

Technology transfer for water resources management

**Nicola Lamaddalena - Deputy Director
CIHEAM Bari**



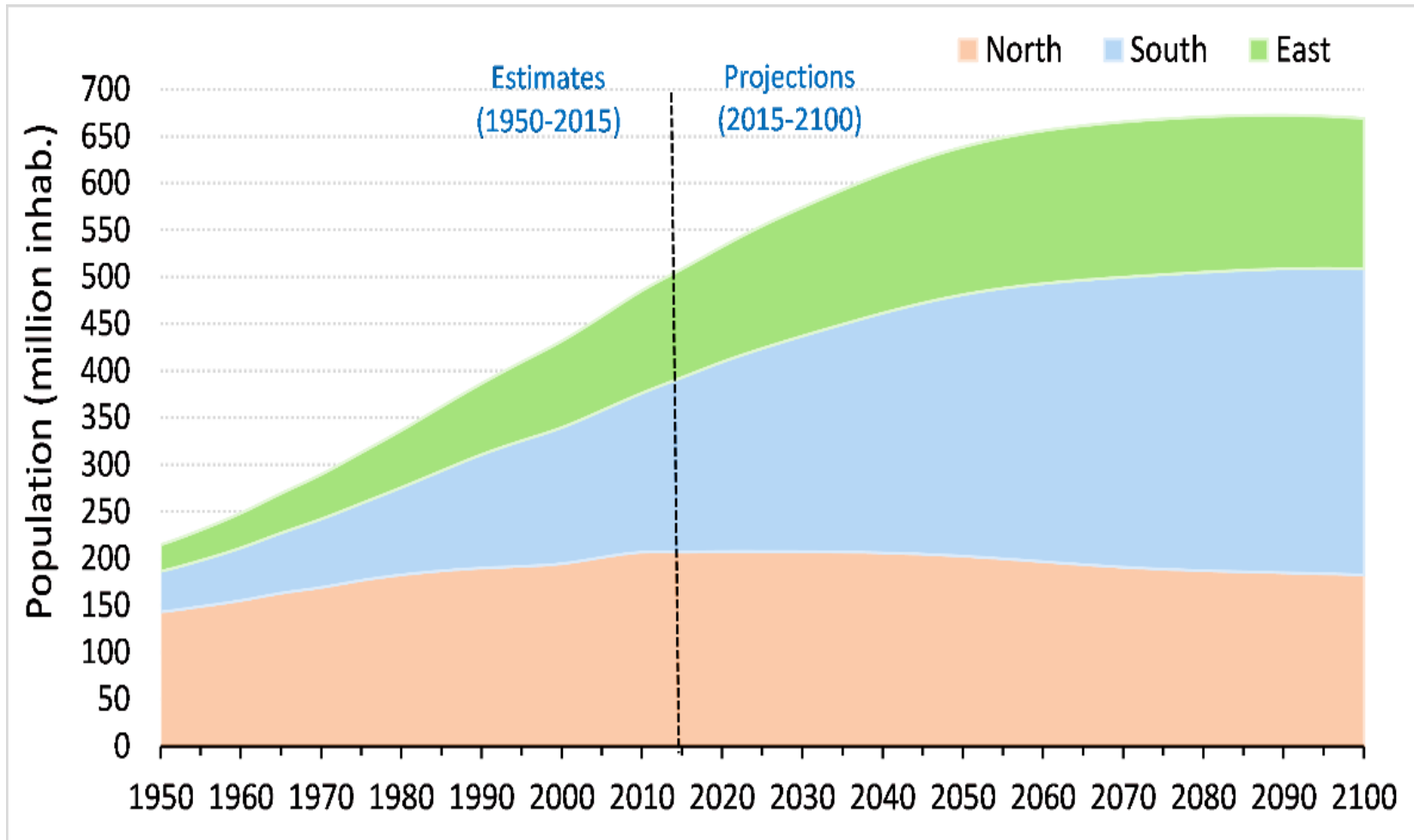
**SKIM Project
Bari, 21 September 2021**

A satellite image of the Earth showing the Mediterranean Basin. The image is split horizontally. The top half shows a wide view of the Earth's curvature with the Arctic region visible. The bottom half is a closer view of the Mediterranean Basin, showing the Mediterranean Sea, the Black Sea, and the surrounding landmasses of Europe, North Africa, and Asia. The text "THE MEDITERRANEAN BASIN" is overlaid in white capital letters on a dark blue background that spans the width of the image.

