Technical Meeting on Improved Water Allocation
Egypt Draft Concept Note

Cairo, League of Arab States

Monday September 26, 2022

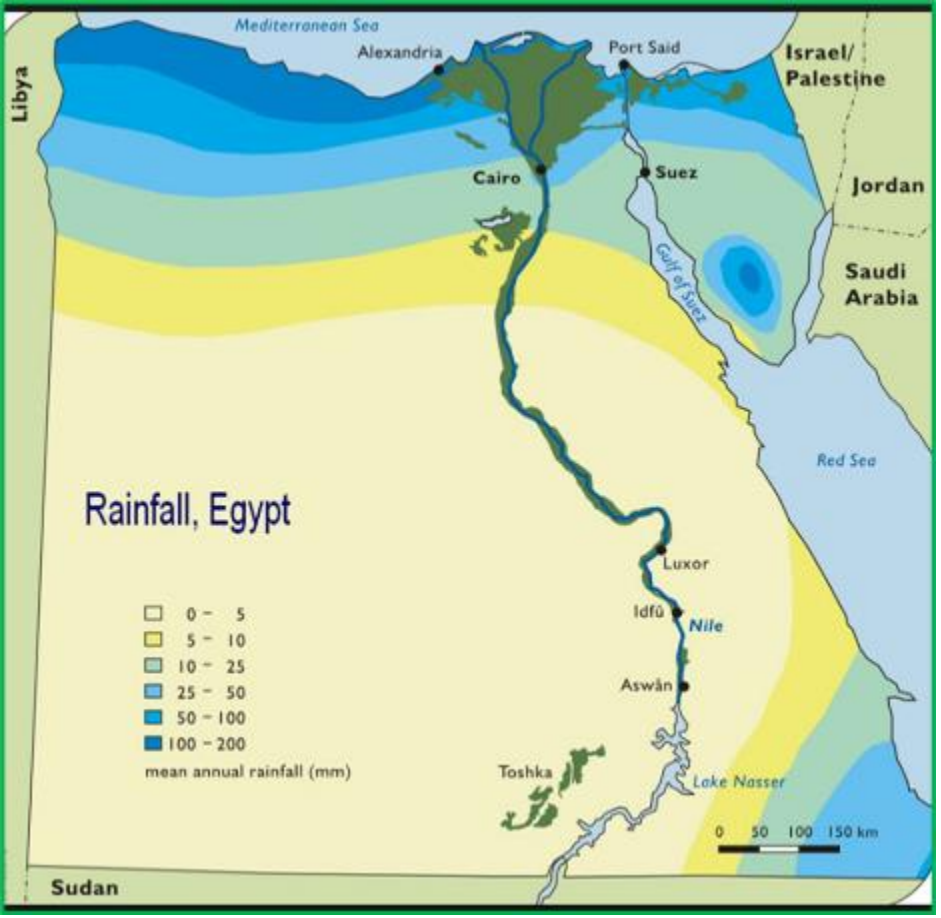
Salwa Othman
Ahmed Aly
Ministry of Water Resources and Irrigation

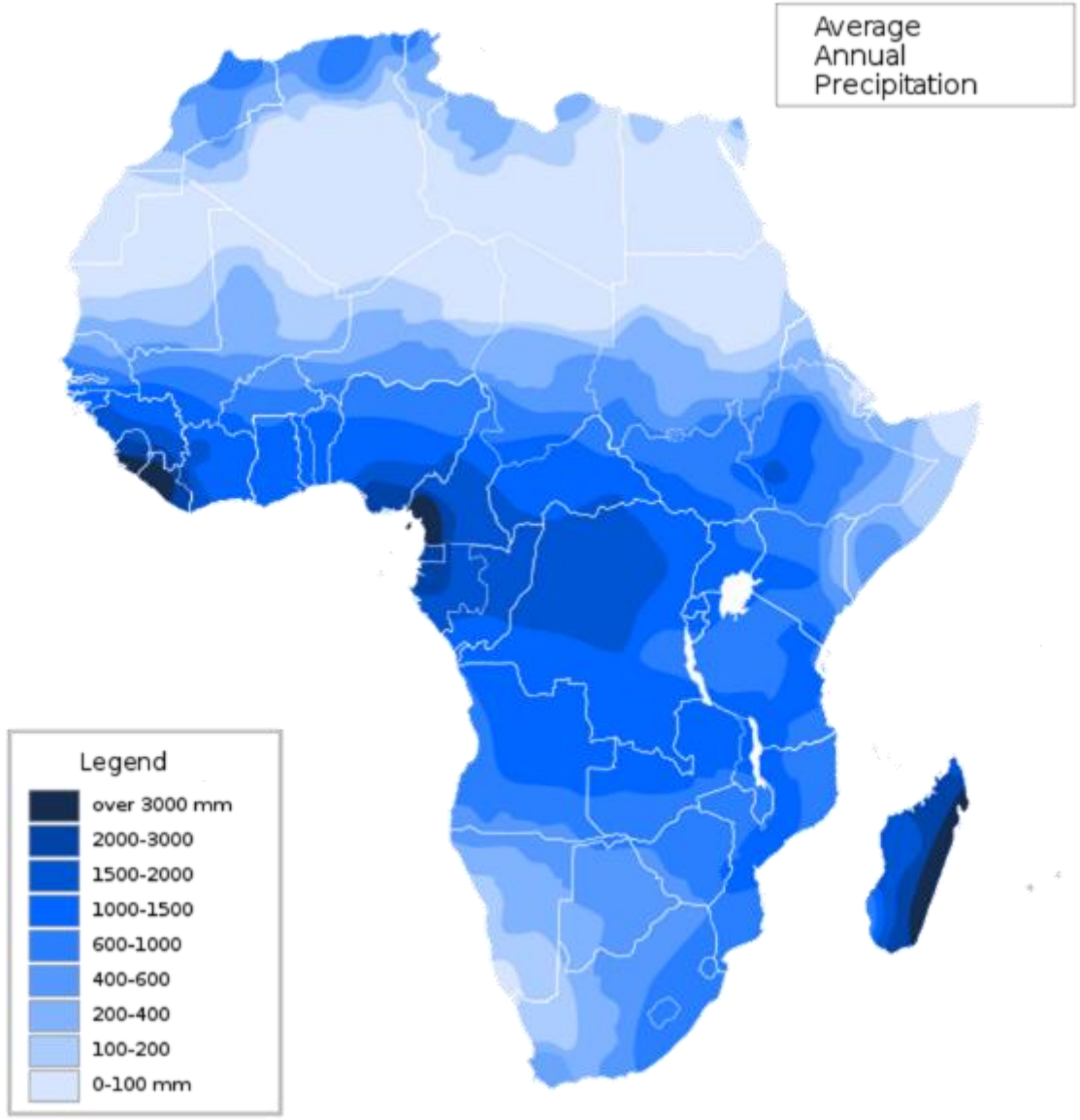
Manal El-Tantawy
Fouad Ahmed
Ministry of Agriculture

Ashraf Ghanem
Cairo University

Food and Agriculture Organization of the United Nations

Shared Prosperity Dignified Life





Water Resources

Nile water

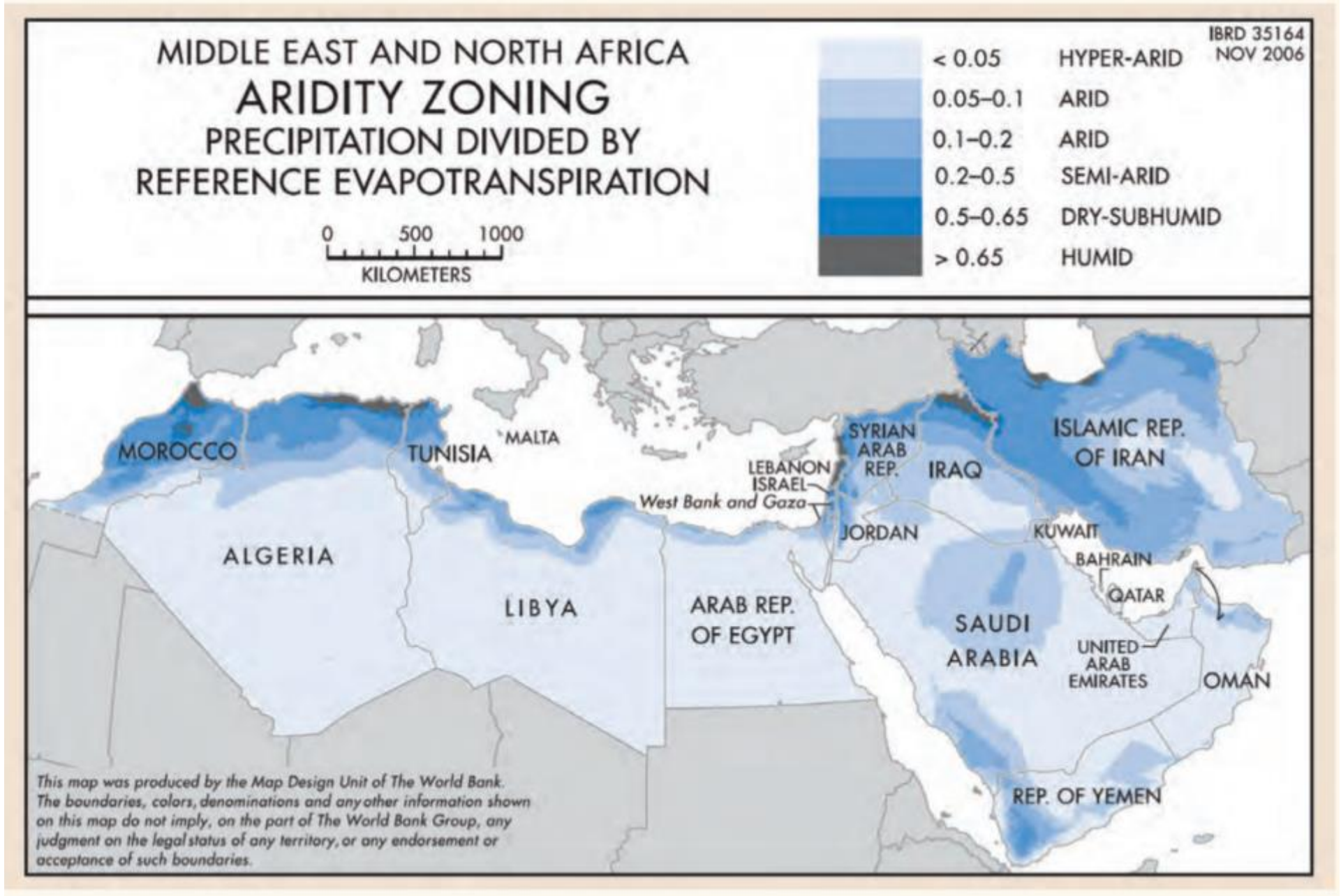
>97% of renewable water resources

Rainfall

Extremely scarce

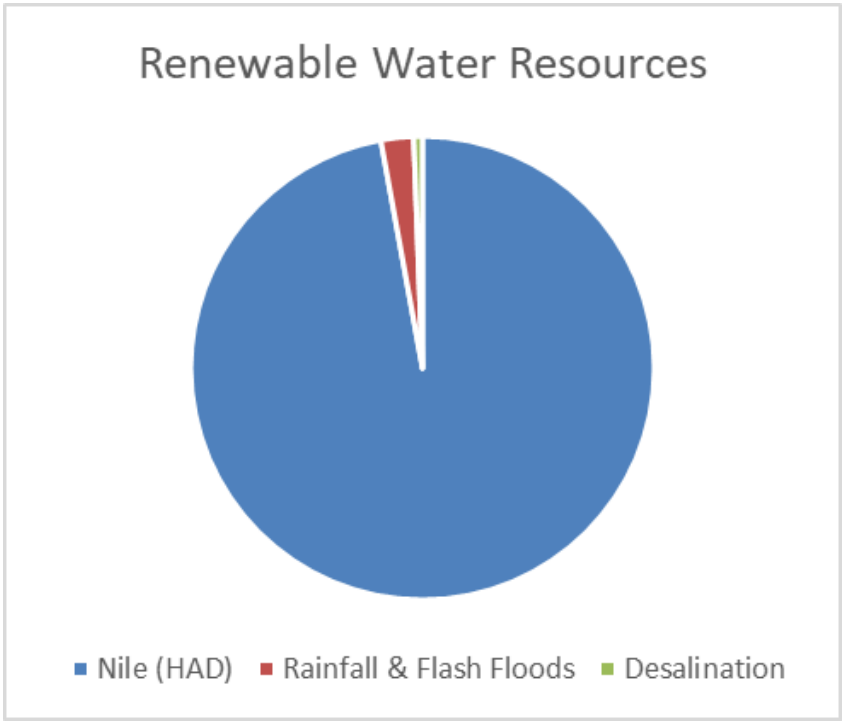
2% of renewable water resources

ARIDITY PRECIPITATION / ET



Egypt’s Water Resources

Renewable Water Resources	BCM	%
Nile (HAD)	55.50	97.1
Rainfall & Flash Floods	1.30	2.3
Desalination	0.35	0.6
	57.15	



Egypt’s water demanding sectors

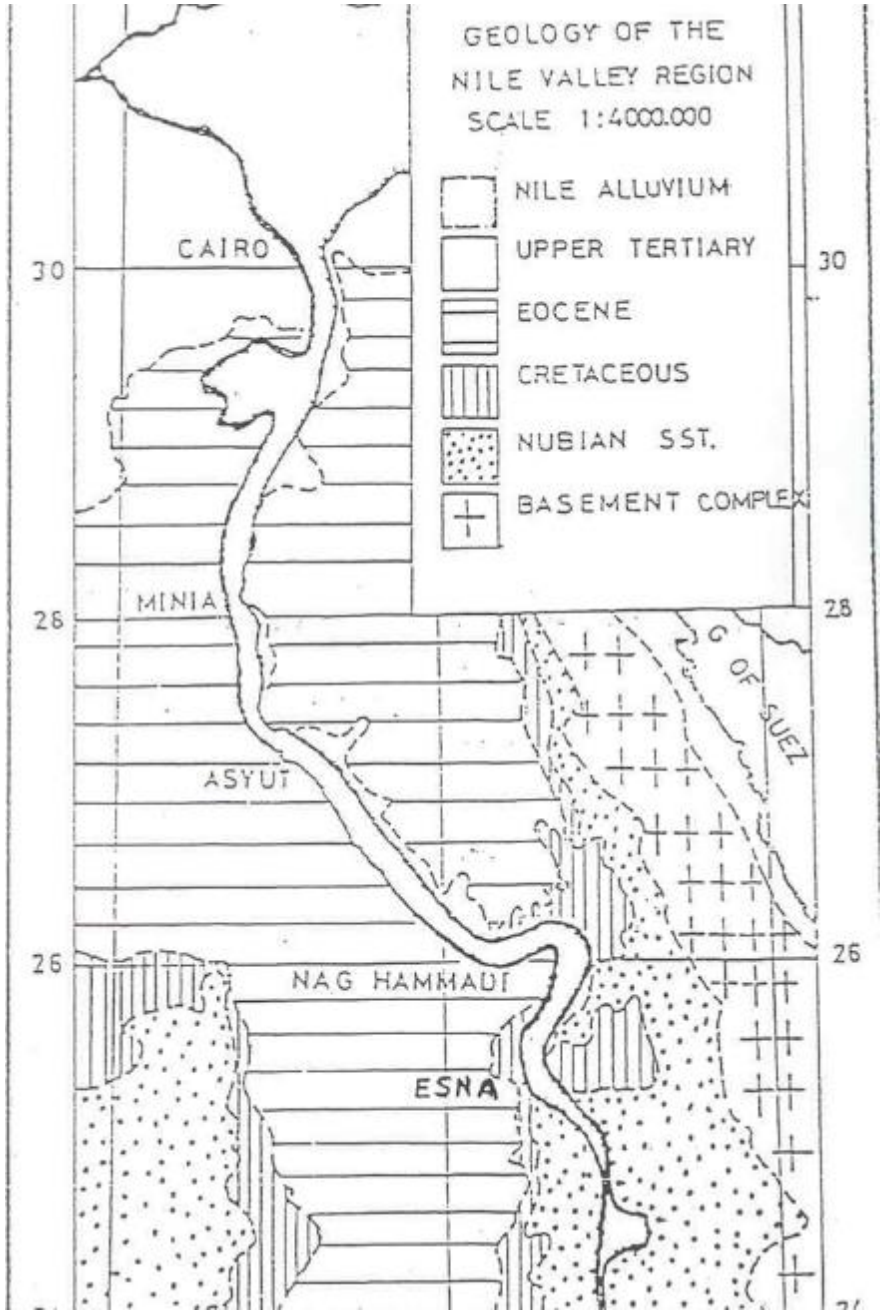
- Agriculture (main water consumer)
- Drinking (population just passed 100 Million)
- Industries
- Fisheries and aquaculture
- Hydropower
- Inland navigation

