • Data about official reuse are very crude (pump flow rate and approximate number of months of operation)
  • There are no data about unofficial reuse rates
  • There are no data about actual groundwater abstractions
• Demand side data:
  • There are no accurate surveys about actual cropped area and actual cropping pattern (such as with the use of remote sensing)
  • There are no accurate data about urbanization and loss of agricultural lands
  • Crop water consumption are usually based on estimates which might not be very accurate.
# Egypt’s Water Balance 2017/2018

## Water Supply

<table>
<thead>
<tr>
<th>Fresh Water Sources</th>
<th>Volume (BCM/year)</th>
<th>Water Demands</th>
<th>Usage/Allocation (BCM/year)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nile (HAD)</td>
<td>55.50</td>
<td>Drinking (fresh water only)</td>
<td>10.70</td>
<td>13.3</td>
</tr>
<tr>
<td>Deep Groundwater</td>
<td>2.45</td>
<td>Industry</td>
<td>5.40</td>
<td>6.7</td>
</tr>
<tr>
<td>Rainfall &amp; Flash Floods</td>
<td>1.30</td>
<td>Agriculture</td>
<td>61.45</td>
<td>76.6</td>
</tr>
<tr>
<td>Desalination</td>
<td>0.35</td>
<td>Drainage to Sea and Evap losses</td>
<td>2.50</td>
<td>3.1</td>
</tr>
<tr>
<td>Environment Balance</td>
<td>0.20</td>
<td>Environmental Balance</td>
<td>0.20</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>TOTAL Supply fresh</strong></td>
<td><strong>59.60</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Reused Water Sources

<table>
<thead>
<tr>
<th>Reused Water Sources</th>
<th>Volume (BCM/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow Groundwater</td>
<td>7.15</td>
</tr>
<tr>
<td>Reuse of Drainage Water</td>
<td>13.50</td>
</tr>
<tr>
<td><strong>TOTAL Water Reused</strong></td>
<td><strong>20.65</strong></td>
</tr>
</tbody>
</table>

## TOTAL Water Supply

**80.25**

**80.25**

## Renewable Water Resources

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<td>0.6</td>
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</table>

**57.15**
Agricultural Drainage
The Need for Agricultural Drainage

Fluctuations of water levels in the Nile Delta before and after the construction of the High Aswan Dam

<table>
<thead>
<tr>
<th>Location</th>
<th>Discharge BCM/y</th>
<th>Salinity (dS/m)</th>
<th>Total salt load M ton/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aswan Dam</td>
<td>55</td>
<td>0.31</td>
<td>11.0</td>
</tr>
<tr>
<td>Delta Barrage</td>
<td>35</td>
<td>0.47</td>
<td>10.5</td>
</tr>
</tbody>
</table>
Agricultural Drainage

Total length of main drain network 24,000 km
Average salinity of drainage water in the Nile Delta
Water quality issues related to drainage water reuse

- Field (open & covered) - collector - main
- Flow either back to Nile or pumped to Canals if water quality acceptable
- Or discharged to (coastal or inland) lakes or to the sea if quality is unacceptable
- effluents from agriculture but increasingly also from municipalities & industries
Drainage water reuse options

- Main canal
- Main drain
- Branch canal
- Branch drain
- Intermediate reuse
- Main drain reuse
- Distributary
- Mesqa
Environmental and health issues related to drainage water reuse
Laws

• Law 147 for Water Resources and Irrigation was issued in October 2021 containing 126 clauses to overwrite Law 12 which was in force since 1984

• The law confirms the authority of the Ministry of Water Resources and Irrigation on all matters related to the management of Egypt’s water resources

• The law refers to Law 48 of year 1982 in matters related to water quality issues
Law 147 of 2021 – selected clauses relevant to project