THE MEDITERRANEAN BASIN

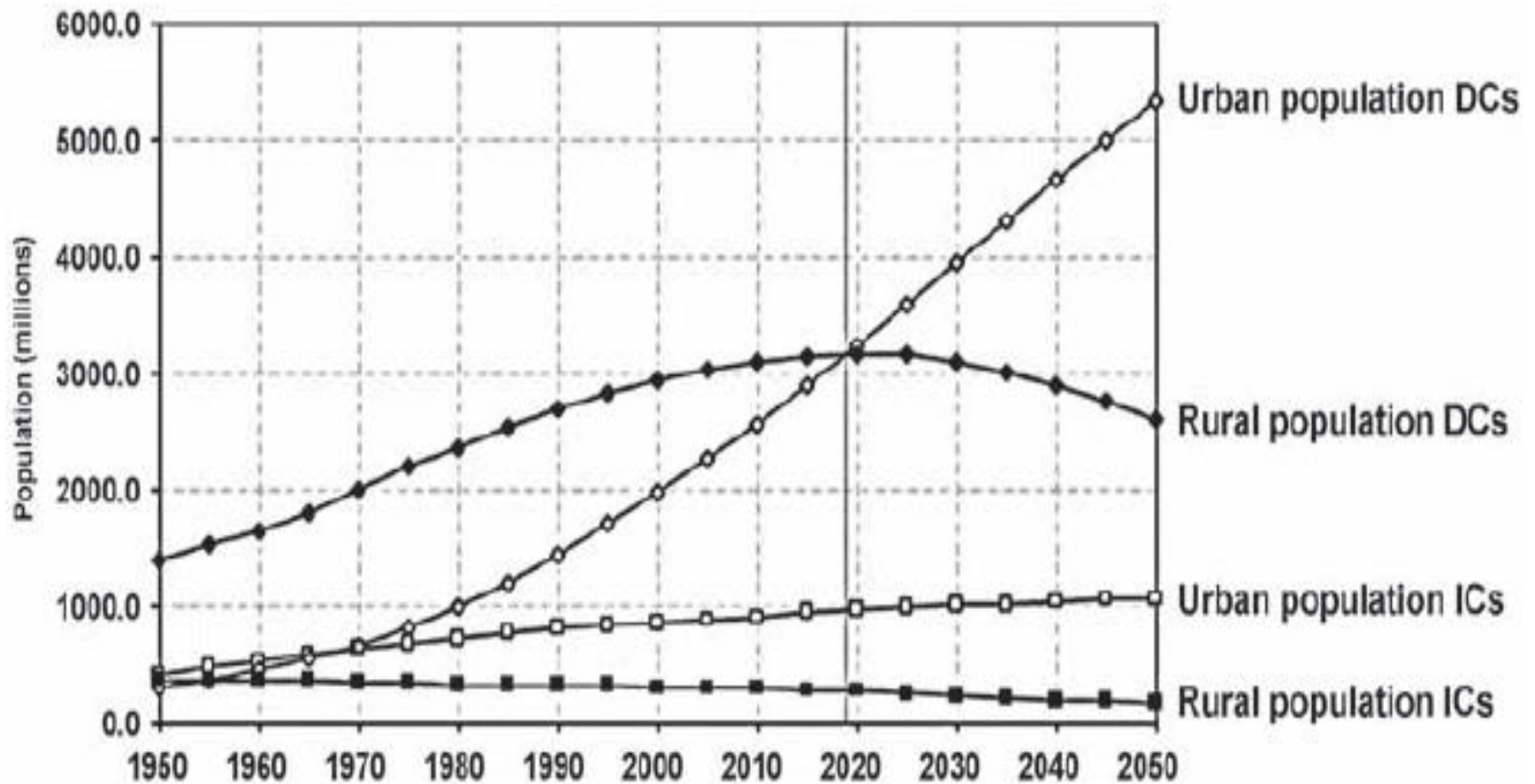


Population of the Mediterranean (North, South and East)



Source: data extracted from the United Nations, 2017

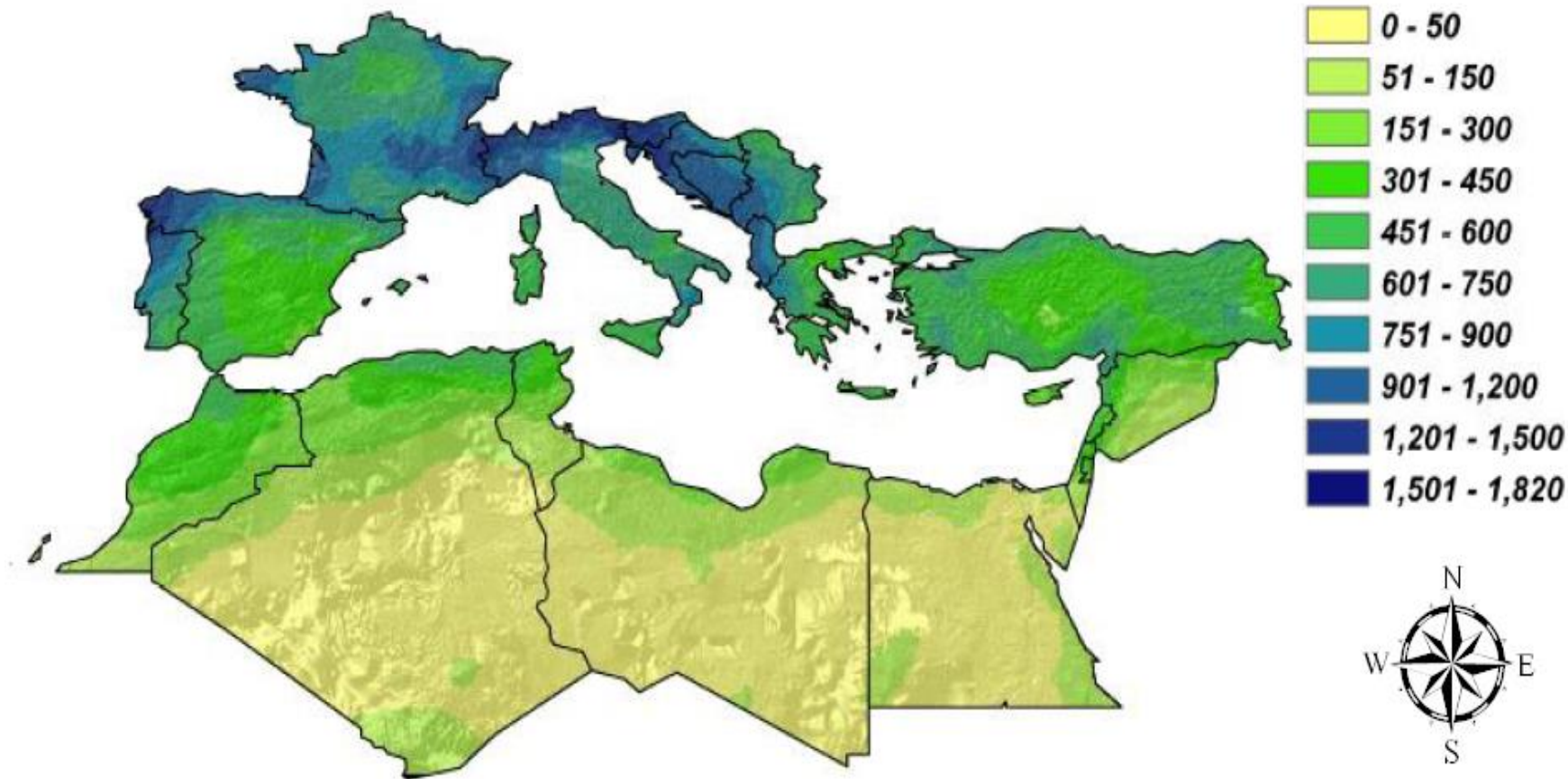
Demographic trends alone suggest that water recycling could become a critical components of water supply globally in the 21st century