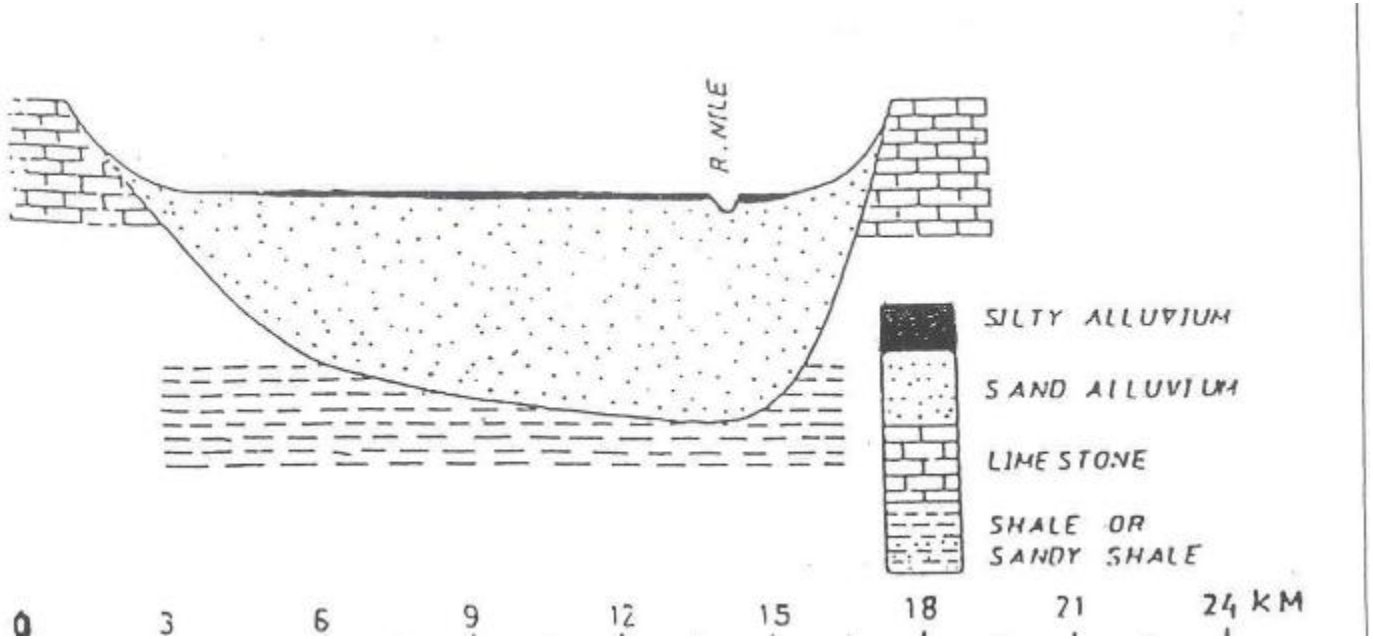
Agricultural Production in Egypt

- 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



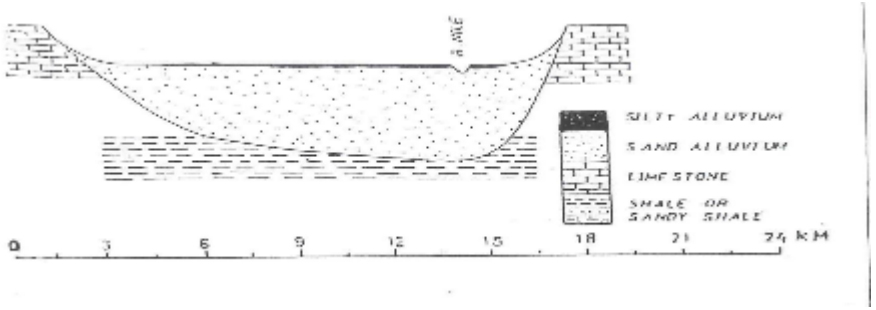


Geology of the Nile Valley

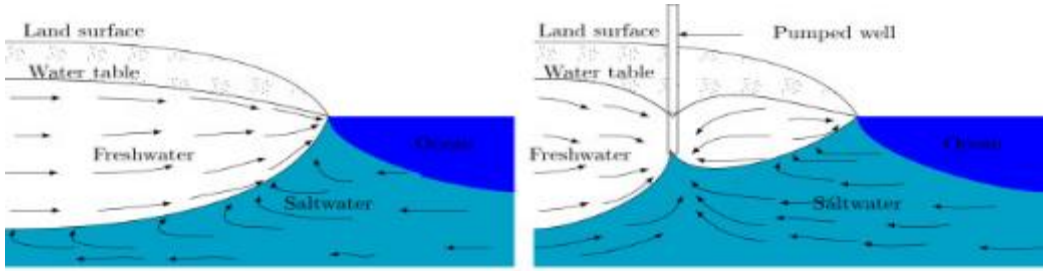
Groundwater use for Agricultue

The Nile Aquifer

A form of water reuse

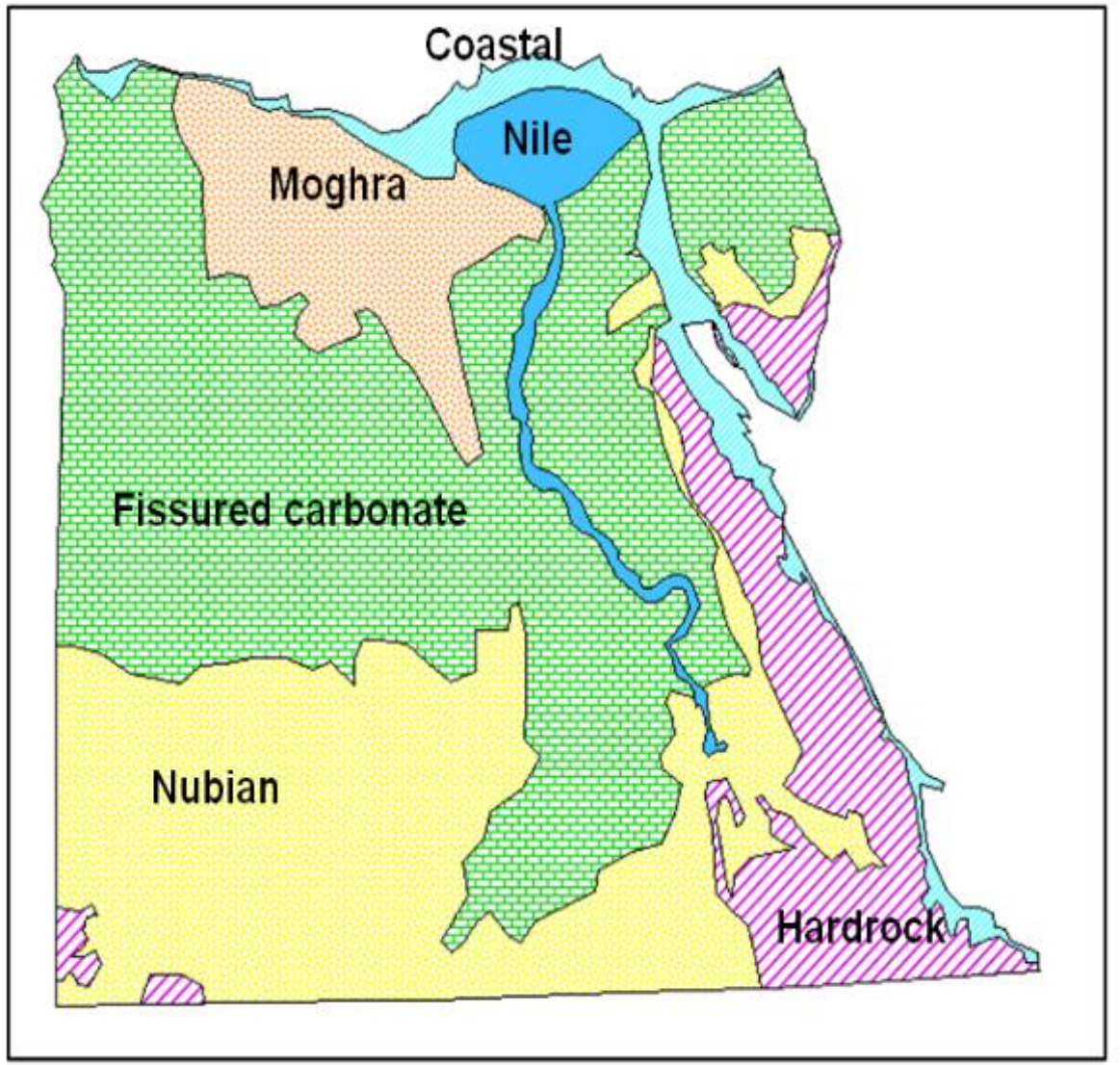


The Coastal Aquifer



Deep groundwater

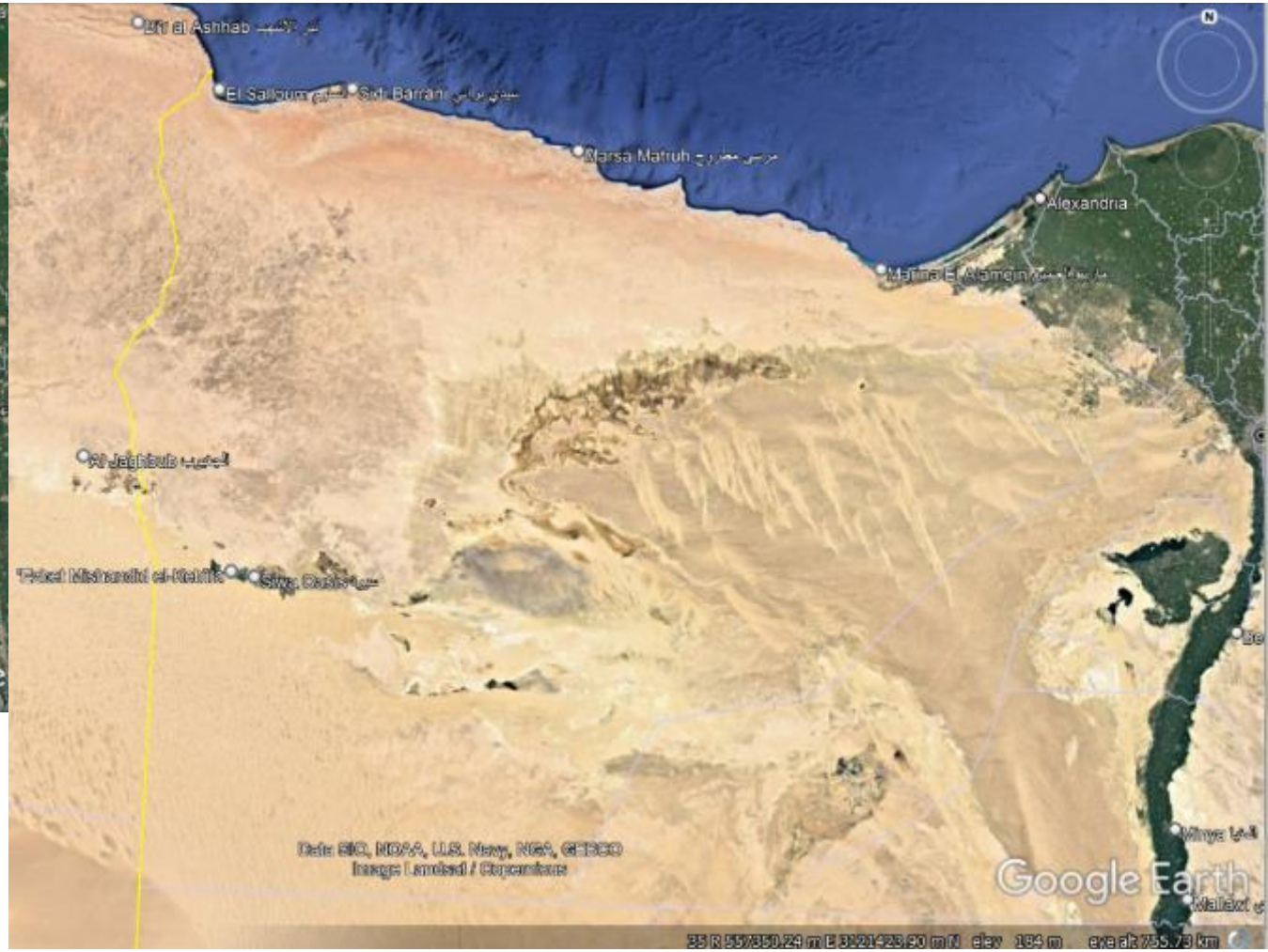
A non-renewable resource



Groundwater Use for Agriculture

Western Nile Delta

Partly Nile water – Partly Groundwater
Modern irrigation mandatory



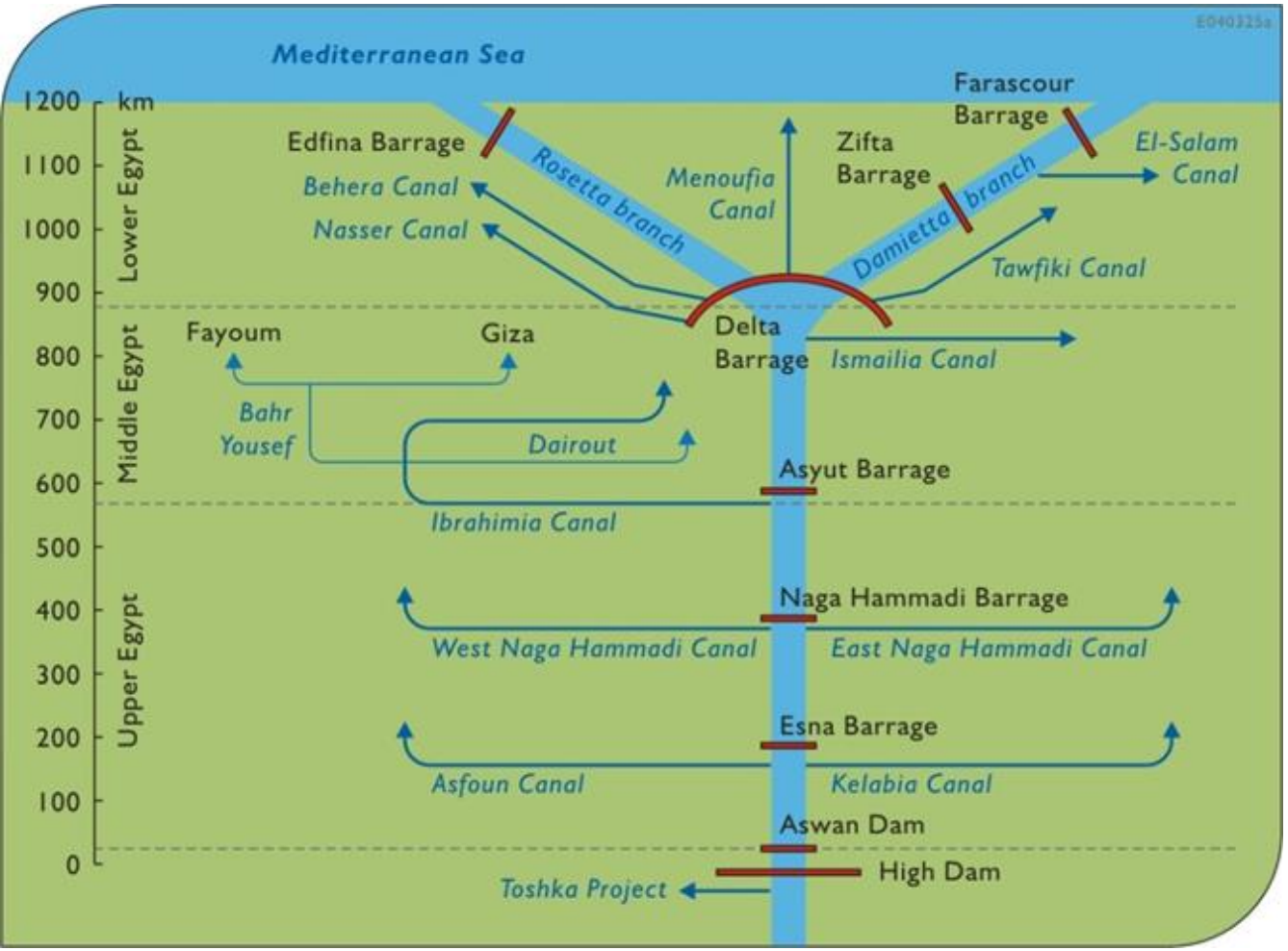
Western Desert Oases

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

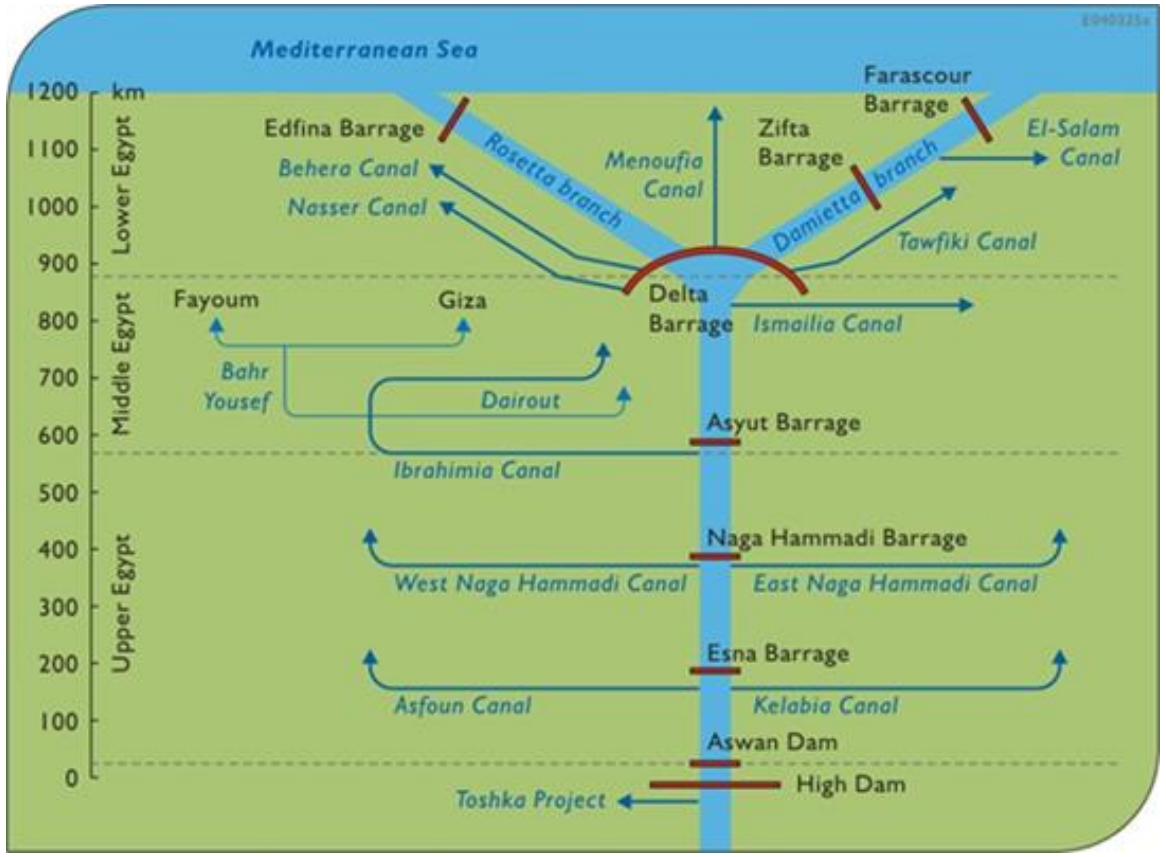


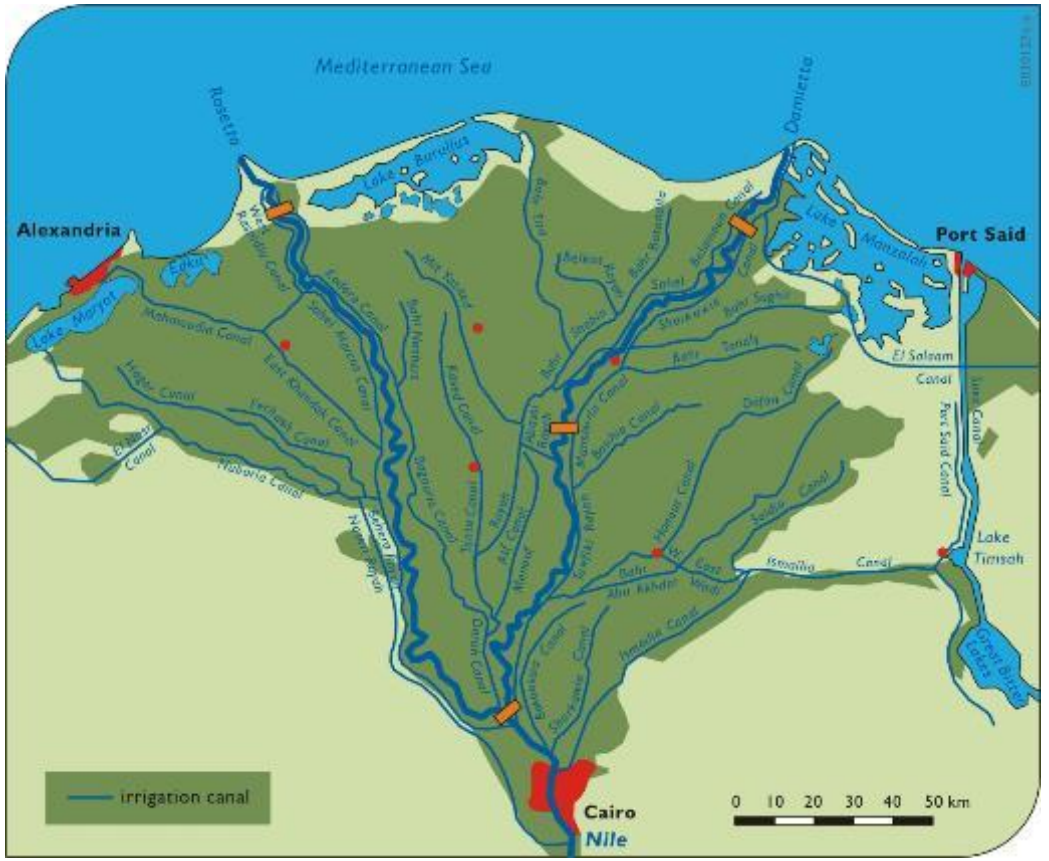
High Aswan Dam

Storage zone	Level (masl)	Volume (BCM)	Cum. volume (BCM)
Dead storage	<147	31.6	31.6
Active storage	147 – 175	89.7	121.3
Flood control storage	175 – 178	16.2	137.5
Maximum surcharge storage	178 – 183	31.4	168.9