- **15**: Water shall be distributed among water users sharing a mesqua according to their relative land share of the command area
- **20**: acknowledges historic water rights
- **26**: the MWRI is responsible for matters related to water distribution for all uses and has the right to adjust the usage pattern if need be.
- **27**: The General Director has the right to prevent a certain water use to ensure equitable water distribution or to prevent water wastage
- **28**: The Ministers of Water and Irrigation and of Agriculture determine the allowed areas to be cultivated by high water demanding crops
- **44**: Anyone using water for other than agricultural uses may be asked to pay a fee per unit water for the use of the water course
- **48 – 51**: issues pertaining to the formation and administration of water user associations
- **52**: related to canal rehabilitation and mandatory cost recovery
- **54**: pertaining to mandatory modernization of irrigation systems
- **62**: mandatory water metering and wastewater treatment for new development projects
- **84**: prohibiting the use of water for any user without a license or approved allocation
- **85**: prohibiting the use of agricultural drainage water or treated wastewater without permission from the MWRI and the Ministry of Health
- **86 – 92**: protection of Egyptian shorelines
- **93 – 97**: issues pertaining to flood protection
- **98 – 111**: penalties
- **112 – 126**: general provisions
<table>
<thead>
<tr>
<th>Nr</th>
<th>Pilot Area</th>
<th>Governorate</th>
<th>Area served (fed.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mit Yazid</td>
<td>Gharbia, Kafr El Sheikh</td>
<td>185,000</td>
</tr>
<tr>
<td>2</td>
<td>Qualabsho-Zaian</td>
<td>El Dakahlia</td>
<td>60,000</td>
</tr>
<tr>
<td>3</td>
<td>El Hammam</td>
<td>Marsa Matruh</td>
<td>50,000</td>
</tr>
<tr>
<td>4</td>
<td>Tansa-Quela</td>
<td>Beni Suef</td>
<td>25,000</td>
</tr>
</tbody>
</table>
1- Mit Yazid Command Area (185,000 feddan)
Mit Yazid
Command Area
1- Mit Yazid Command Area

- Catchment home to several million people
- Mit Yazid Canal is 63.2 km long taking off from Bahr Shebeen
- Provides water to 42 branch canals and larger mesqas
- Provides water to 16 WTP
- Water supply includes 17 drainage reuse pump stations
- Extends over Governorates of Gharbia and Kafr El-Shiekh
- Hydrologic boundary divided among 5 irrigation districts
- Contains all possible water uses (agriculture, municipal, drinking water, industry and aquaculture)
- Affected by seawater intrusion issues in the northern part
FAO WaPOR
The FAO portal to monitor WAter Productivity through Open access of Remotely sensed derived data
Downloaded values for 2021
Time series of area average reference and actual ET values for 2021
NDVI (Normalized Difference Vegetation Index) values computed from Landsat data for two dates in 2021

\[ \text{NDVI} = \frac{(\text{NIR} - \text{RED})}{(\text{NIR} + \text{RED})} \]

NDVI always ranges from -1 to +1
Negative values: most likely water
Close to 1: dense green leaves
1 – Mit Yazid

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One hydraulic unit of ~185,000 fed</td>
<td>Relatively large and complex area</td>
</tr>
<tr>
<td>Total area improved by several projects (IIP, IIIMP) since year 2000</td>
<td>Stretches over two governorates and five irrigation districts</td>
</tr>
<tr>
<td>Data Available (numerous national and international research institutions analyzed and evaluated)</td>
<td></td>
</tr>
<tr>
<td>17 drainage water reuse stations</td>
<td></td>
</tr>
<tr>
<td>Water uses include agriculture, 16 drinking water stations, industries</td>
<td></td>
</tr>
<tr>
<td>Despite previous projects, water issues still exist</td>
<td></td>
</tr>
</tbody>
</table>
2- Qualabsho Zaian Command Area (60,000 feddan)
2- Qualabsho Zaian Command Area
2- Qualabsho Zaian Command Area
Downloaded values for 2021
NDVI values computed from Landsat data for 2021
<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One hydraulic unit of ~60,000 fed</td>
<td>Mainly agriculture, some aquaculture, variability of water uses relatively limited</td>
</tr>
<tr>
<td>One of the new reclamation areas</td>
<td>Urgent need for solutions to problems (time constraint)</td>
</tr>
<tr>
<td>Some branch canals rehabilitated</td>
<td></td>
</tr>
<tr>
<td>Water sources include Nile and drainage water</td>
<td></td>
</tr>
<tr>
<td>Consideration of establishing a station for treatment of drainage water</td>
<td></td>
</tr>
<tr>
<td>Severe water shortage and allocation issues</td>
<td></td>
</tr>
<tr>
<td>Proximity to sea: water logging and soil and water salinization issues</td>
<td></td>
</tr>
</tbody>
</table>
3- El-Hammam Command Area (50,000 feddan)
3- El-Hammam Command Area (50,000 feddan)