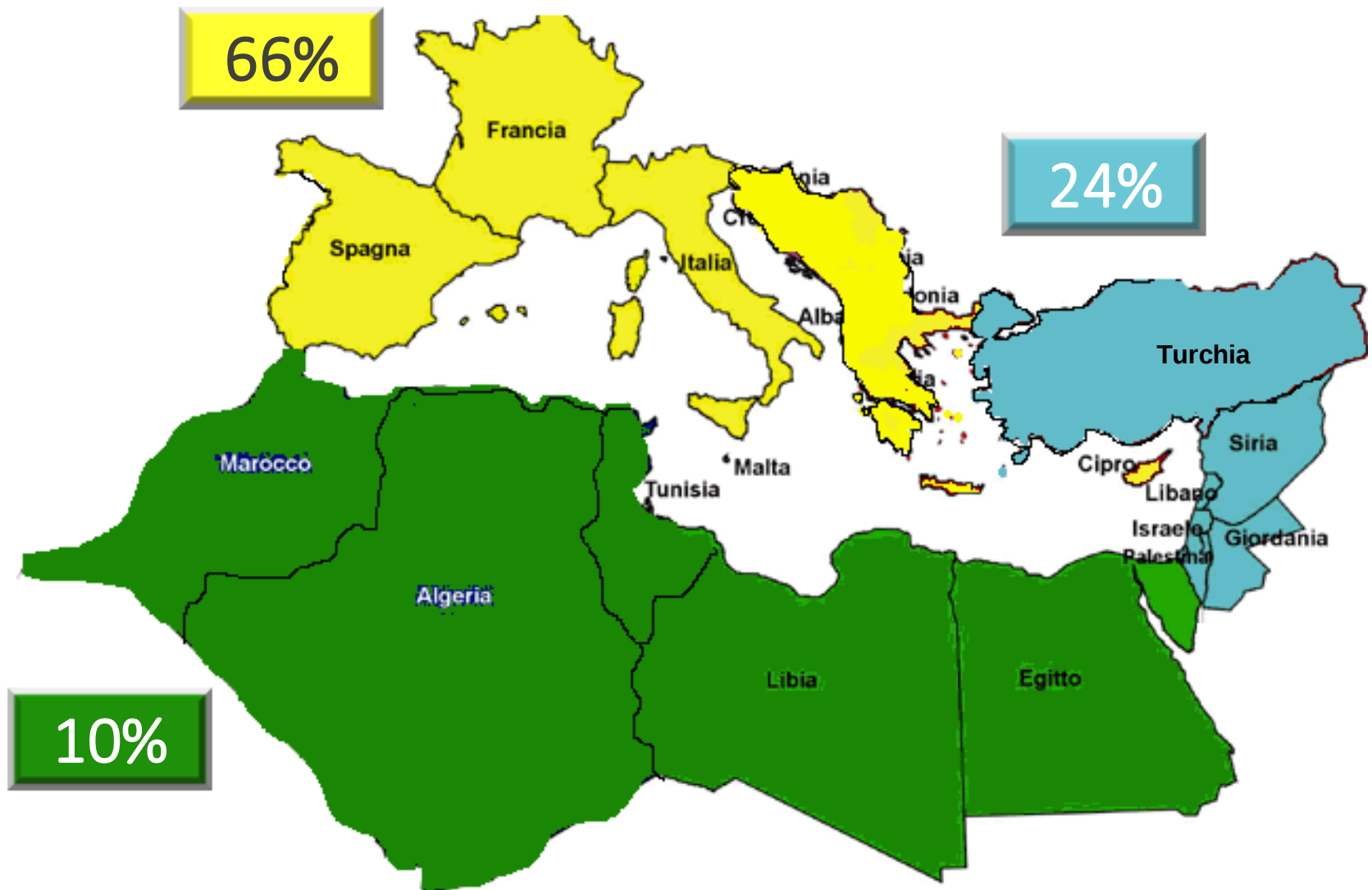
YEARLY AVERAGE RAINFALL

mm/year



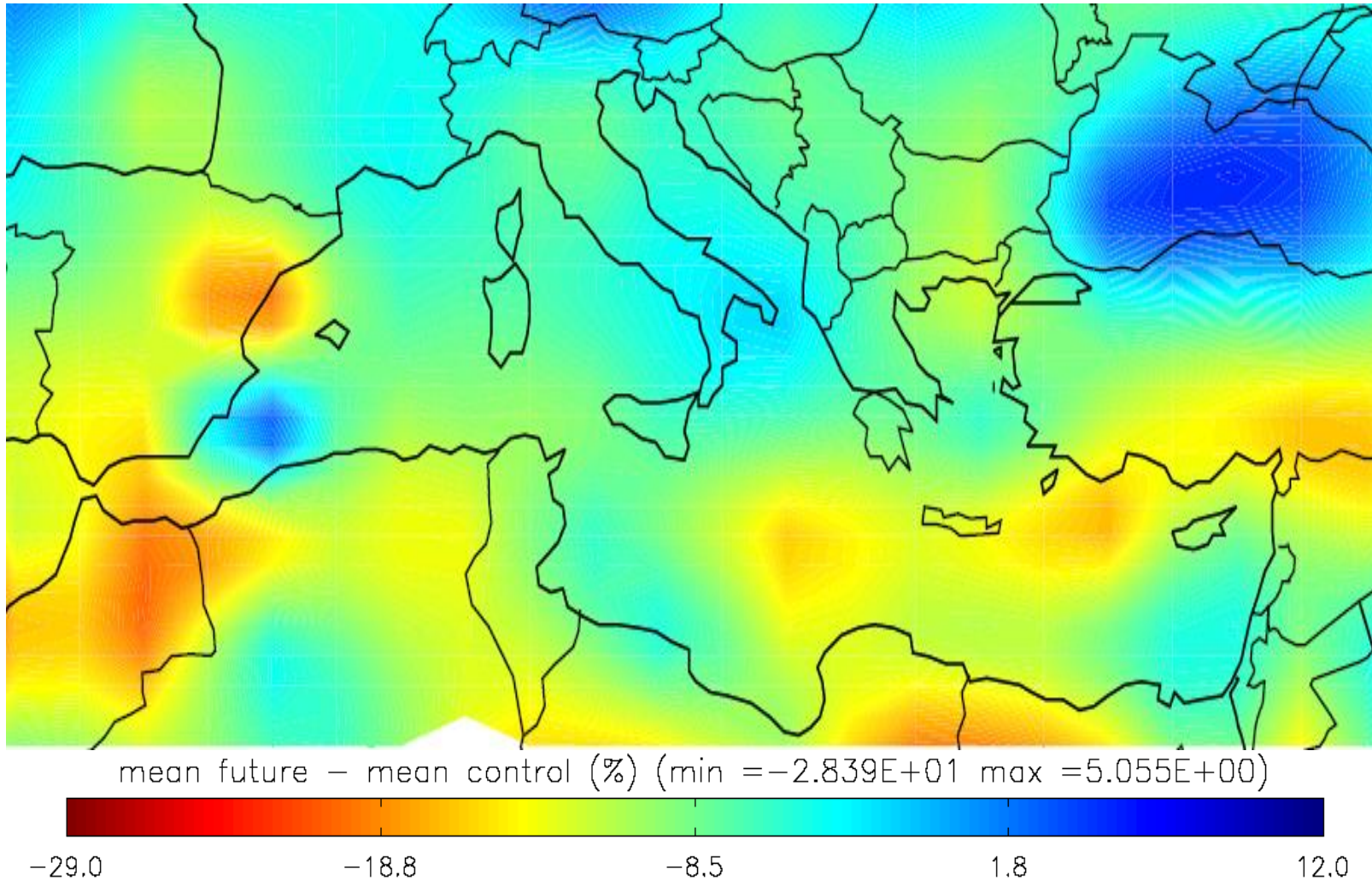


DISTRIBUTION OF WATER RESOURCES