Aswan High Dam – Flood Control

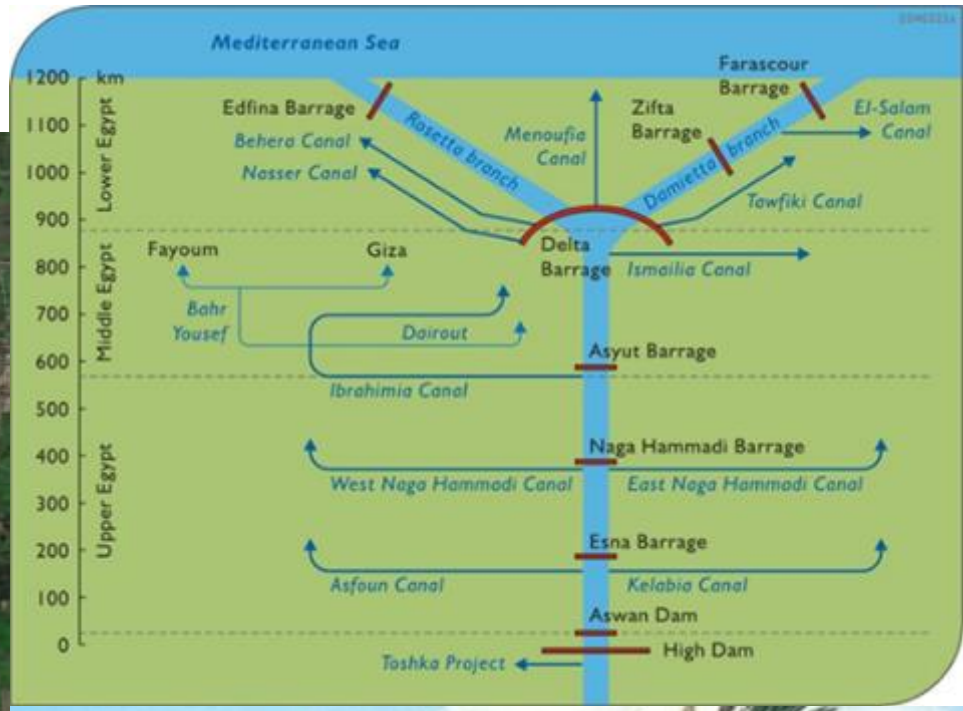
Main Irrigation Canals in the Nile Delta





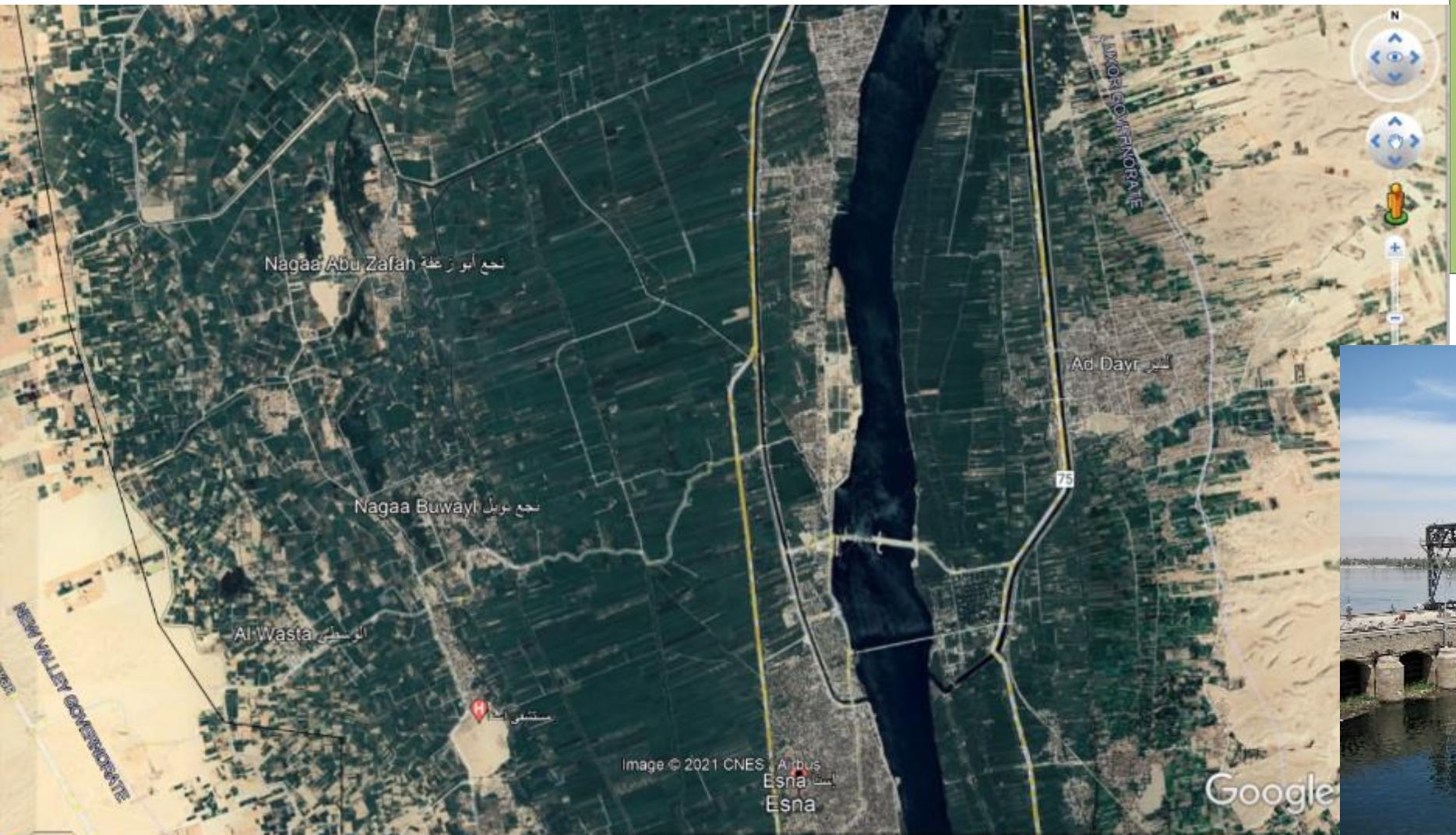
Total length of Nile River and its branches within Egypt 1530 km
Total length of canal network 33,000 km

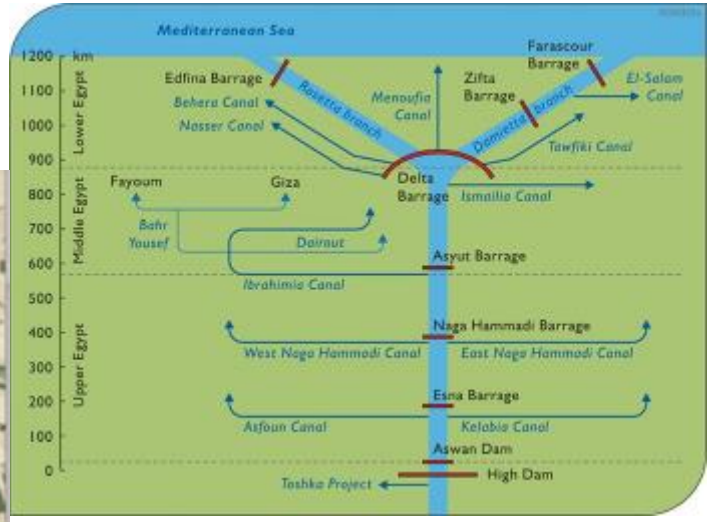
Nile Delta Barrage



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

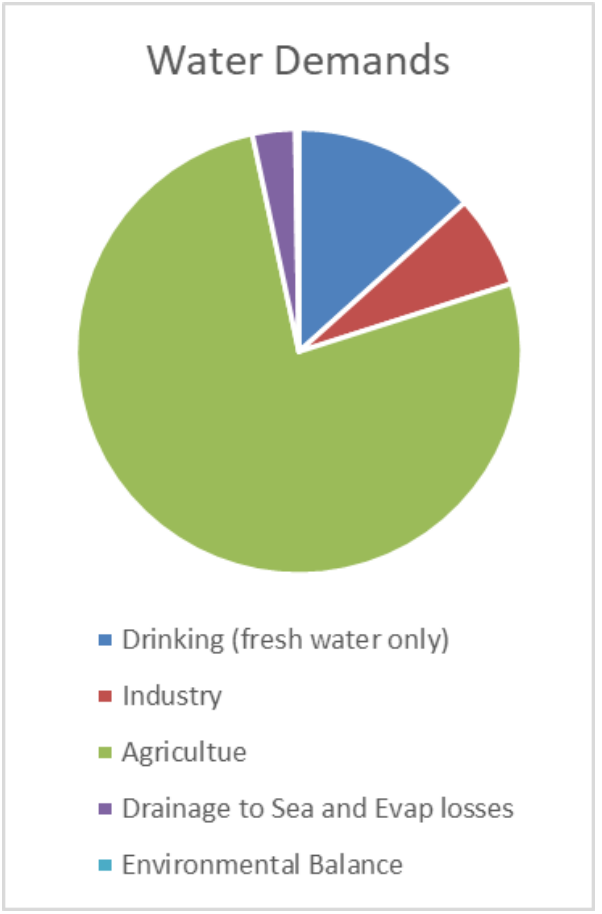
- 22 irrigation Directorates, subdivided into 62 Inspectorates and about 206 Districts.
- An inspectorate covers about 4 districts.
- The area of an irrigation district is between 20,000 and 60,000 feddan (about 40,000 – 100,000 farmers).
- Other organisation units used in the management of irrigation 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:

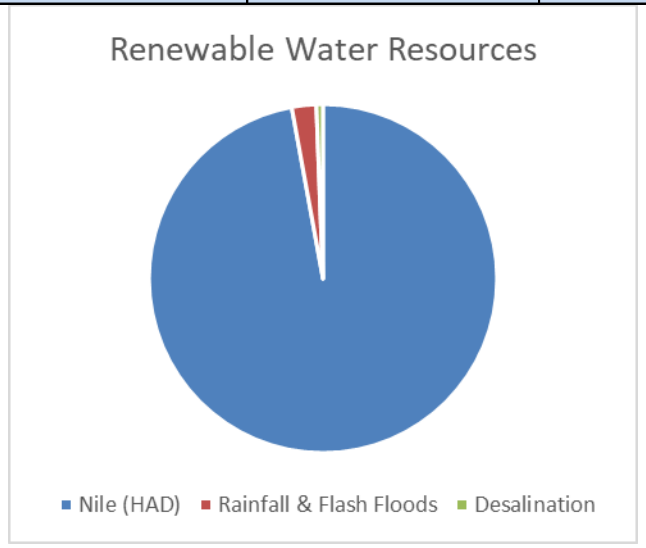
- Administrative and hydrologic boundaries don't match
- Supply side data:
  - The actual flows are not measured directly. However, a telemetry system has been installed which measures continuously water levels which can be converted to flow rates at major hydraulic structures along the Nile and main 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	Volume (BCM/year)	Water Demands	Usage/Allocation	
Fresh Water Sources			**(BCM/year)**	**%**
Nile (HAD)	55.50	Drinking (fresh water only)	10.70	13.3
Deep Groundwater	2.45	Industry	5.40	6.7
Rainfall & Flash Floods	1.30	Agricultue	61.45	76.6
Desalination	0.35	Drainage to Sea and Evap losses	2.50	3.1
		Environmental Balance	0.20	0.2
TOTAL Supply fresh	**59.60**			
Reused Water Sources				
Shallow Groundwater (Delta)	7.15			
Reuse of Drainage Water	13.50			
TOTAL Water Reused	**20.65**			
TOTAL Water Supply	**80.25**	**TOTAL Water Usage or Allocation**	**80.25**	

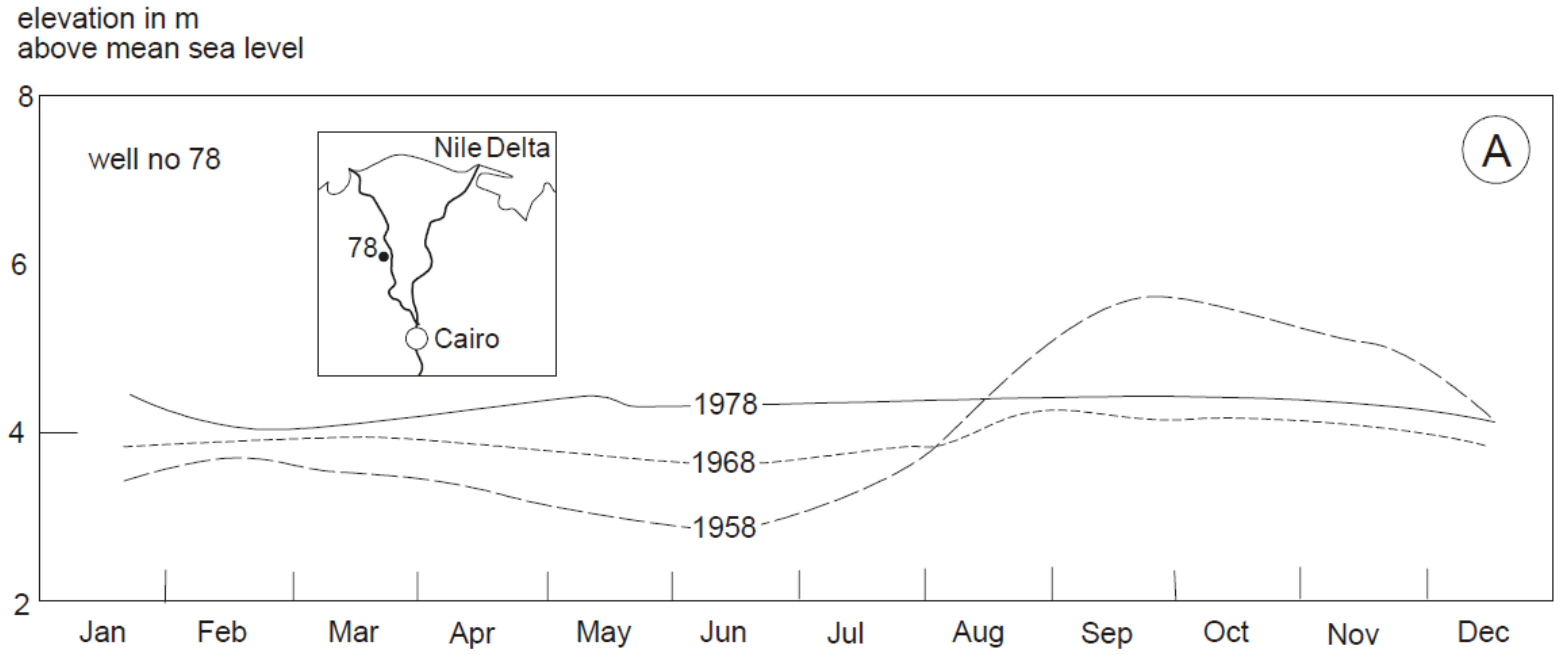


Renewable Water Resources	BCM	%
Nile (HAD)	55.50	97.1
Rainfall & Flash Floods	1.30	2.3
Desalination	0.35	0.6
	57.15	



Agricultural Drainage

The Need for Agricultural Drainage

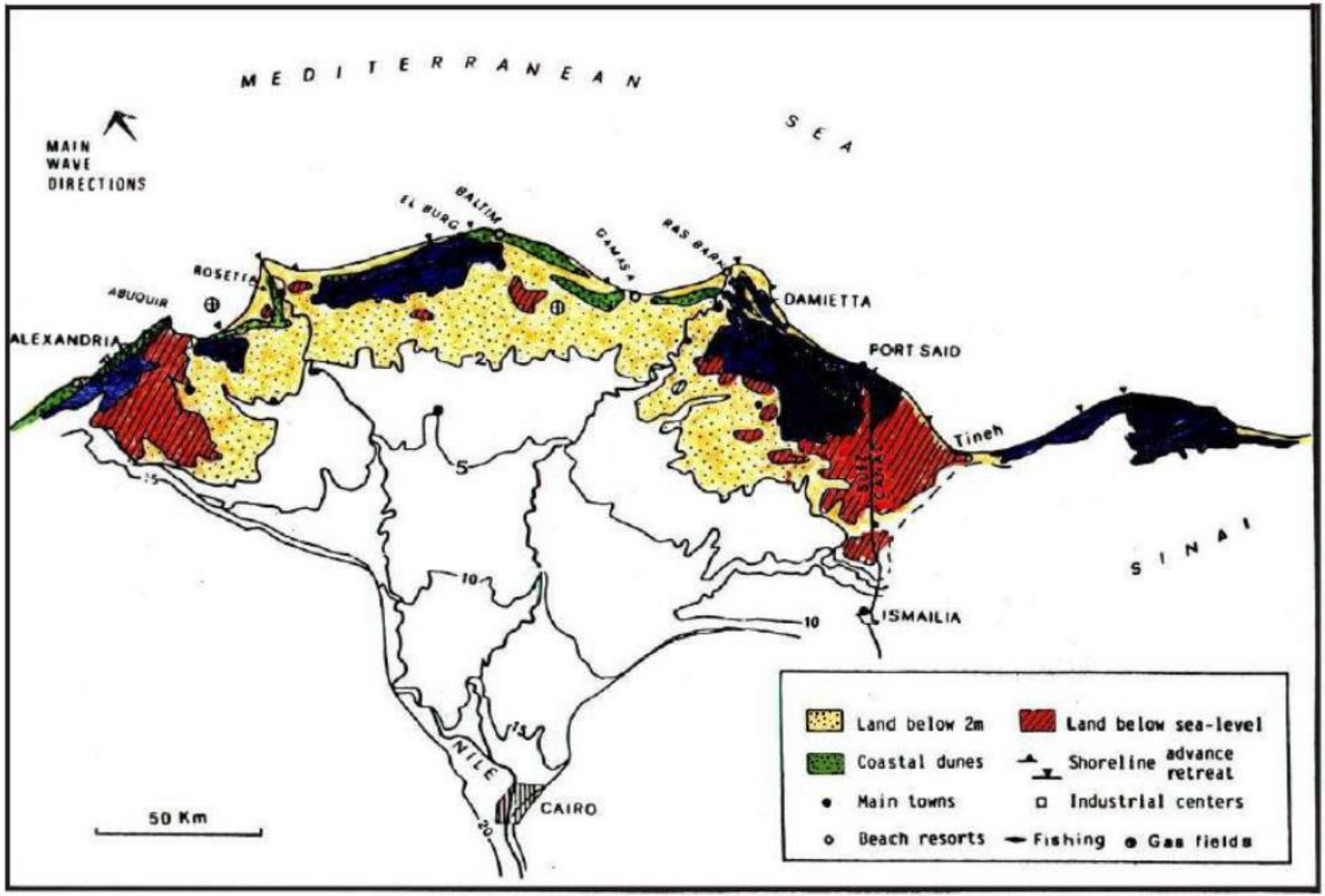


Fluctuations of water levels in the Nile Delta before and after the construction of the High Aswan Dam

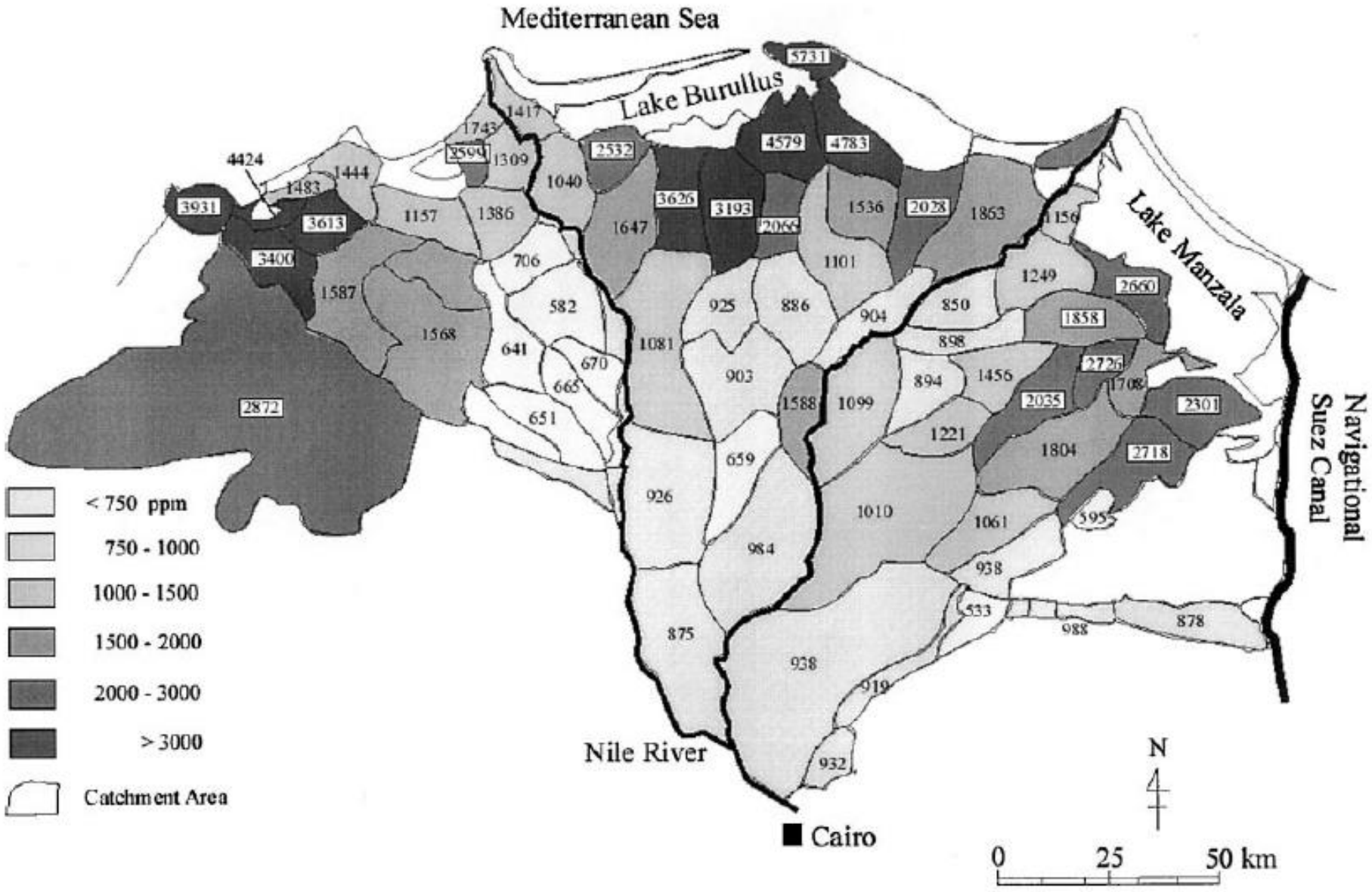
Location	Discharge BCM/y	Salinity (dS/m)	Total salt load M ton/y
Aswan Dam	55	0.31	11.0
Delta Barrage	35	0.47	10.5