• Canal length about 50 km
• Fed from El-Nasr Canal
• Feeds drinking water station for Alamein
• Feeds irrigation water for North Coast developments
3- El-Hammam Command Area
3- El-Hammam Command Area
(50,000 feddan)

Downloaded values for 2021
NDVI values computed from Landsat data for 2021
### 3 – El-Hammam

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One hydraulic unit of ~50000 fed</td>
<td>Limited variability of water uses</td>
</tr>
<tr>
<td>Good data availability due to ongoing and previous projects</td>
<td>Not served by drainage due to dispute with governorate</td>
</tr>
<tr>
<td>Some branch canals rehabilitated under previous project</td>
<td>Urgent need for solutions to problems (time constraint)</td>
</tr>
<tr>
<td>Water uses include agriculture and drinking water stations</td>
<td></td>
</tr>
</tbody>
</table>
4- Tansa Quela Command Area (~25,000 feddan)
4- Tansa Quela Command Area (~25,000 feddan)
4- Tansa Quella Command Area (~25,000 feddan)

- Located in Bani Suef Governorate
- Fed from Ibrahimia Canal
- Main canal length: Tansa 2.76km, Quella 20.30 km
- Total length of canals (main, branch and sub-branch) ~ 167 km
- Water supply problems due to degradation of canal cross section
- Deterioration of water control infrastructure
- Divided into 3 subregions for irrigation rotations
3- El-Hammam Command Area (50,000 feddan)

Downloaded values for 2021
NDVI values computed from Landsat data for 2021
<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>One hydraulic unit of ~25,000 fed</td>
<td>Relatively small area</td>
</tr>
<tr>
<td>Good data availability due to ongoing and previous projects</td>
<td>Shortage of water in the end of canal and its branches</td>
</tr>
<tr>
<td>Some branch canals rehabilitated under previous project</td>
<td>Variability of water uses relatively limited</td>
</tr>
<tr>
<td>7 drainage water reuse stations</td>
<td>Intersects with 3 irrigation districts</td>
</tr>
<tr>
<td>Water uses include agriculture and drinking water stations</td>
<td></td>
</tr>
</tbody>
</table>

Under ongoing feasibility study from JICA for improved water allocation expected to be completed by June 2023
Proposed Work Plan till end of 2022

• Study the advantages and disadvantages of the different pilot areas and make preliminary selection of an area of them (we may need to make visits at this stage to help with the selection)

• Communicate with officials to take the required approvals for selected area

• Collect available data and reports for the study area

• Make visits to the selected area and meet with district engineers, agricultural extension officers and local leaders of water user associations

• Prepare a descriptive report for the study area which presents the available data and the required but not available data; the water distribution system, hydraulic structures, rotations, cropping pattern, administrative system, agricultural and non-agricultural water needs, water user associations and water councils if any... etc.

• Prepare the work plan for the next phase (2023) of the project, the plan for collecting missing data, analyzing data, identifying problems and proposals for solutions and budget estimates for project activities
Thank you