IN THE MEDITERRANEAN REGION

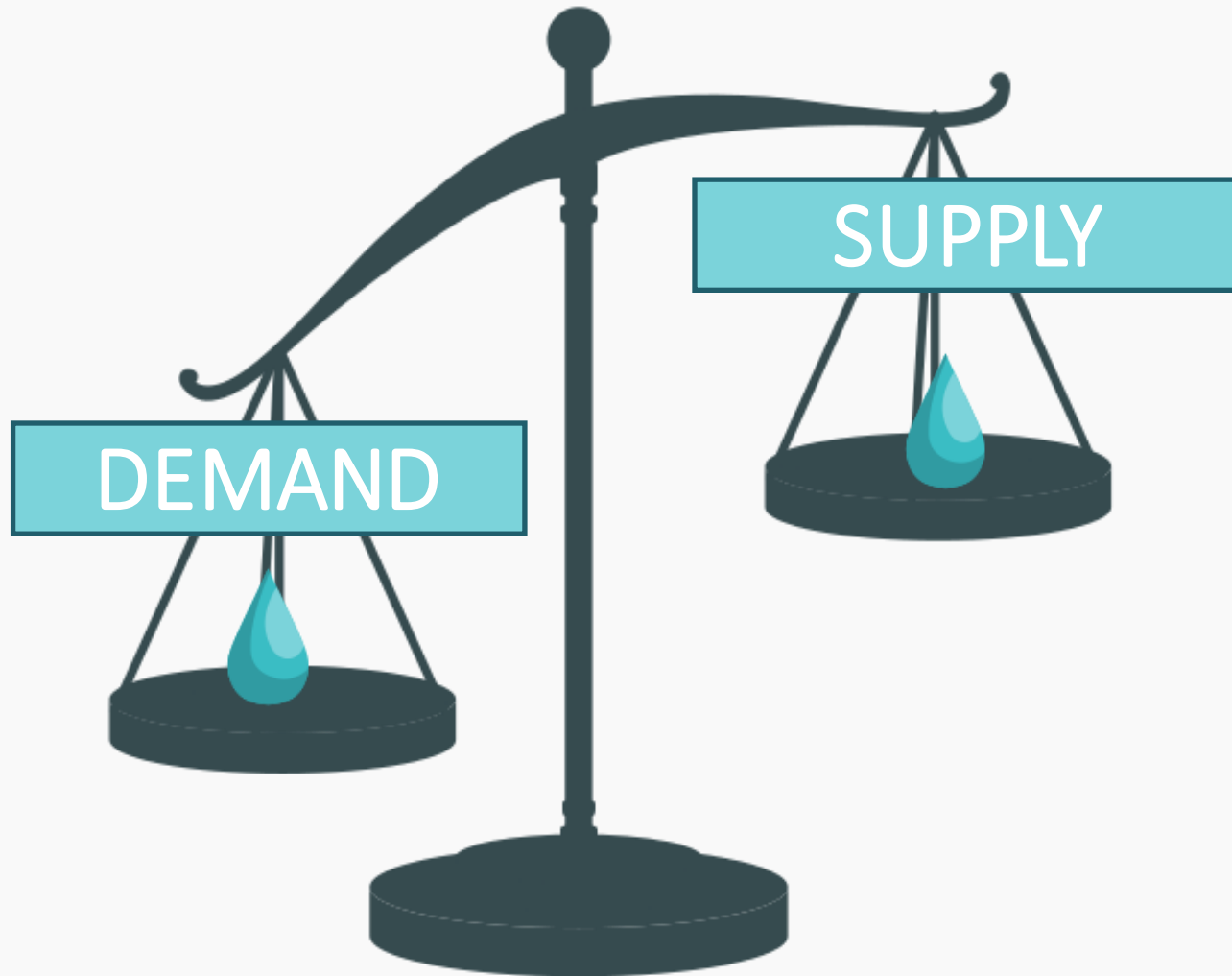




Variation of annual average precipitation in the next sixty years (A2 scenario)