Agricultural Drainage

Total length of main drain network 24,000 km


MEDITERRANEAN SEA
MAIN WAVE DIRECTIONS
EL BURG
BALTIM
GAMASA
RAS BARR
ROSETTA
ABUQUIR
ALEXANDRIA
DAMIETTA
PORT SAID
Tineh
SUEZ CANAL
SINAI
ISMAILIA
NILE
CAIRO
2
5
10
15
20
50 Km
Land below 2m
Land below sea-level
Coastal dunes
Shoreline advance retreat
Main towns
Industrial centers
Beach resorts
Fishing
Gas fields

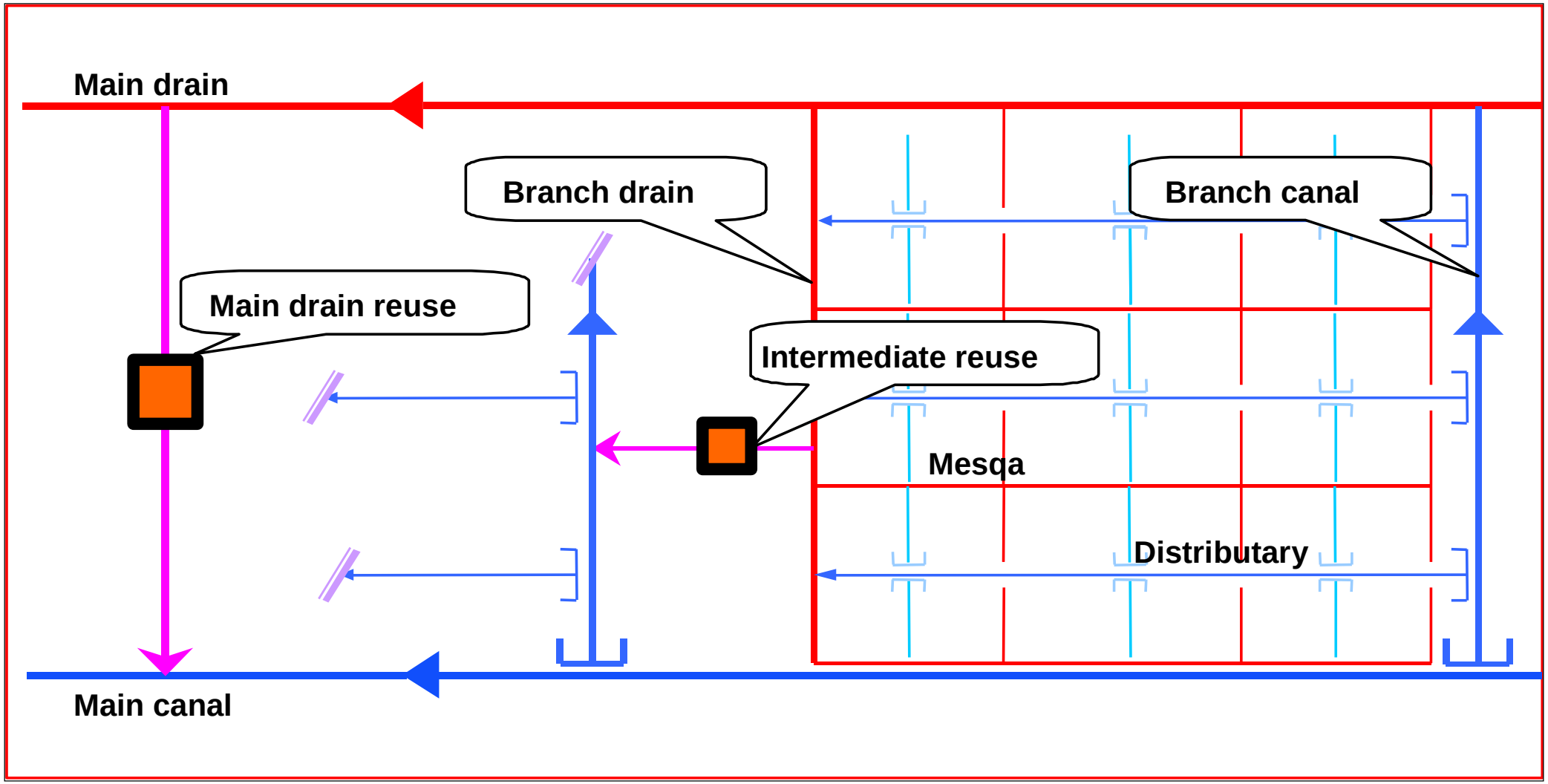
Average salinity of drainage water in the Nile Delta



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



Environmental and health issues related to drainage water reuse

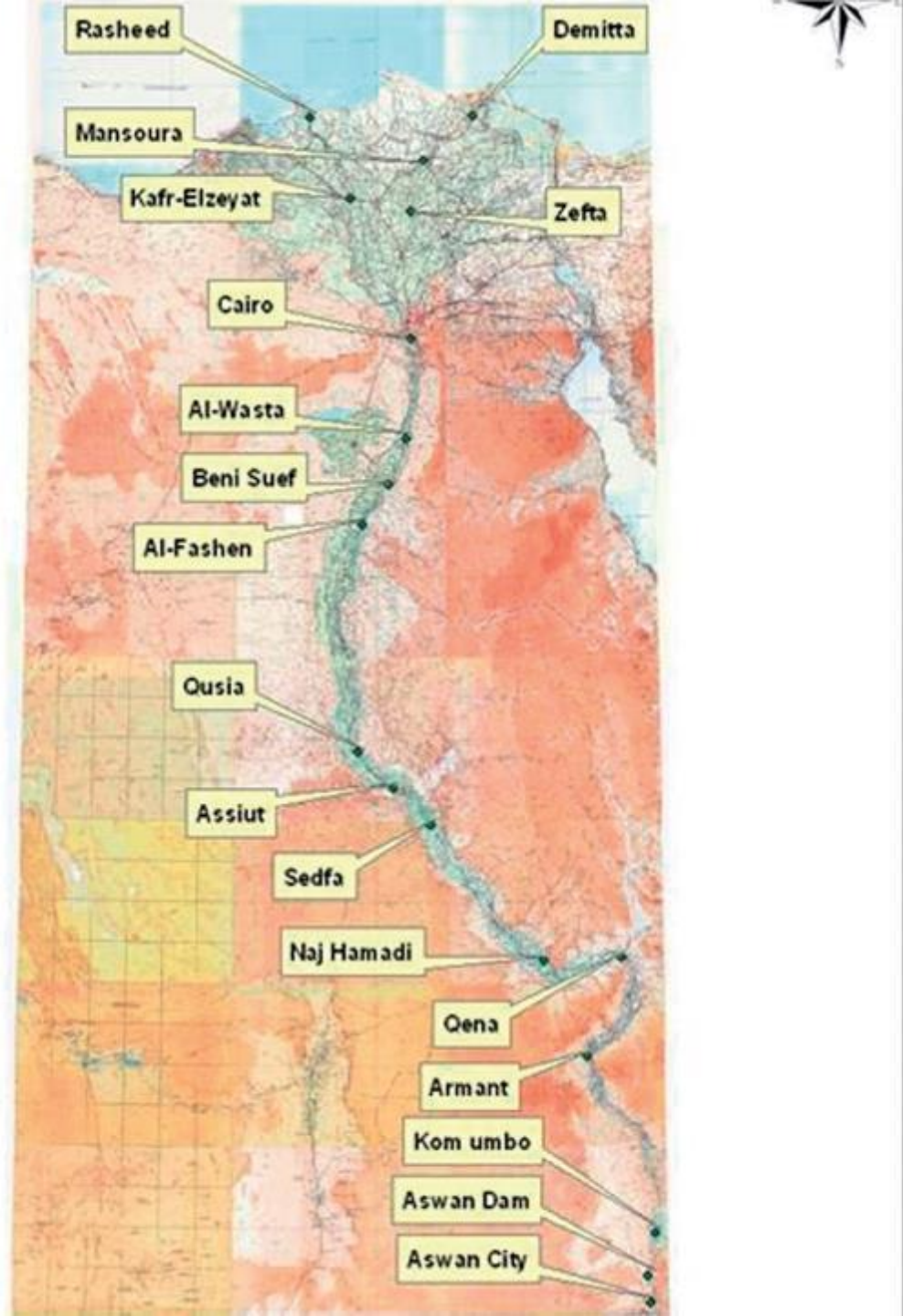
Toxicological & Environmental Chemistry
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713653210

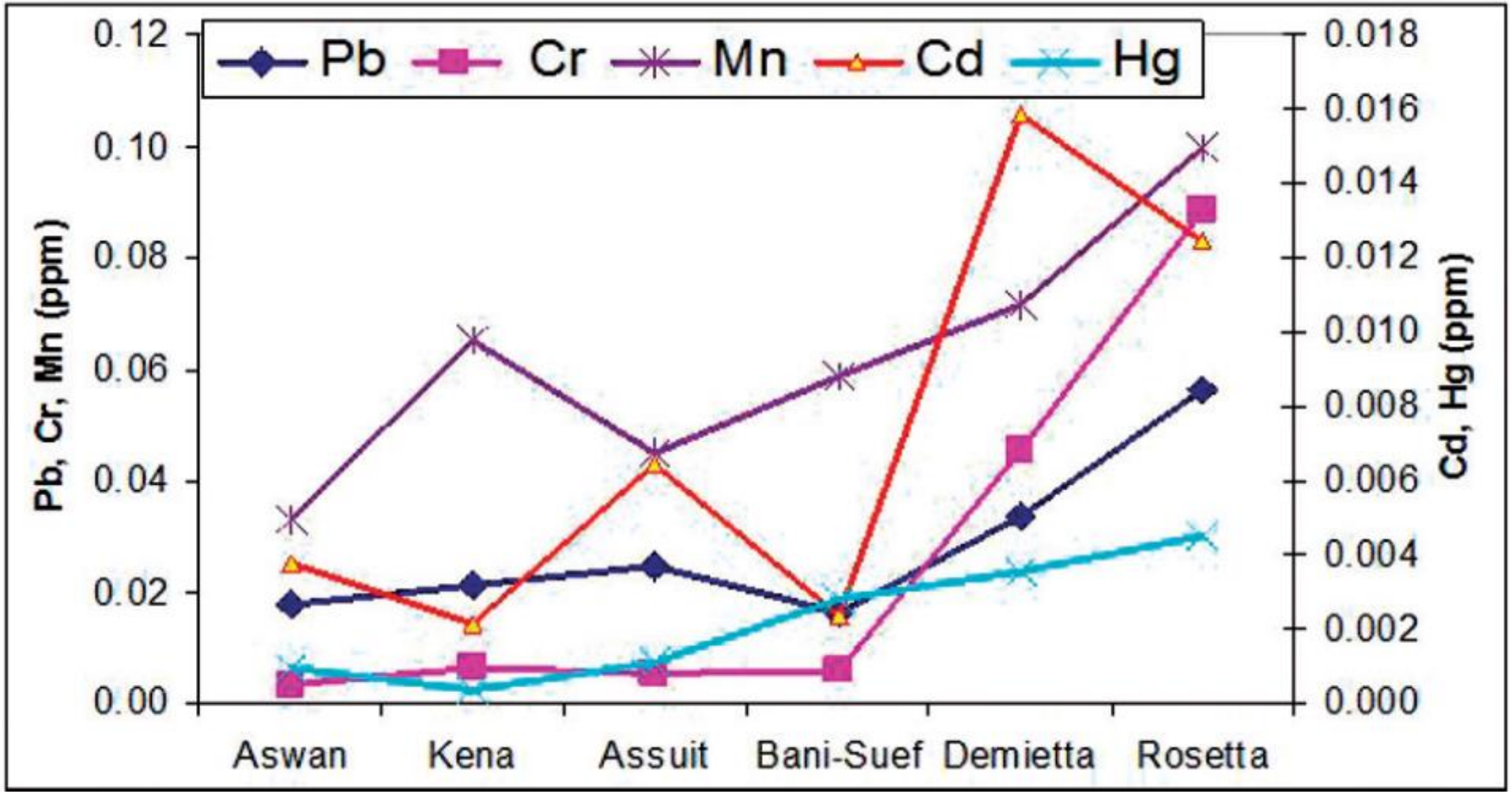
In situ evaluation of the genotoxic potential of the river Nile: I. Micronucleus and nuclear lesion tests of erythrocytes of *Oreochromis niloticus niloticus* (Linnaeus, 1758) and *Clarias gariepinus* (Burchell, 1822)

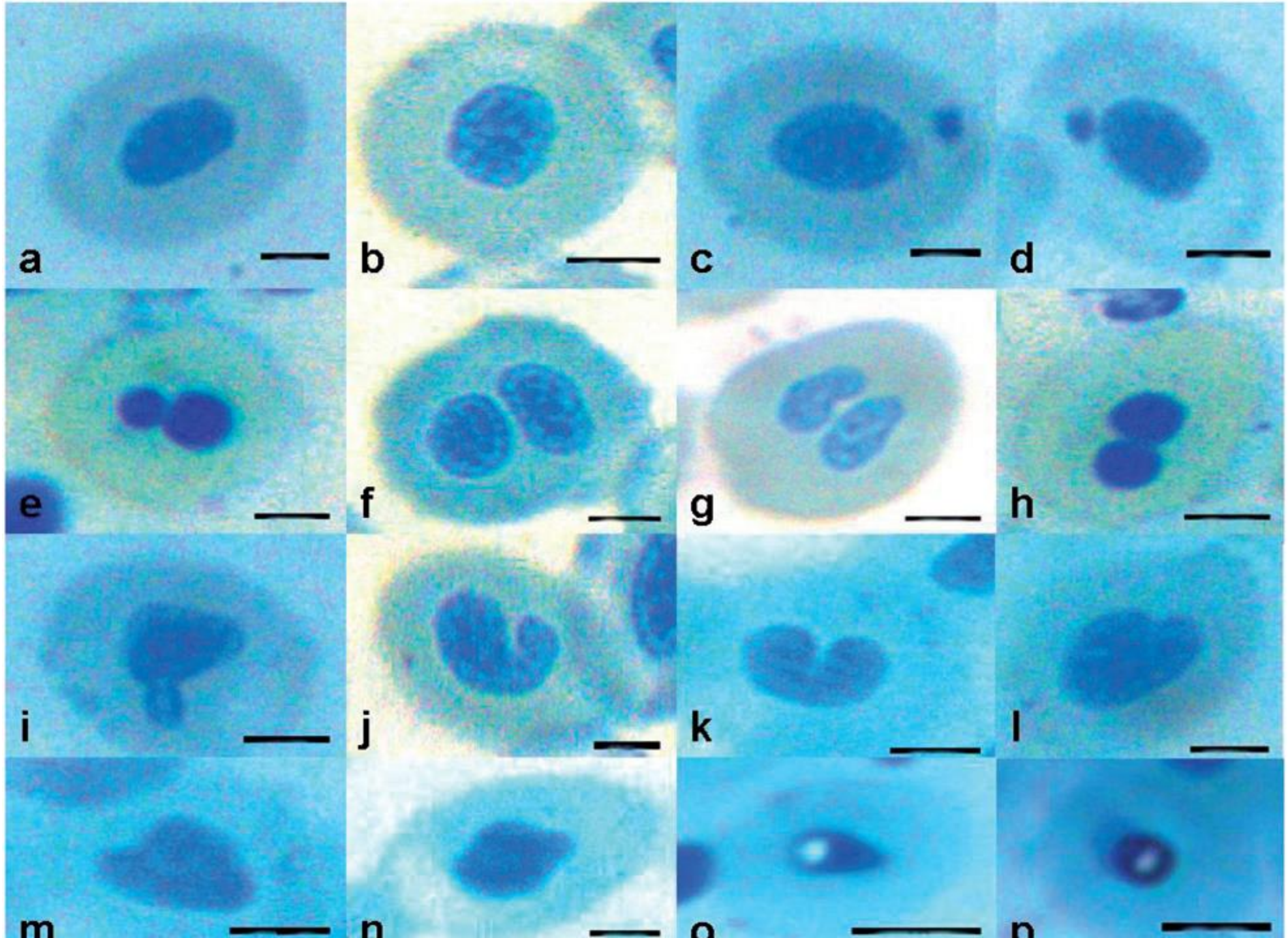
Alaa G. M. Osman[ab]; Abd-El-Baset M. Abd El Reheem[a]; Mohsen A. Moustafa[a]; Usama M. Mahmoud[c]; Khaled Y. Abuel-Fadl[d]; Werner Kloas[be]

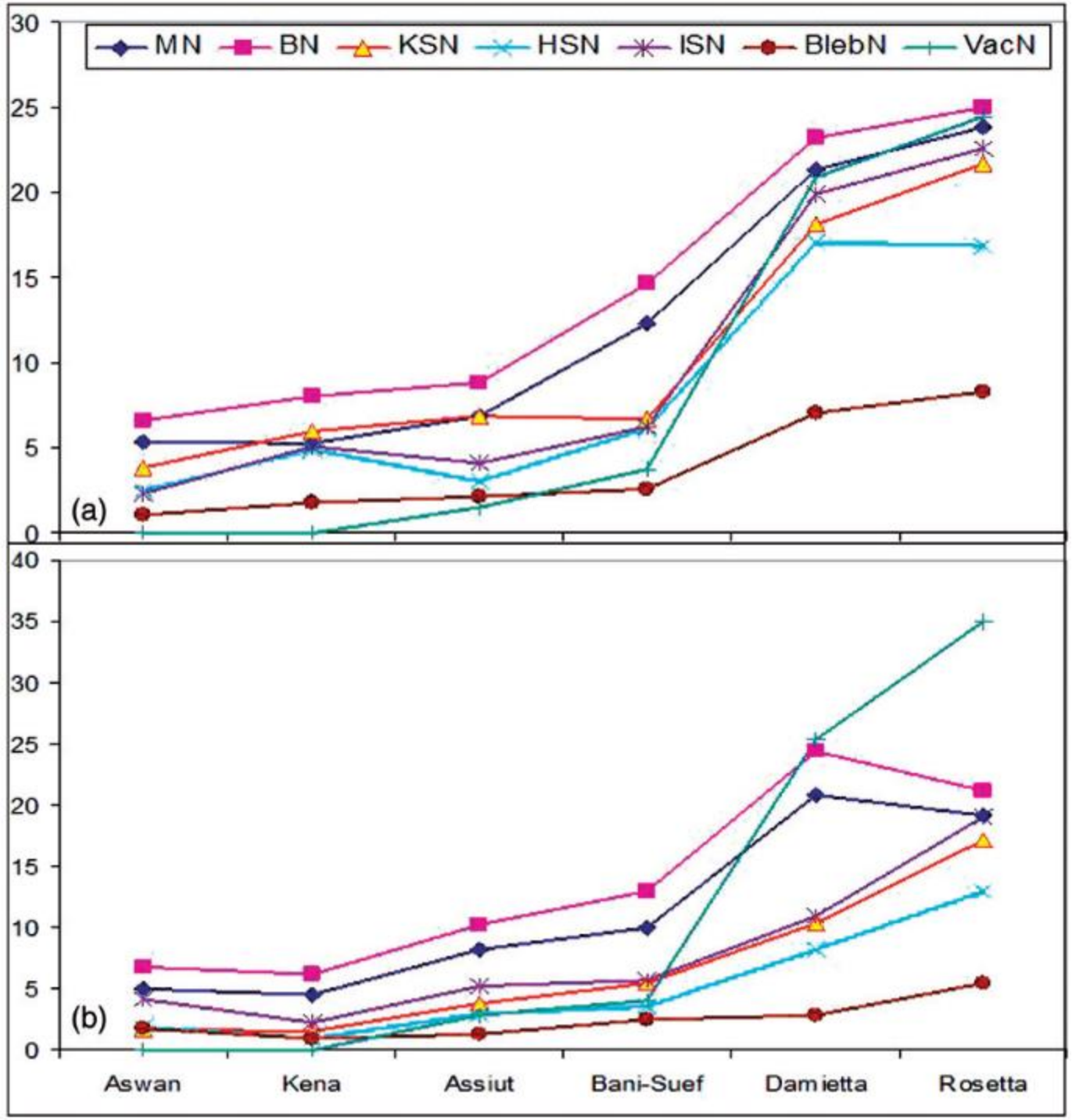
[a] Department of Zoology, Faculty of Science, Al-Azhar University (Assiut Branch), 71524 Assiut, Egypt [b] Department of Ecophysiology and Aquaculture, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, 12587 Berlin, Germany [c] Department of Zoology, Faculty of Science, Assuit University, Assiut, Egypt [d] The Egyptian Environmental Affairs Agency (EEAA), Assiut, Egypt [e] Department of Endocrinology, Humboldt University, Berlin, Germany

First published on: 30 March 2011


Rasheed
Demitta
Mansoura
Kafr-Elzeyat
Zefta
Cairo
Al-Wasta
Beni Suef
Al-Fashen
Qusia
Assiut
Sedfa
Naj Hamadi
Qena
Armant
Kom umbo
Aswan Dam
Aswan City


Pb
Cr
Mn
Cd
Hg
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Pb, Cr, Mn (ppm)
Cd, Hg (ppm)
Aswan
Kena
Assuit
Bani-Suef
Demietta
Rosetta


a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p


MN
BN
KSN
HSN
ISN
BlebN
VacN
(a)
(b)
Aswan
Kena
Assiut
Bani-Suef
Damietta
Rosetta

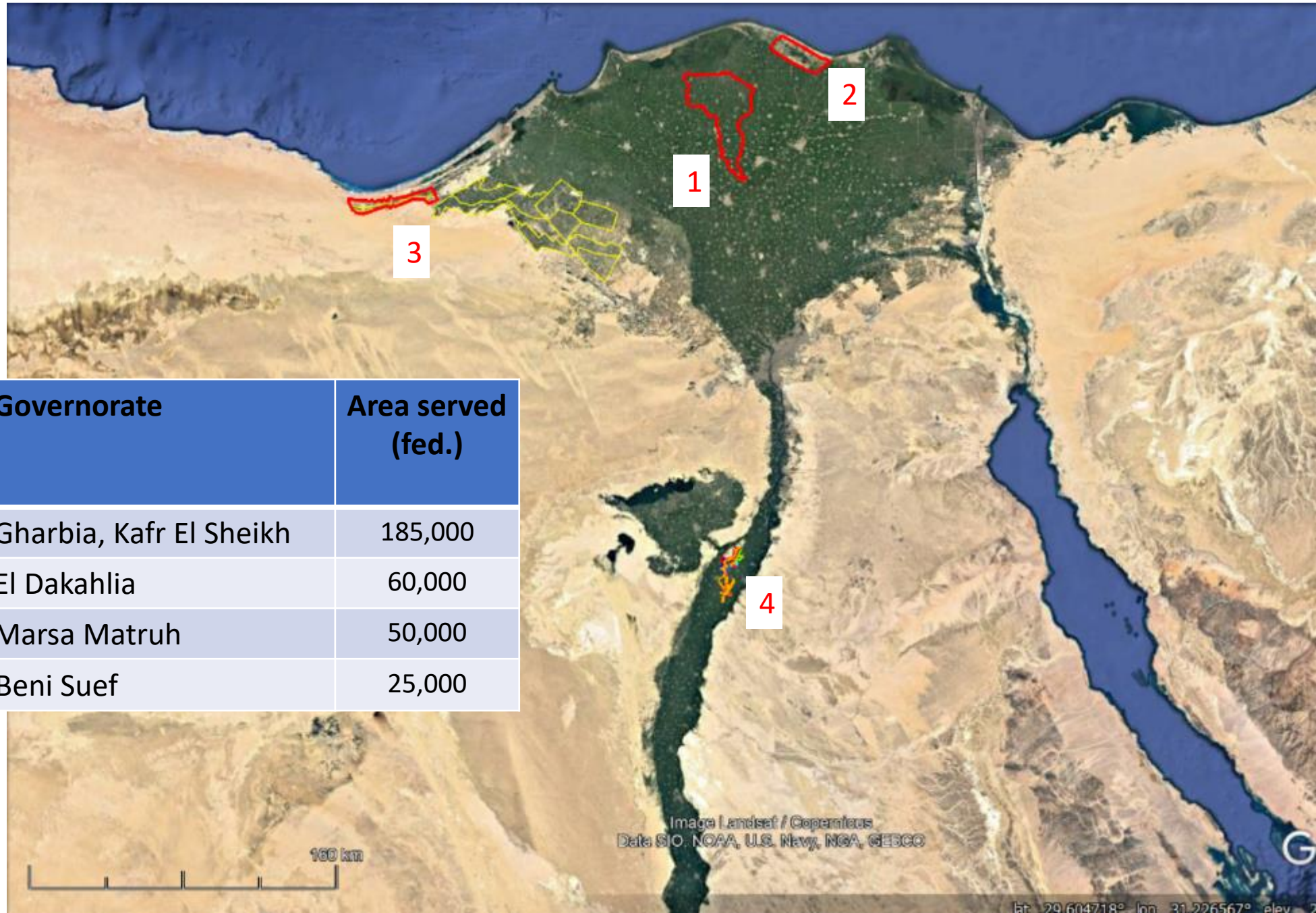
Laws

- 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

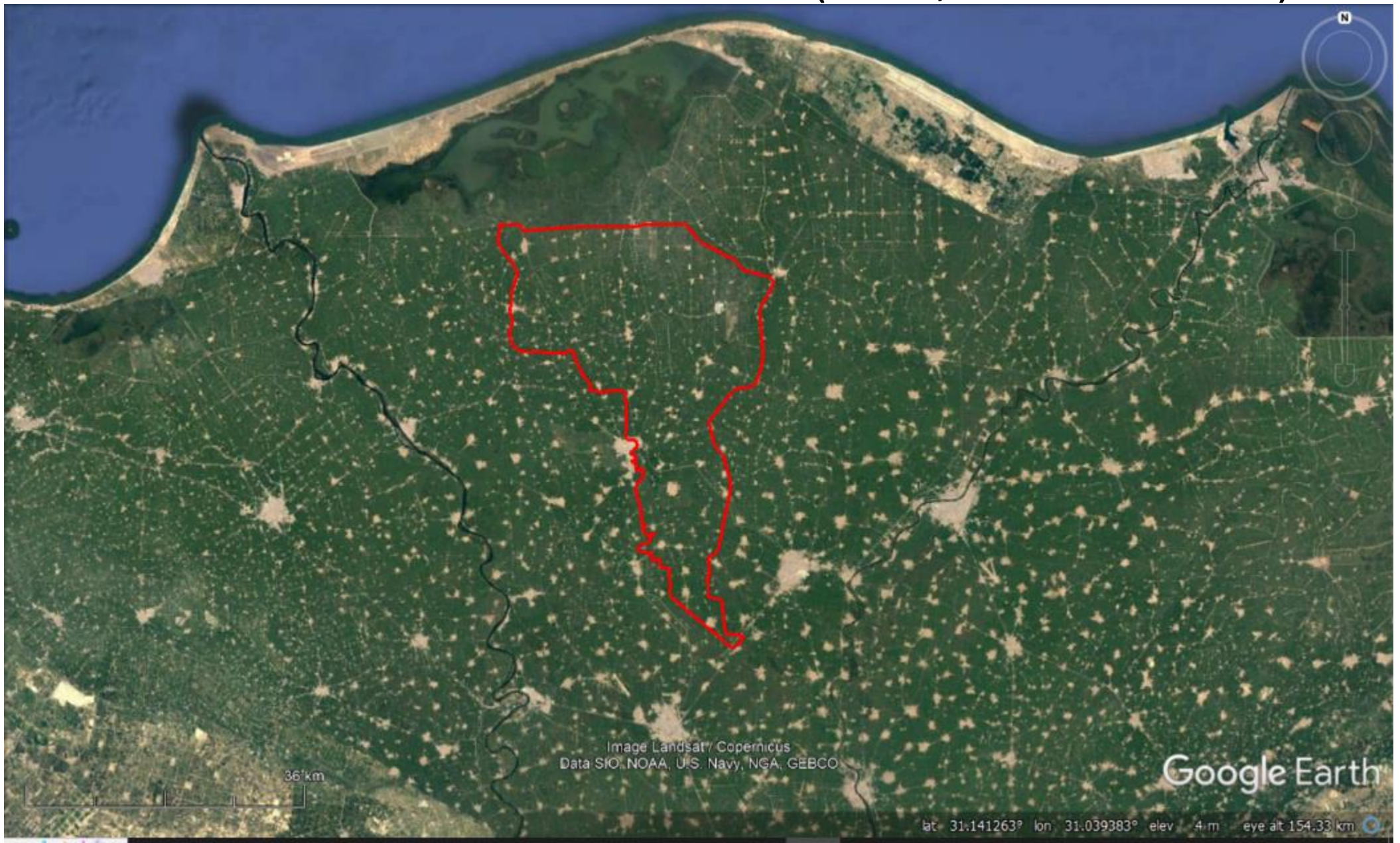
- 15: Water shall be distributed among water users sharing a mesqua according to their relative land share of the command area
- 20: acknowledges historic water rights
- 26: the MWRI is responsible for matters related to water distribution for all uses and has the right to adjust the usage pattern if 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
- 68 – 81: pertaining to mandatory licensing of groundwater wells
- 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

Pilot Areas under consideration



Nr	Pilot Area	Governorate	Area served (fed.)
1	Mit Yazid	Gharbia, Kafr El Sheikh	185,000
2	Qualabsho -Zaian	El Dakahlia	60,000
3	El Hammam	Marsa Matruh	50,000
4	Tansa-Quela	Beni Suef	25,000

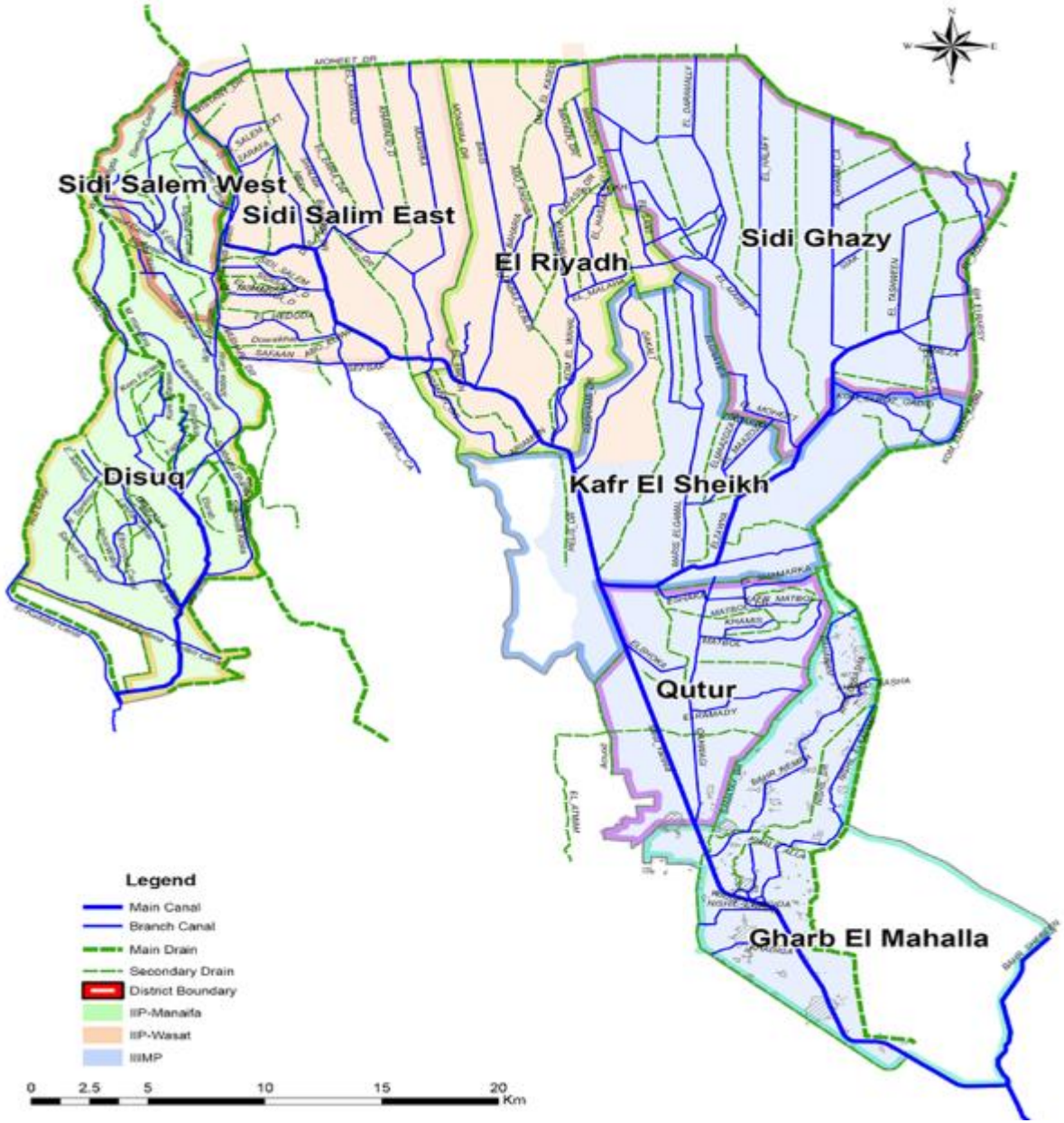
1- Mit Yazid Command Area (185,000 feddan)



Mit Yazid Command Area

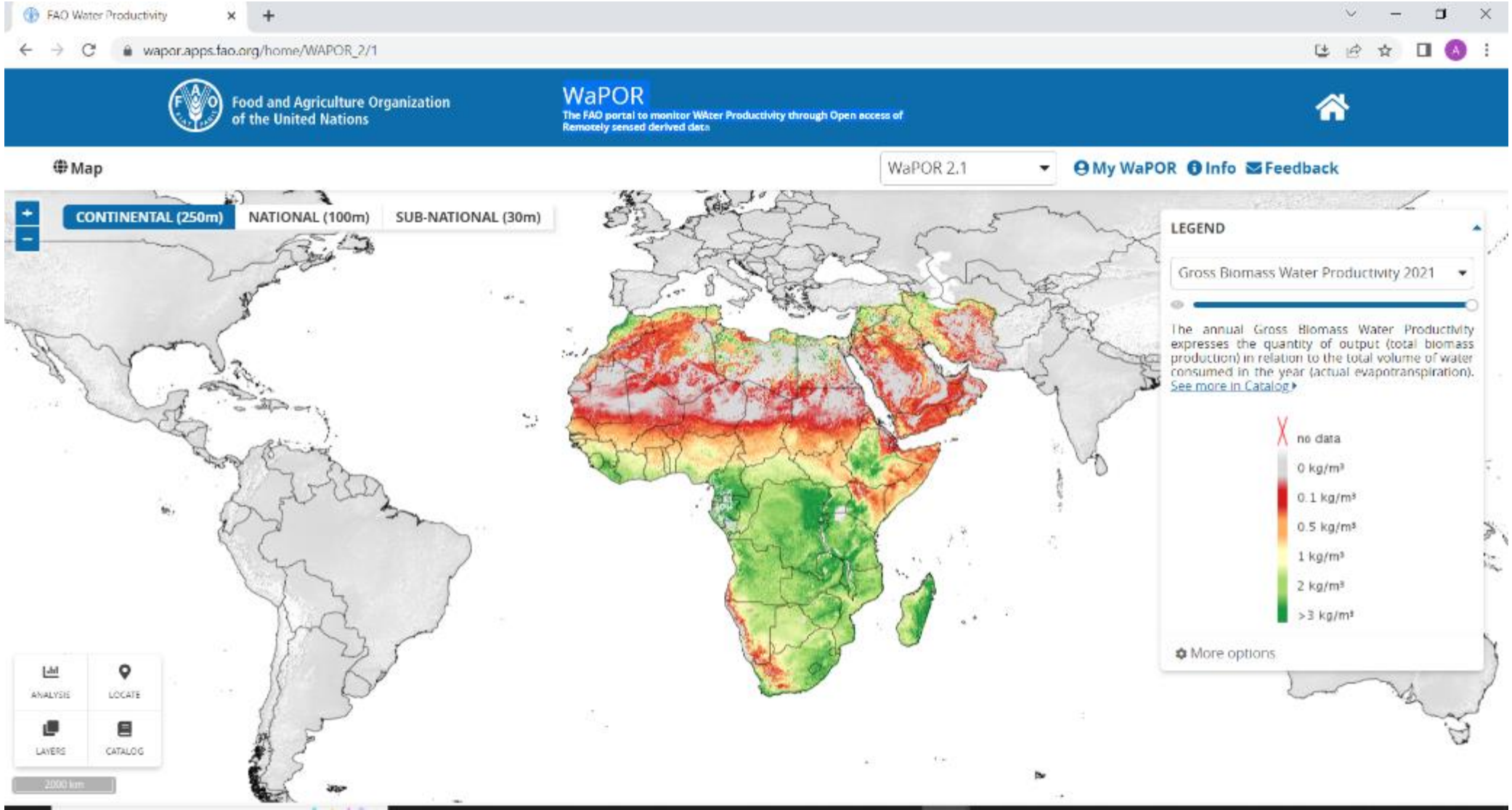
1- Mit Yazid Command Area

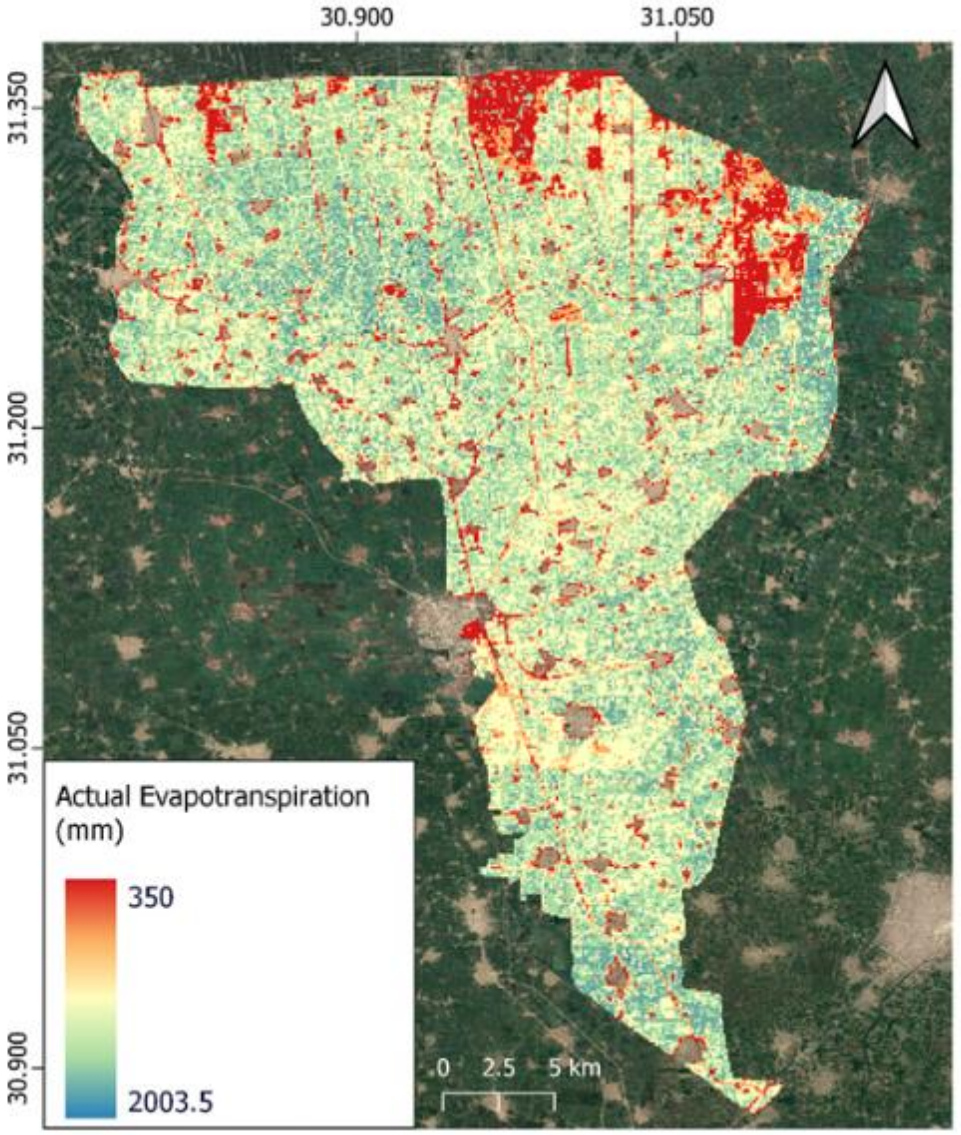
- Catchment home to several million people
- Mit Yazid Canal is 63.2 km long taking off from Bahr Shebeen
- Provides water to 42 branch canals and larger mesqas
- Provides water to 16 WTP
- Water supply includes 17 drainage reuse pump stations
- Extends over Governorates of Gharbia and Kafr El-Shiekh
- 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