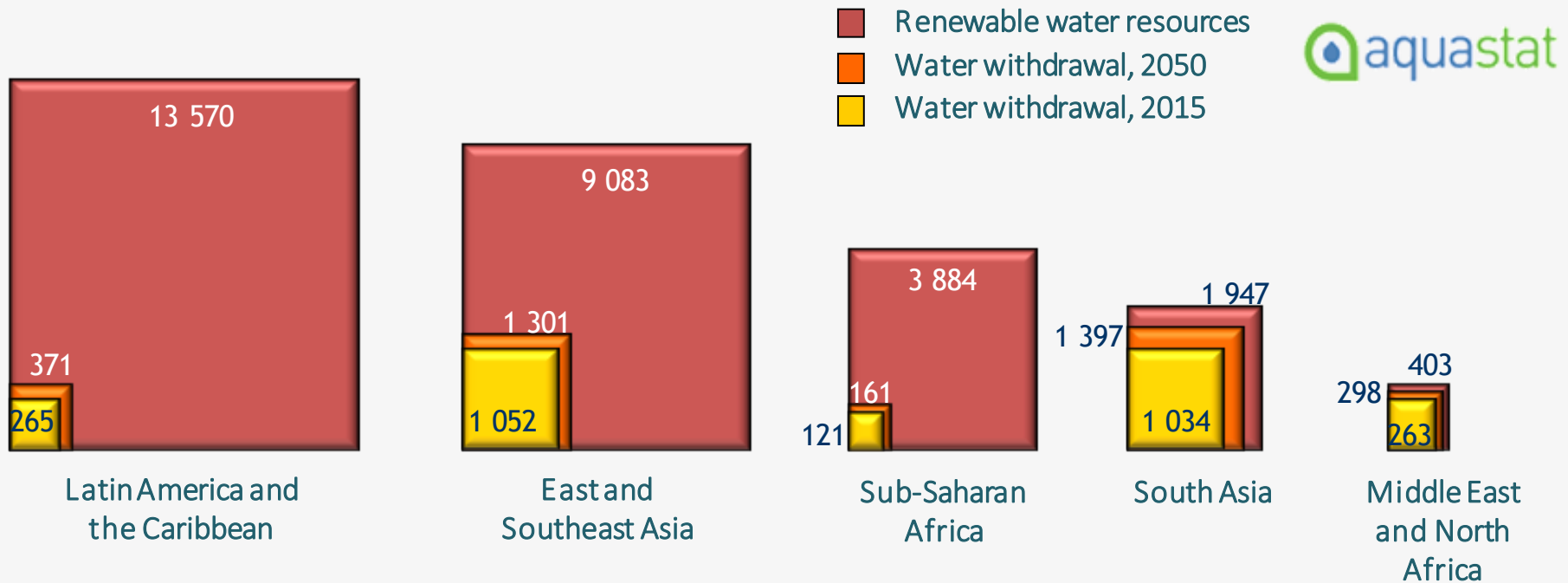


THE CHALLENGE



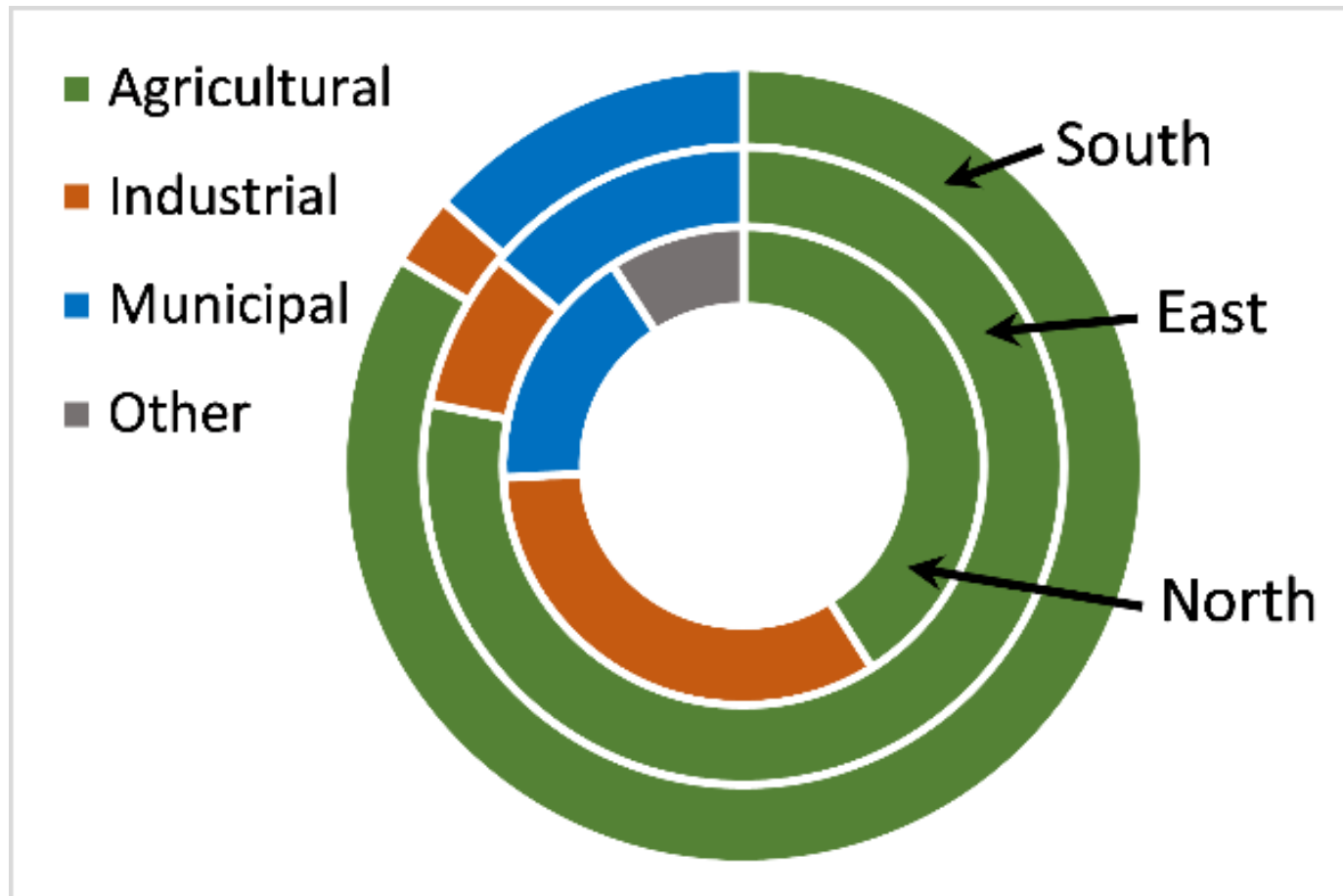


Freshwater resources: current (2015) and predicted (2050) water withdrawal (km³)