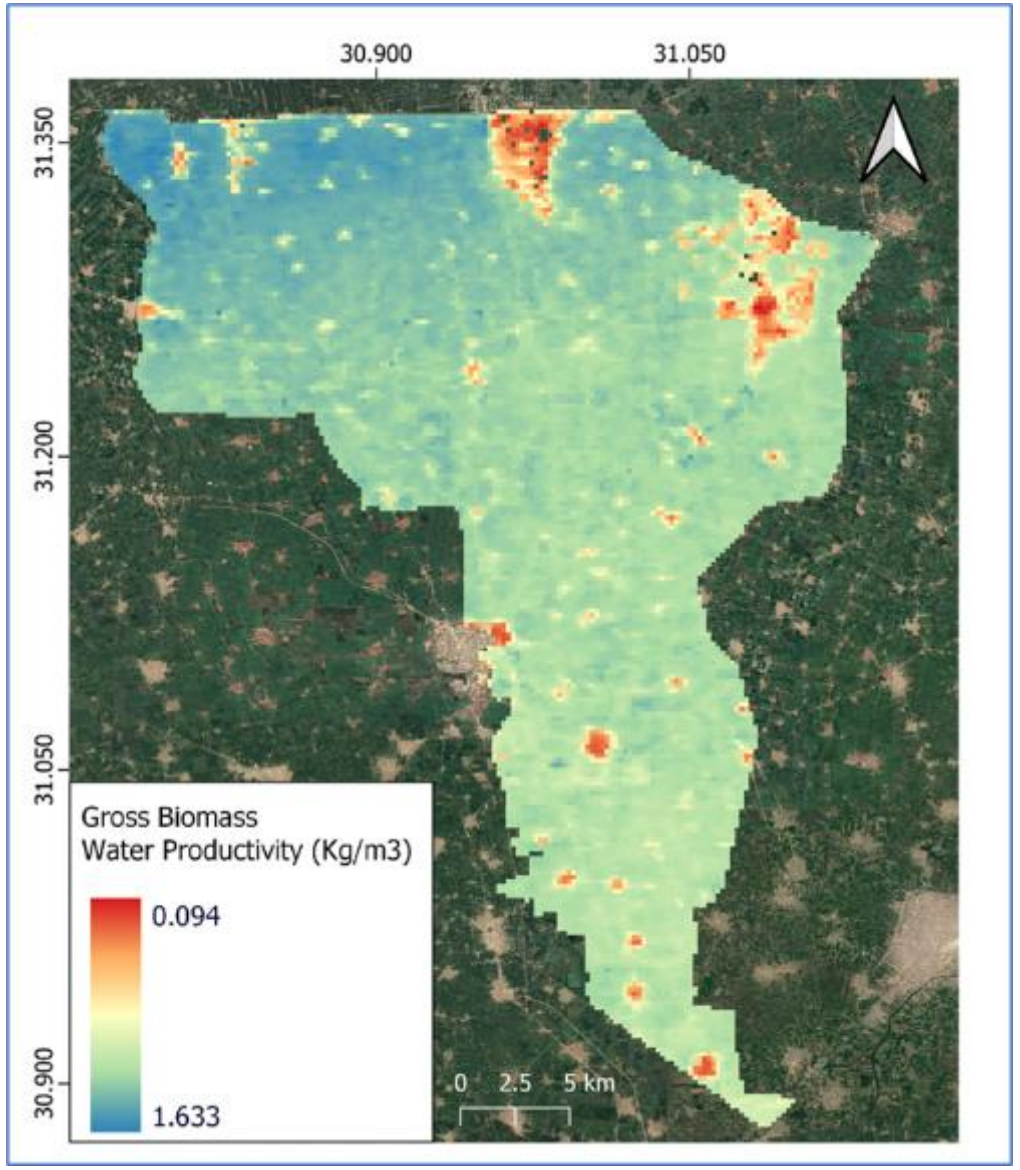


FAO WaPOR

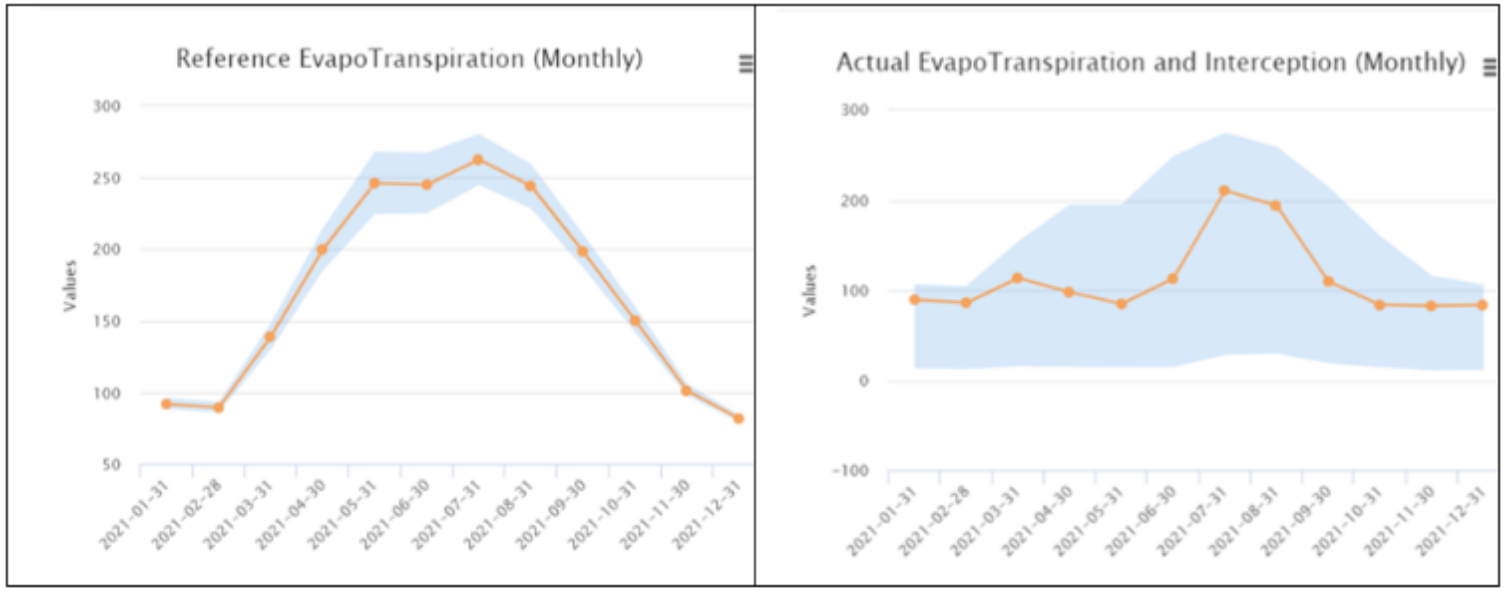
The FAO portal to monitor WAter Productivity through Open access of Remotely sensed derived data

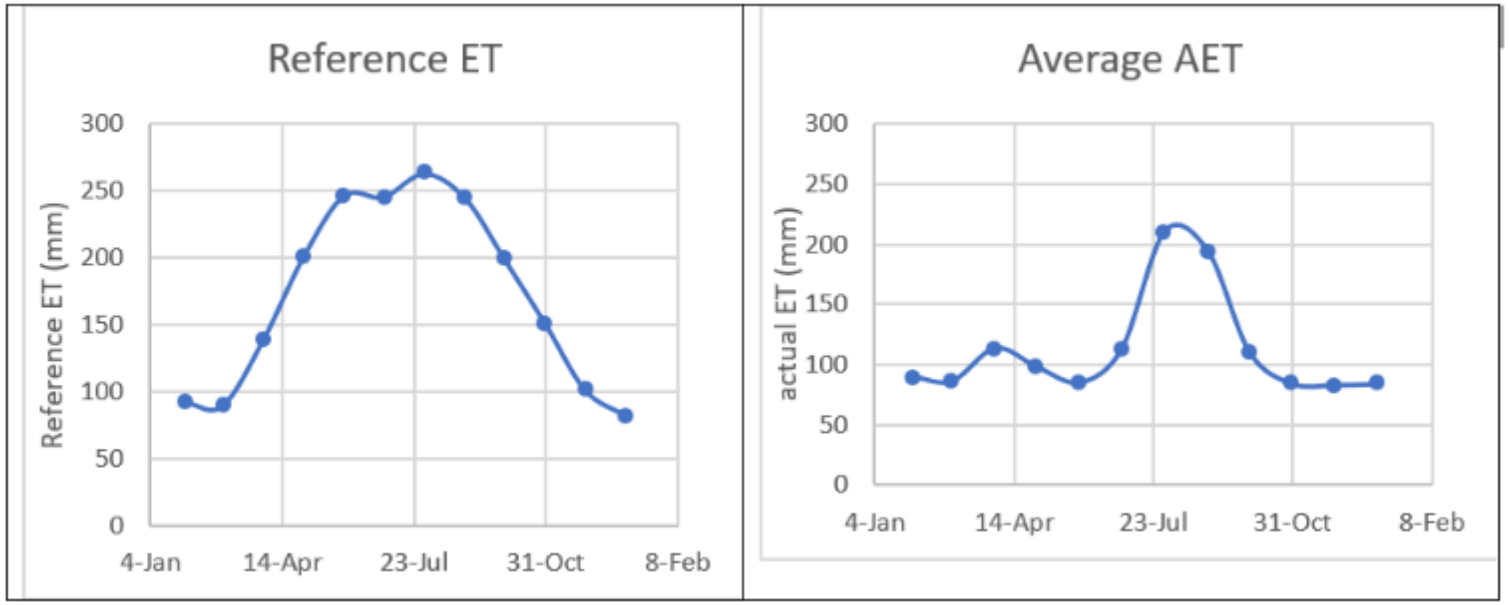






Downloaded values for 2021

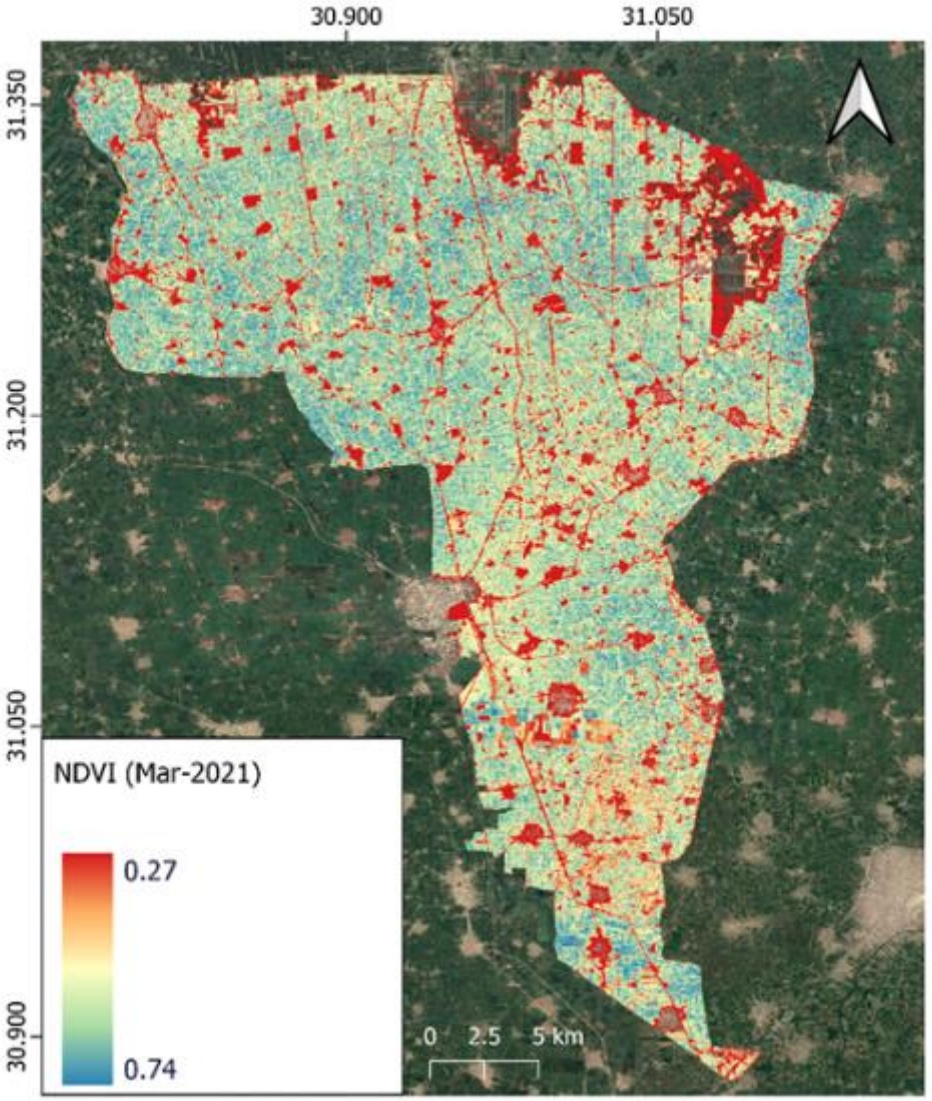


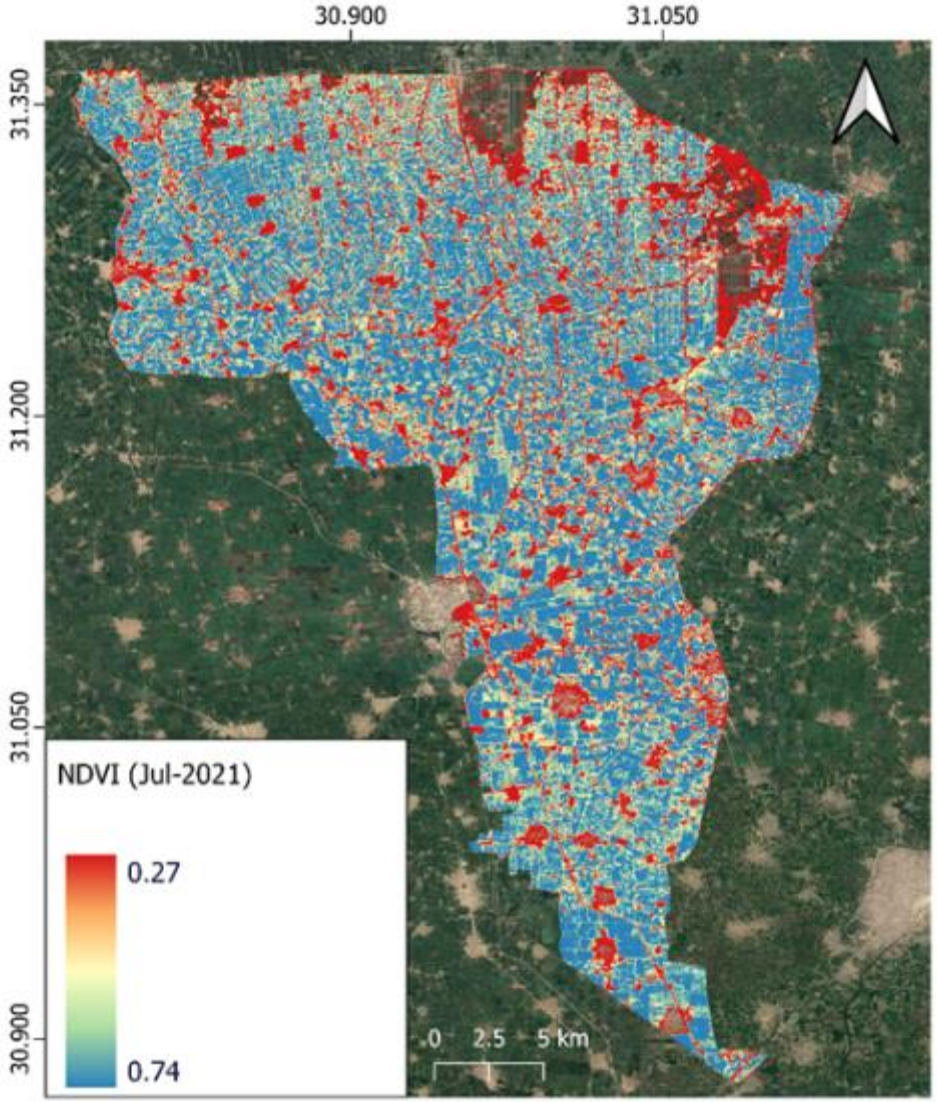


Time series of area average reference and actual ET values for 2021

NDVI (Normalized Difference Vegetation Index) values computed from Landsat data for two dates in 2021

NDVI = (NIR-RED)/(NIR+RED)
NDVI always ranges from -1 to +1
Negative values: most likely water
Close to 1: dense green leaves



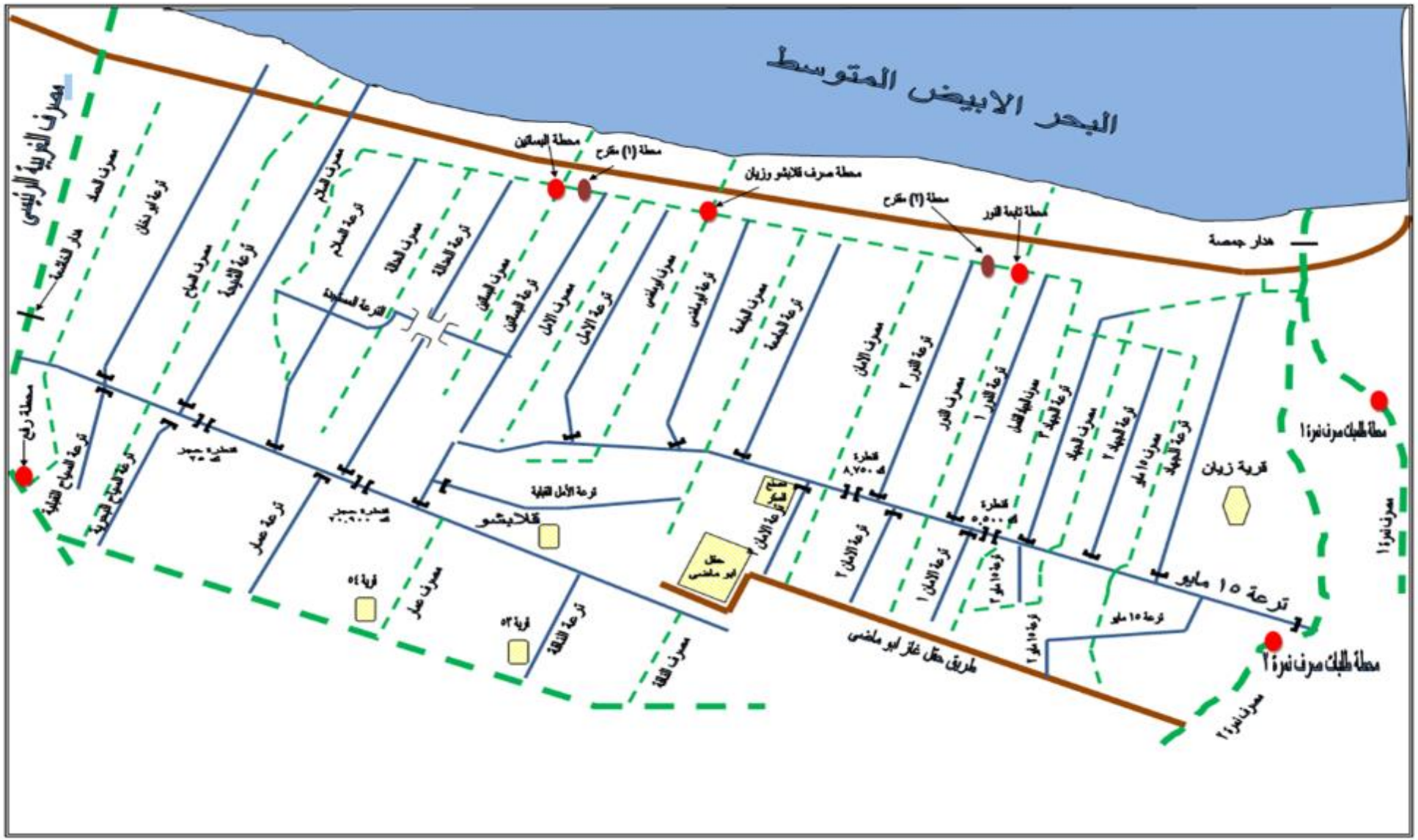


1 – Mit Yazid

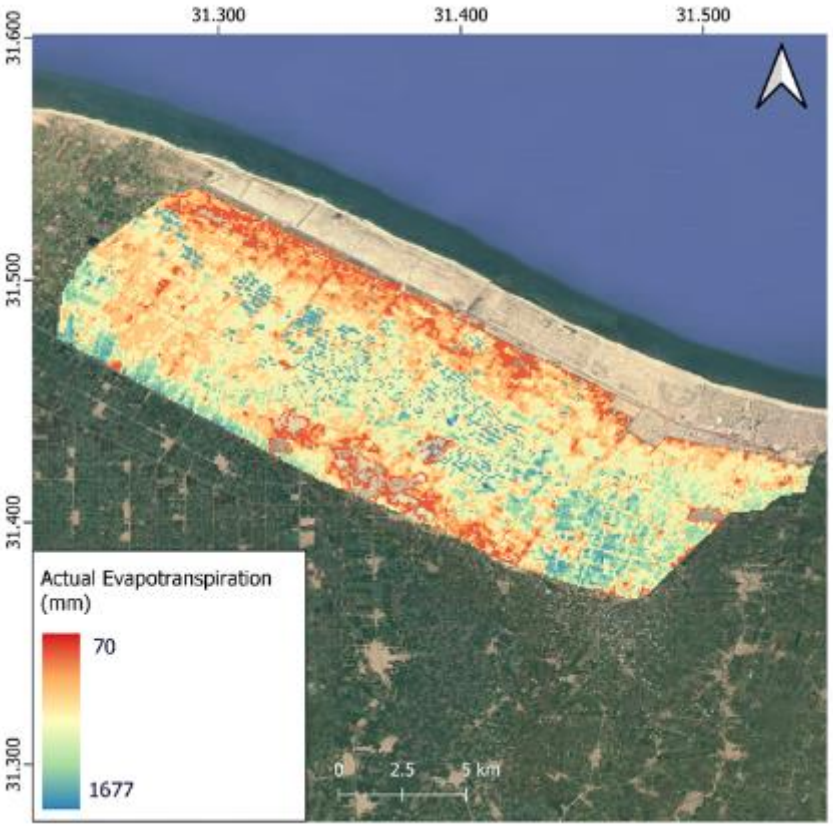
Pros	Cons
One hydraulic unit of ~185,000 fed	Relatively large and complex area
Total area improved by several projects (IIP, IIIMP) since year 2000	Stretches over two governorates and five irrigation districts
Data Available (numerous national and international research institutions analyzed and evaluated)	
17 drainage water reuse stations	
Water uses include agriculture, 16 drinking water stations, industries	
Despite previous projects, water issues still exist	

2- Qualabsho Zaian Command Area (60,000 feddan)

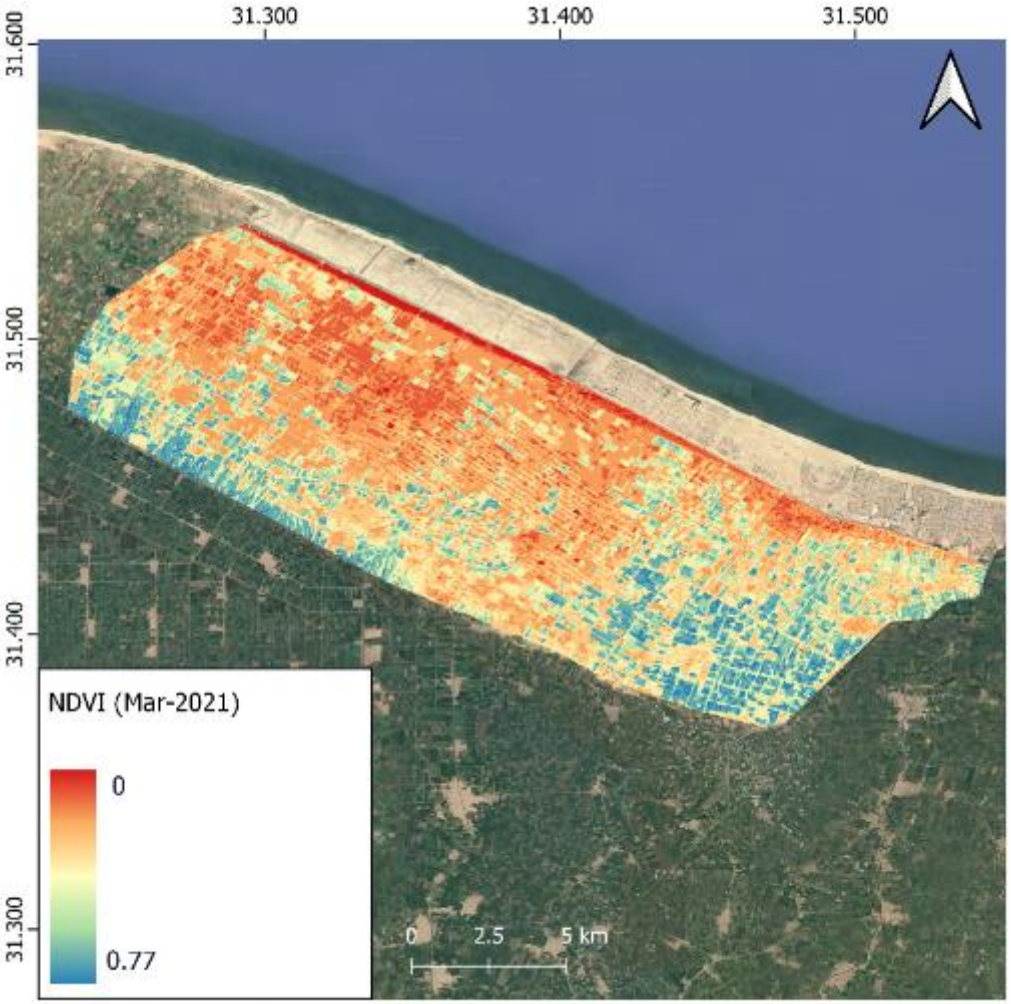
2- Qualabsho Zaian Command Area

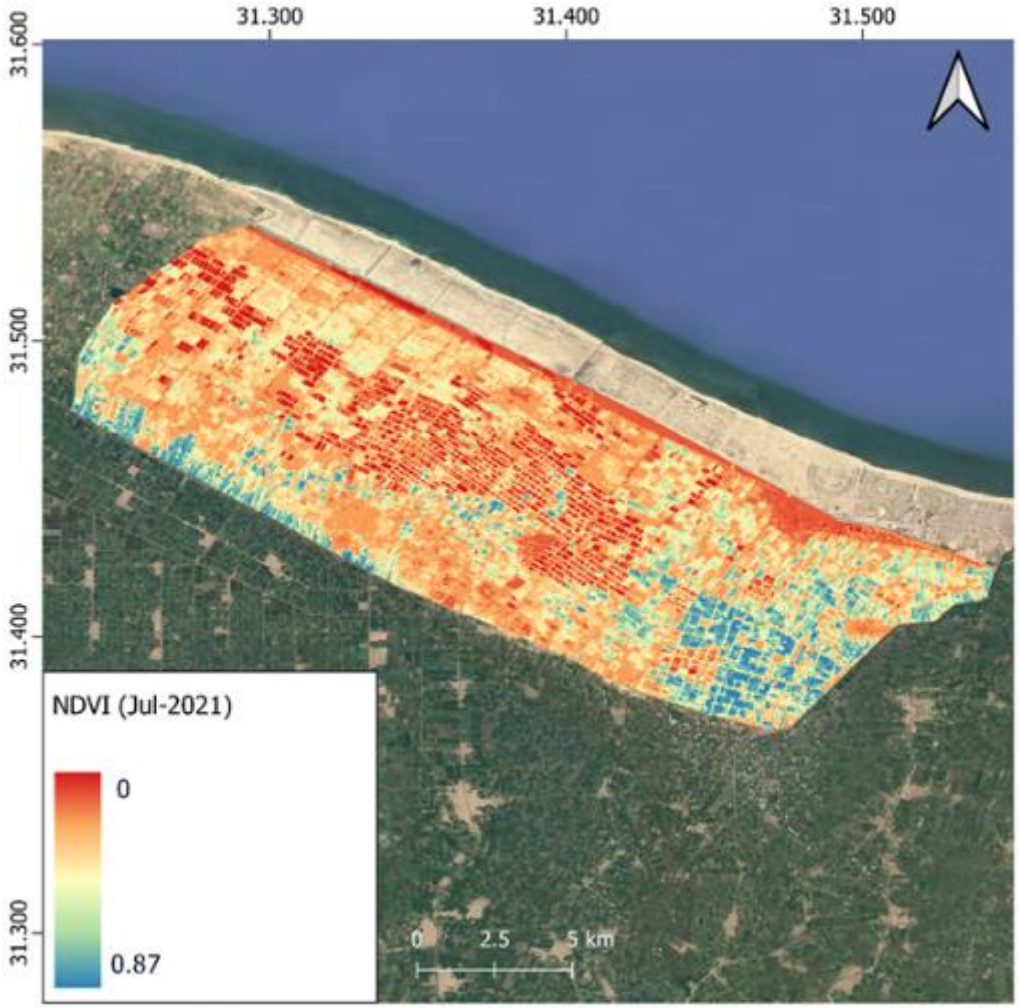


2- Qualabsho Zaian Command Area



Downloaded values for 2021





NDVI values computed from Landsat data for 2021

2 – Qualabsho Zaian

Pros	Cons
One hydraulic unit of ~60,000 fed	Mainly agriculture, some aquaculture, variability of water uses relatively limited
One of the new reclamation areas	Urgent need for solutions to problems (time constraint)
Some branch canals rehabilitated	
Water sources include Nile and drainage water	
Consideration of establishing a station for treatment of drainage water	
Severe water shortage and allocation issues	
Proximity to sea: water logging and soil and water salinization issues	

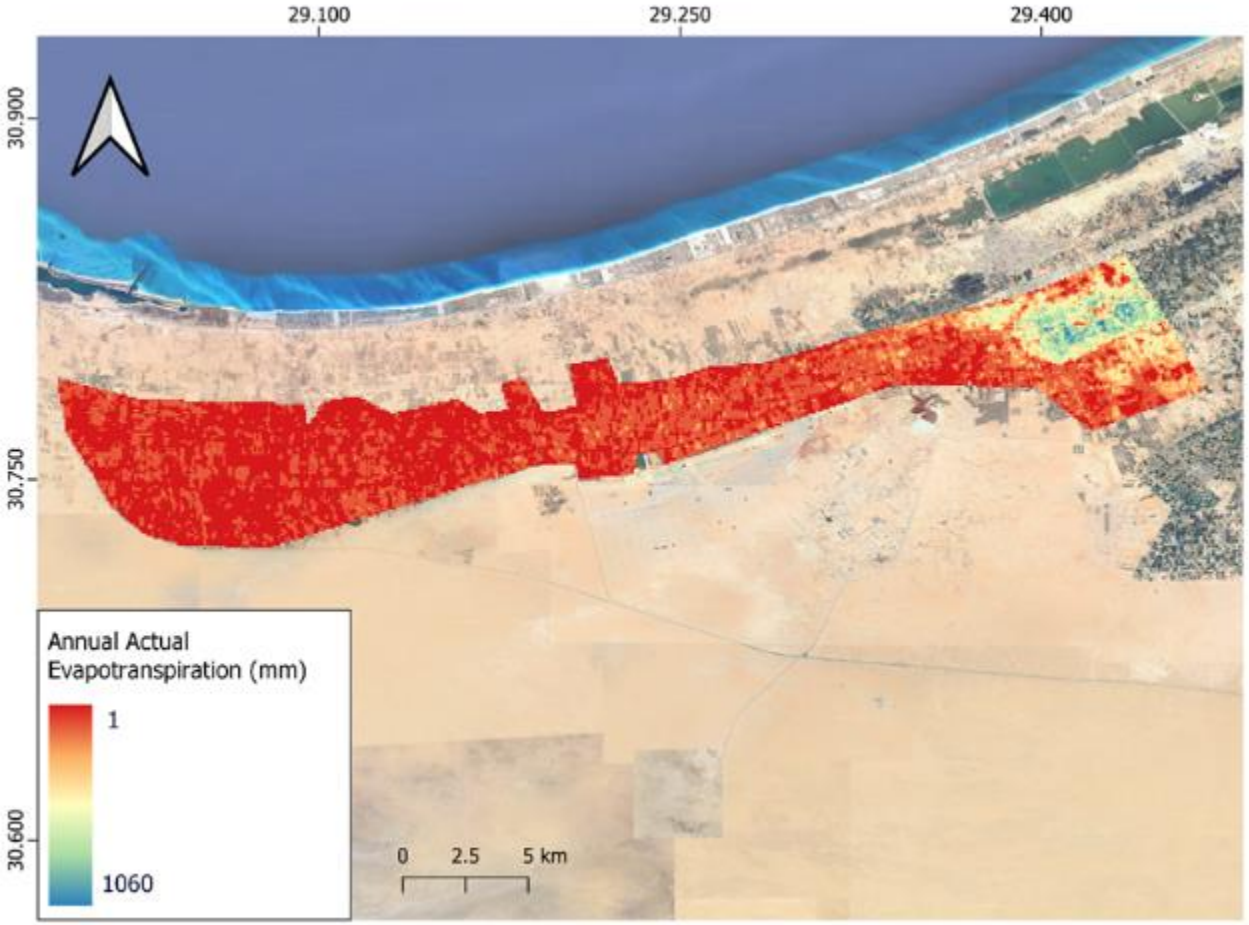
3- El-Hammam Command Area (50,000 feddan)

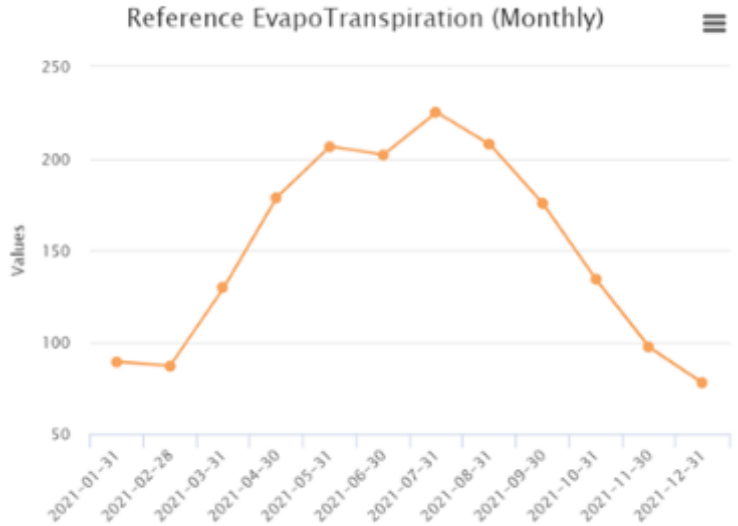
3- El-Hammam Command Area (50,000 feddan)

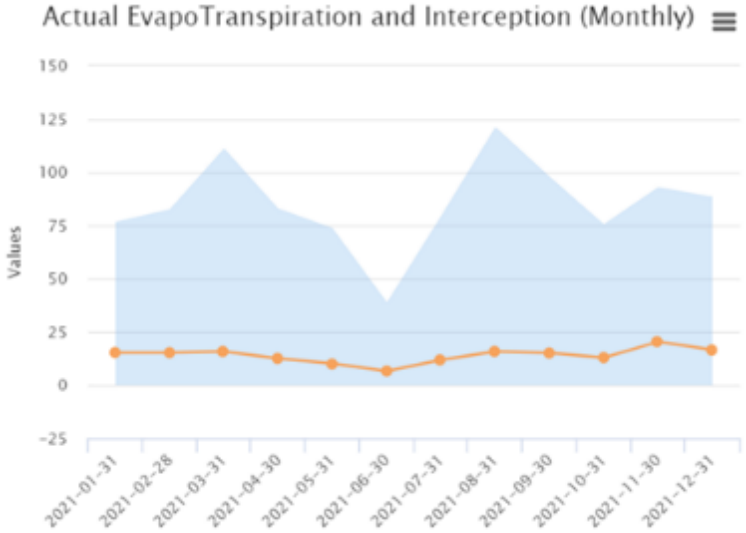
- Canal length about 50 km
- Fed from El-Nasr Canal
- Feeds drinking water station for Alamein
- Feeds irrigation water for North Coast developments