Water Withdrawals by sector

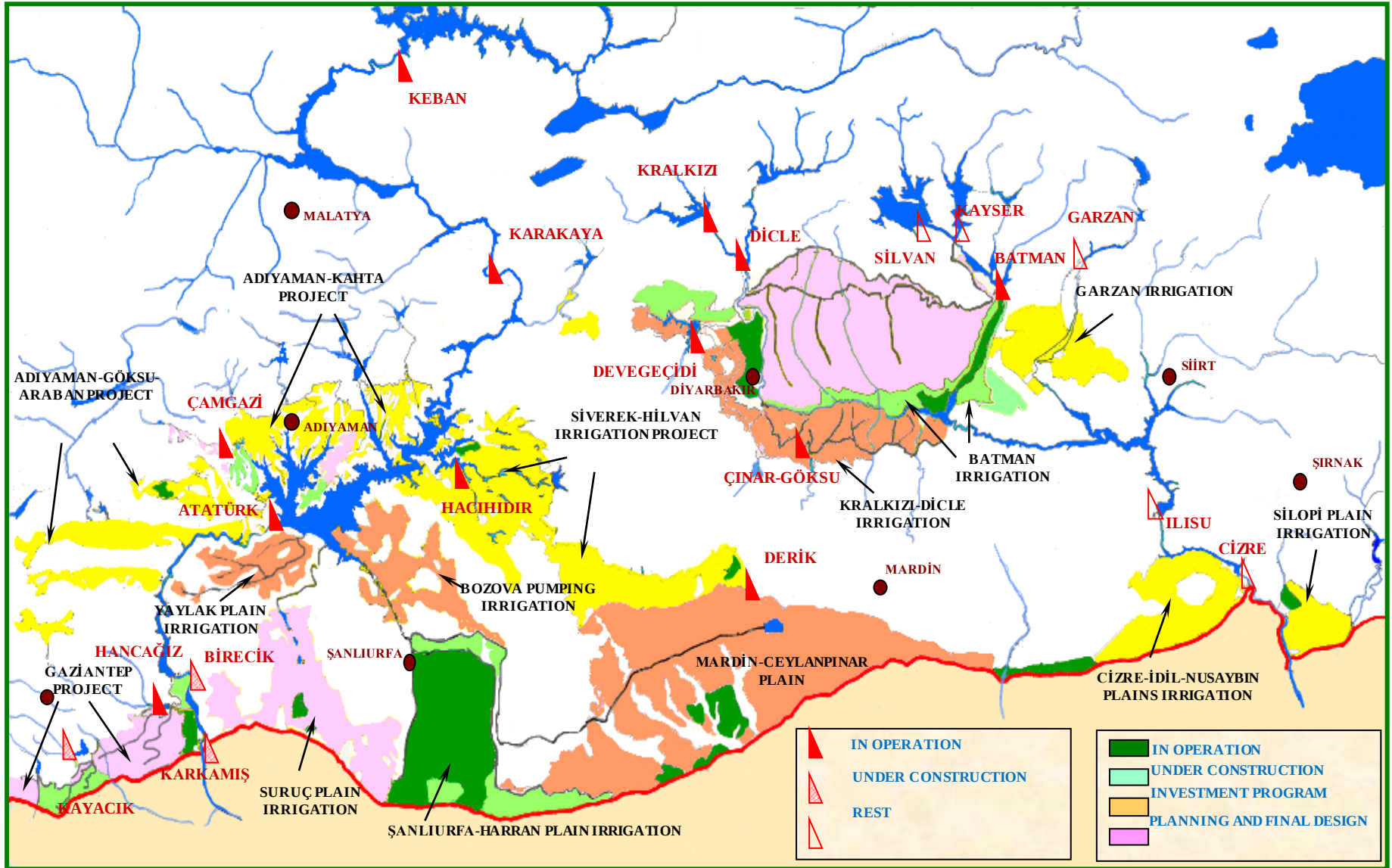


Source: data extracted from Aquastat database. FAO, 2016



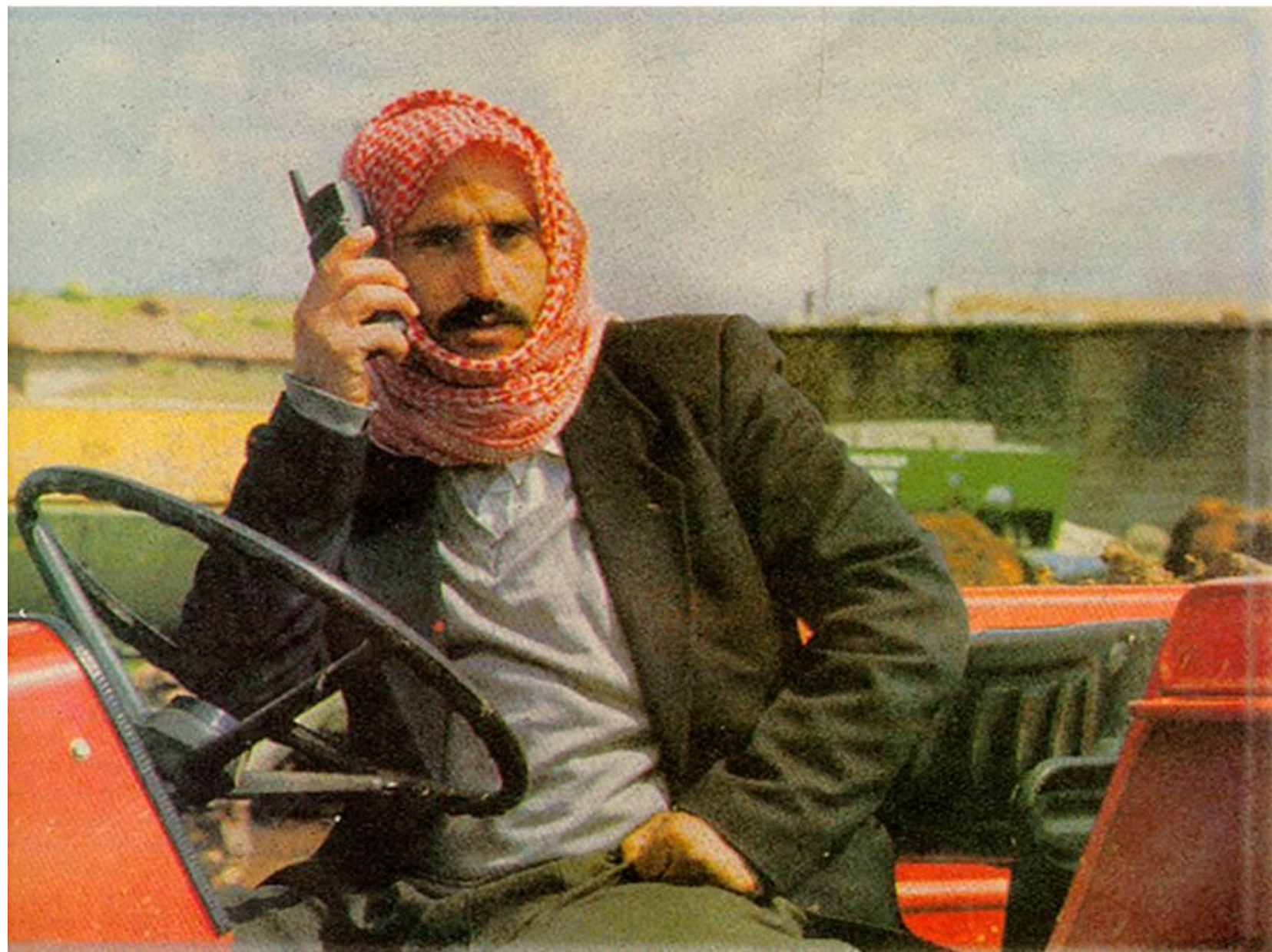
In the past years the policy choices privileged the big hydraulic infrastructures in irrigation giving priorities to the quantitative aspect rather than the qualitative (Supply Management).