3- El-Hammam Command Area

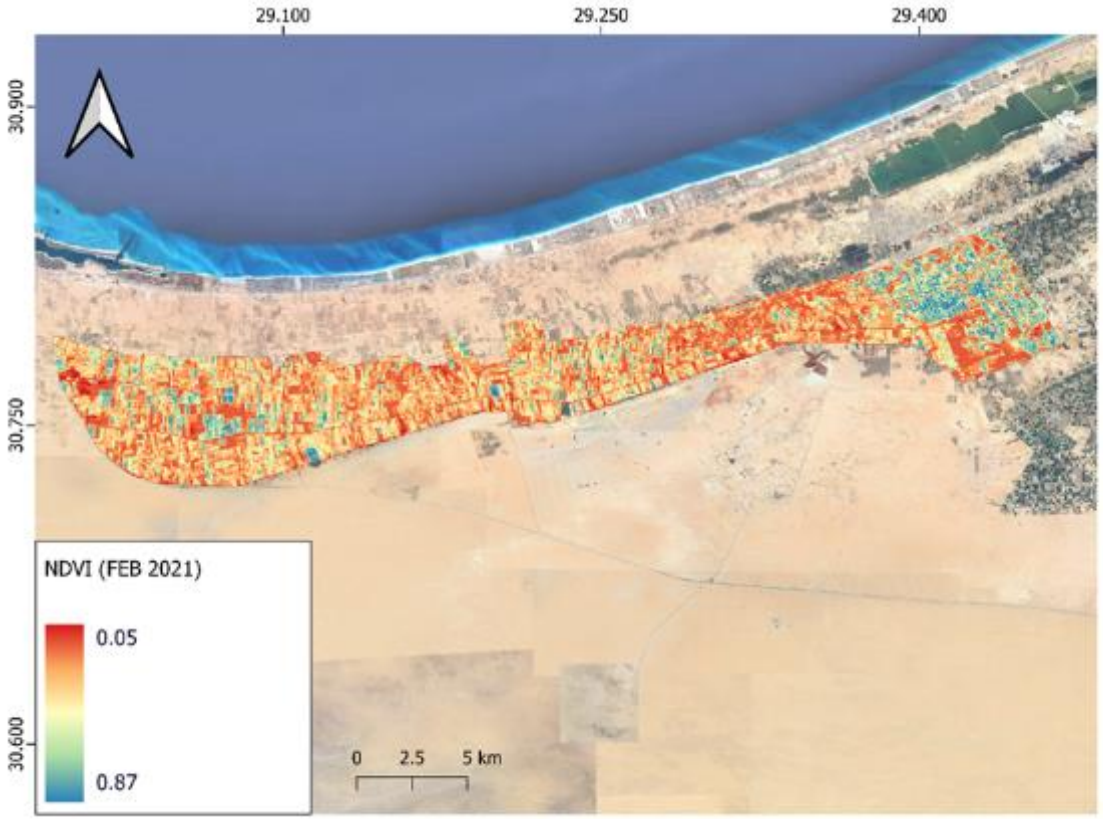
3- El-Hammam Command Area (50,000 feddan)

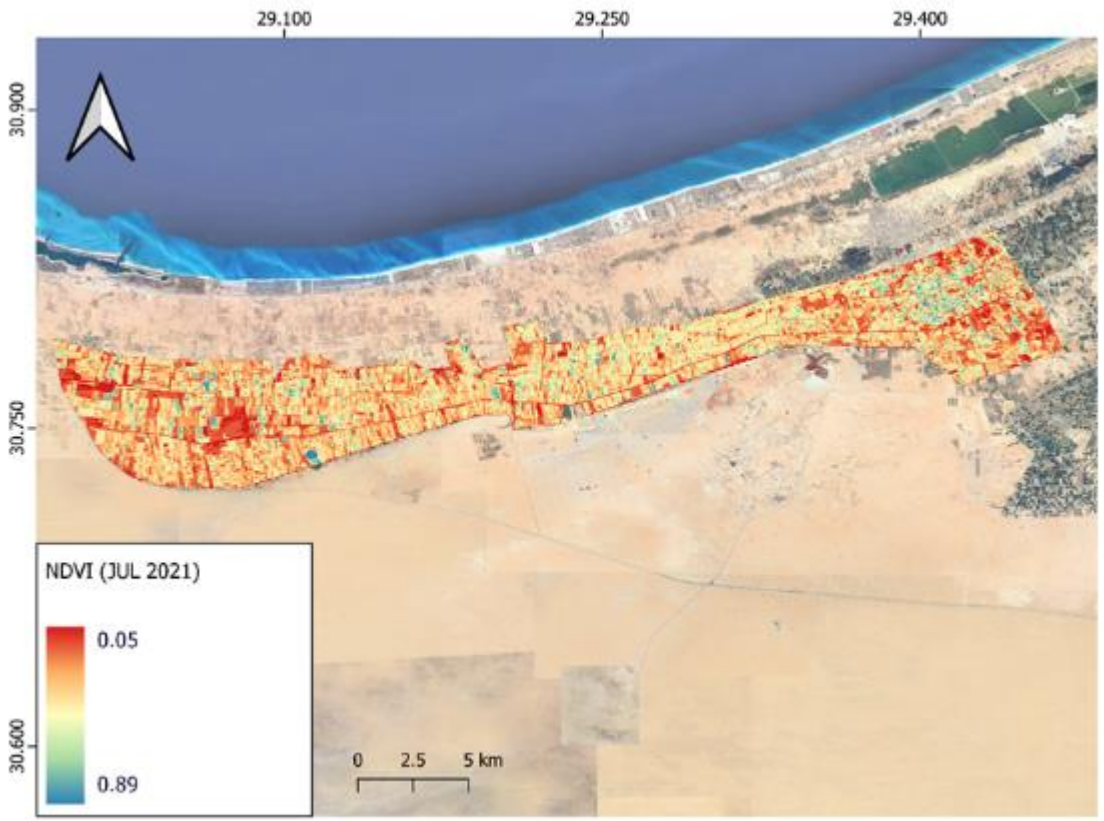






Downloaded values for 2021



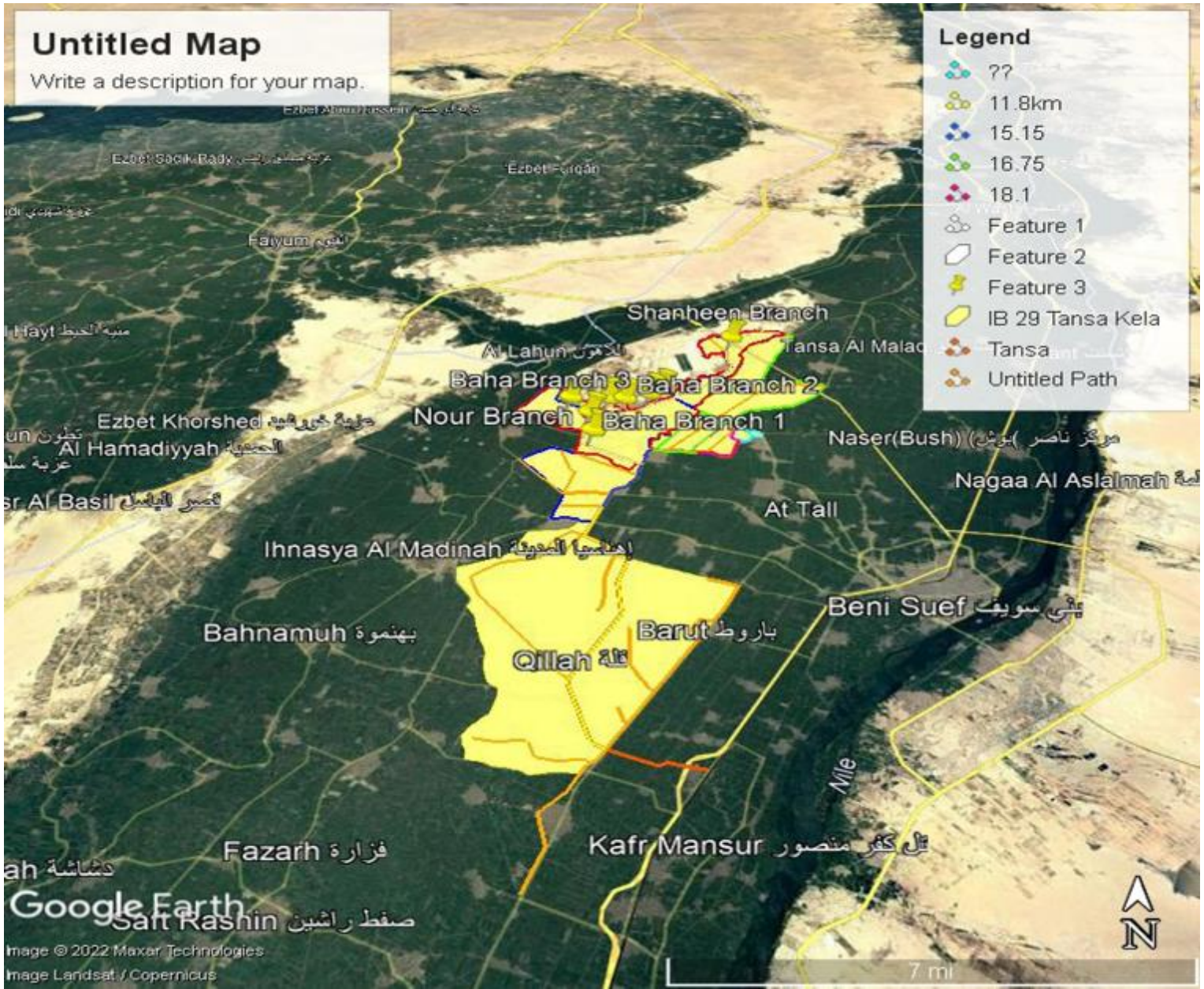


NDVI values computed from Landsat data for 2021

3 – El-Hammam

Pros	Cons
One hydraulic unit of ~50000 fed	Limited variability of water uses
Good data availability due to ongoing and previous projects	Not served by drainage due to dispute with governorate
Some branch canals rehabilitated under previous project	Urgent need for solutions to problems (time constraint)
Water uses include agriculture and drinking water stations	

4- Tansa Quela Command Area (~25,000 feddan)



4- Tansa Quela Command Area (~25,000 feddan)

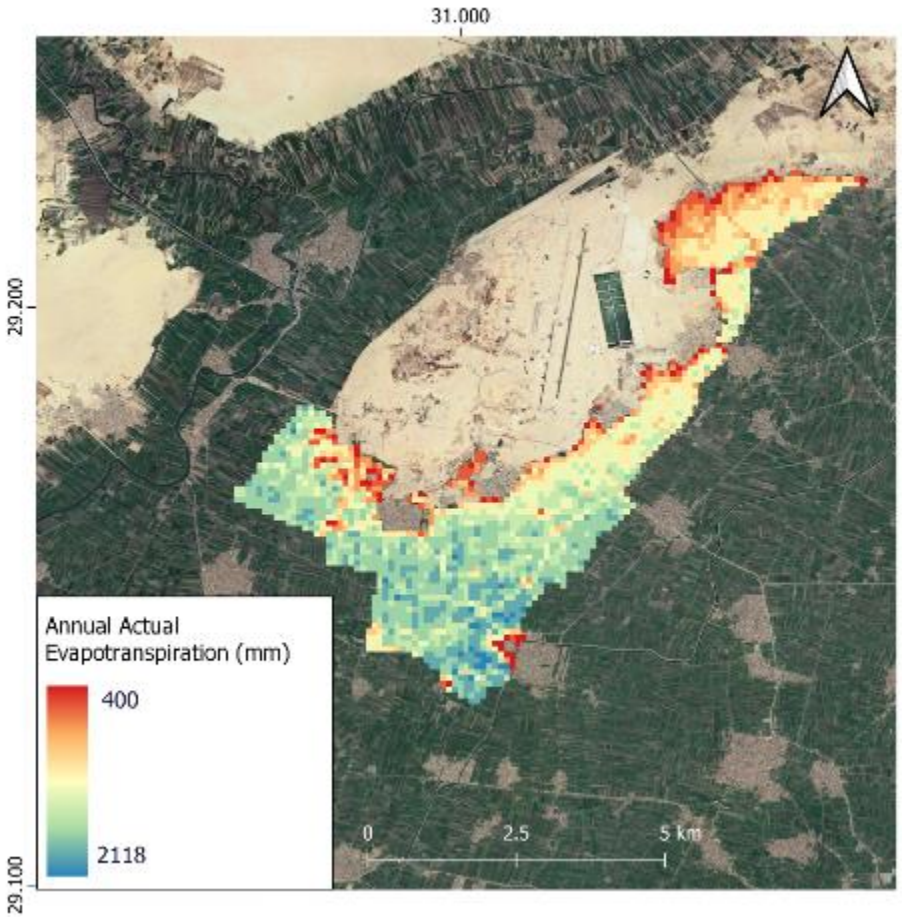
4- Tansa Quella Command Area (~25,000 feddan)

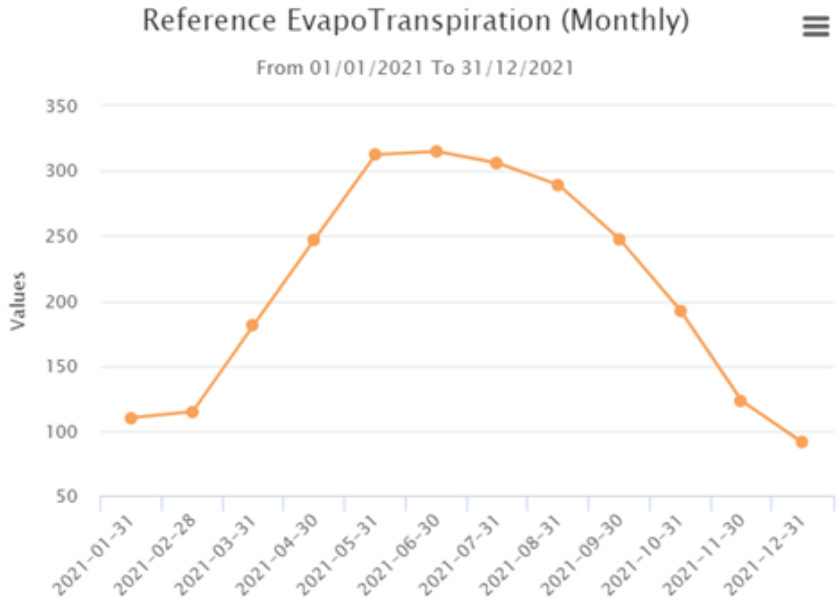
- Located in Bani Suef Governorate
- Fed from Ibrahimia Canal
- Main canal length: Tunsa 2.76km, Quella 20.30 km
- Total length of canals (main, branch and sub-branch) ~ 167 km
- Water supply problems due to degradation of canal cross section
- Deterioration of water control infrastructure
- Divided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

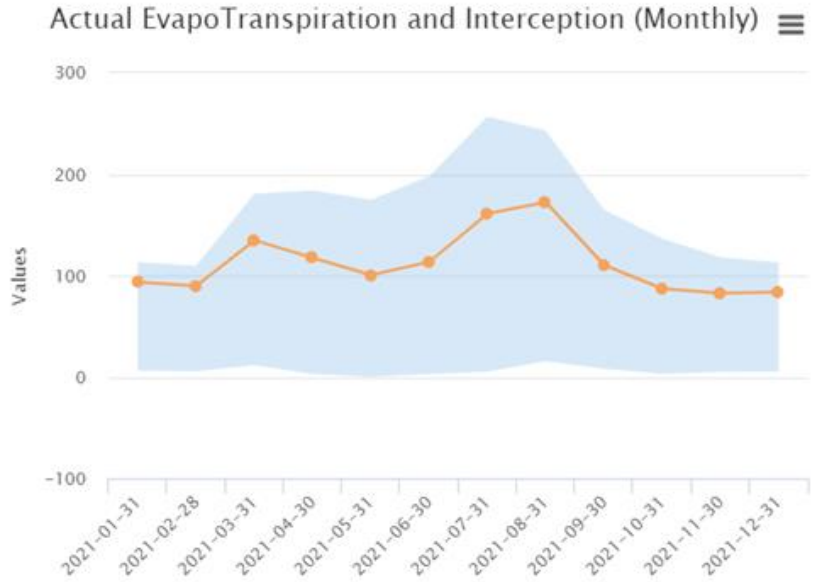
Table 1 General Information of Tunsa-Kella Irrigation System

Item	Description
Location	It is located in Beni Suef Governorate, covering three irrigation districts, namely: Ahnasiya, West and East Beni Suef
Source of water	Ibrahimia Canal Flow level is controlled by a small weir set at about 30m from the intake on Tunsa canal
Total length of main canal	Tunsa = 2.76 km Kella = 20.30 km
Total Command Area	The total command area irrigated in this unit is about 24,920 feddan including Meska from main canal
Major Structures	4 Regulator (Kella, Towa, Baha, Dandeel) 5 Intake (North Amar, South Amar, Towa, Baha and Dandeel) 6 Pump Station (Baroot, El Hagry, Kella, Baha, Dandel, Abshna)
Major branch canal	4 major branch (North Amar, Towa, Baha and Dandeel)
Minor branch canal	10 on the main canal 44 on branch and sub branch canal
Total canal length in the system	About 167.00 km (23 km Main Canal + 144 km branch and sub branch canals)

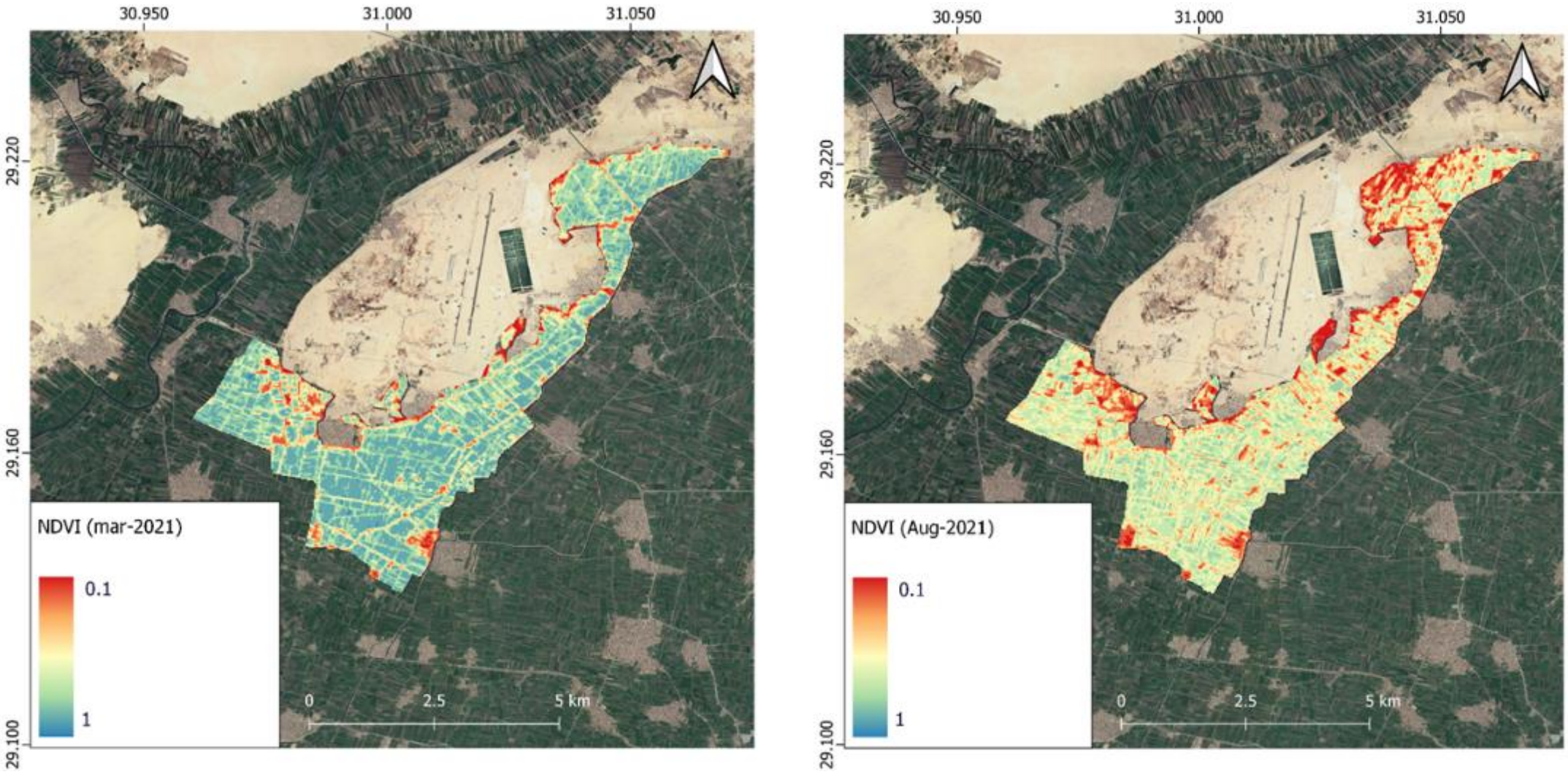
3- El-Hammam Command Area (50,000 feddan)







Downloaded values for 2021



NDVI values computed from Landsat data for 2021

4 – Tansa-Quela

Pros	Cons
One hydraulic unit of ~25,000 fed	Relatively small area
Good data availability due to ongoing and previous projects	Shortage of water in the end of canal and its branches
Some branch canals rehabilitated under previous project	Variability of water uses relatively limited
7 drainage water reuse stations	Intersects with 3 irrigation districts
Water uses include agriculture and drinking water stations	
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