GAP PROGRAM









Kabur river - 1975



Kabur river - 2006



Kebrit spring - 1999



Kebrit Spring - 2005



Kebrit spring - 2006



Kebrit spring - 2007











CALIBRATED NOZZLE FOR EGYPT



Pressure (Bars)	Discharge (L/s)
0.15	0.75
0.2	0.8
0.4	0.84
0.5	0.89



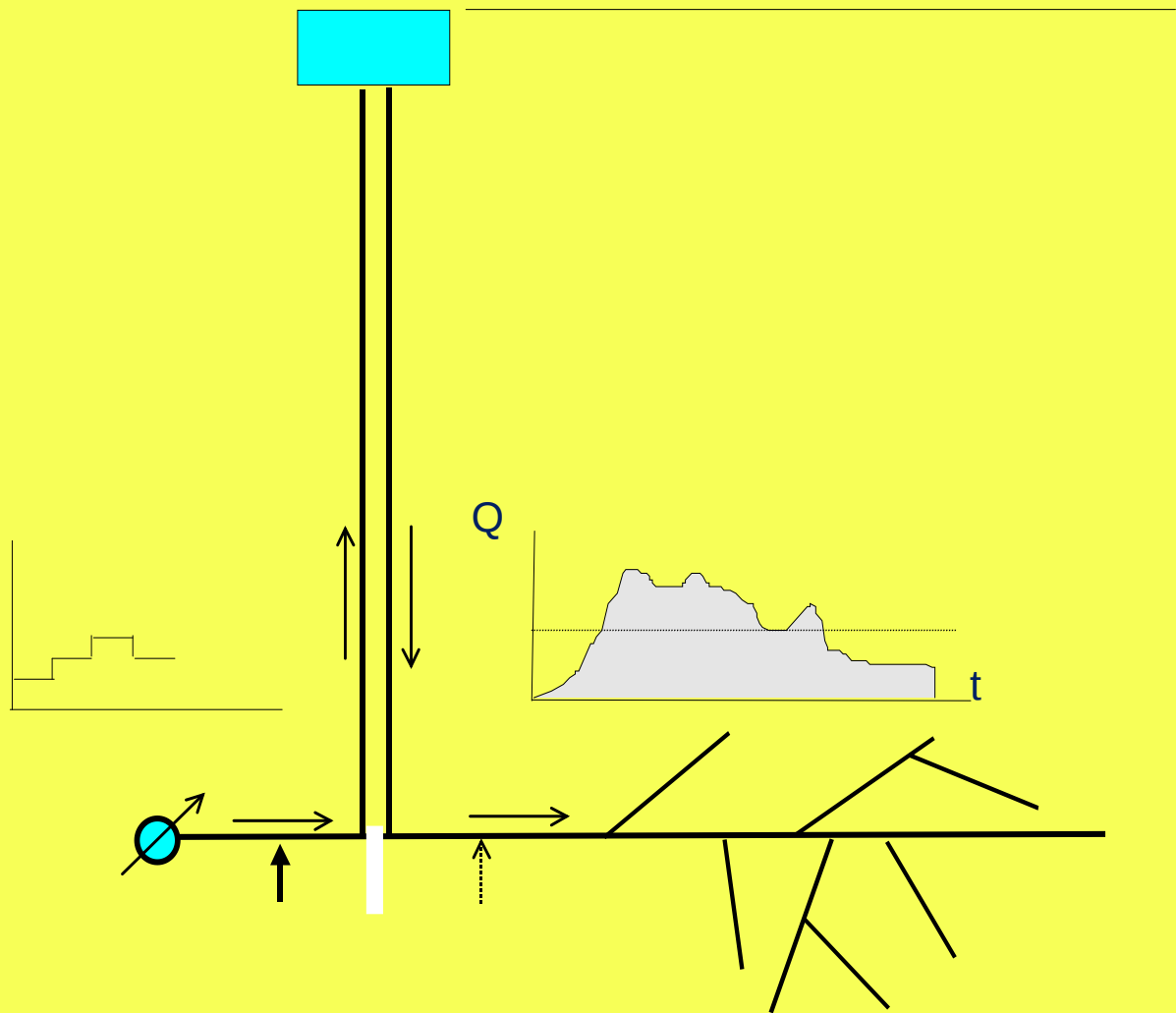
HIGHER DISTRIBUTION UNIFORMITY WITH LESS WATER VOLUME

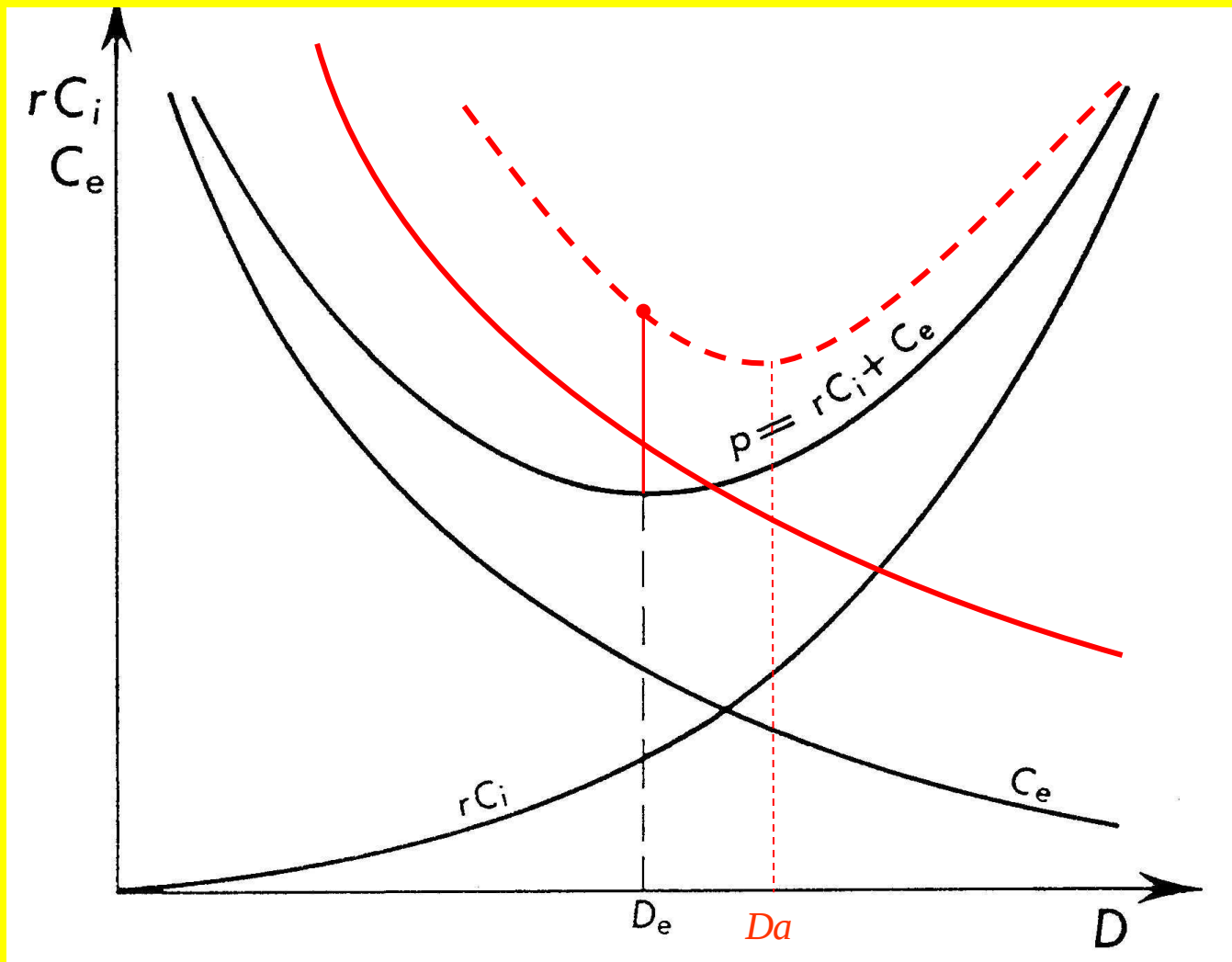


MOROCCO

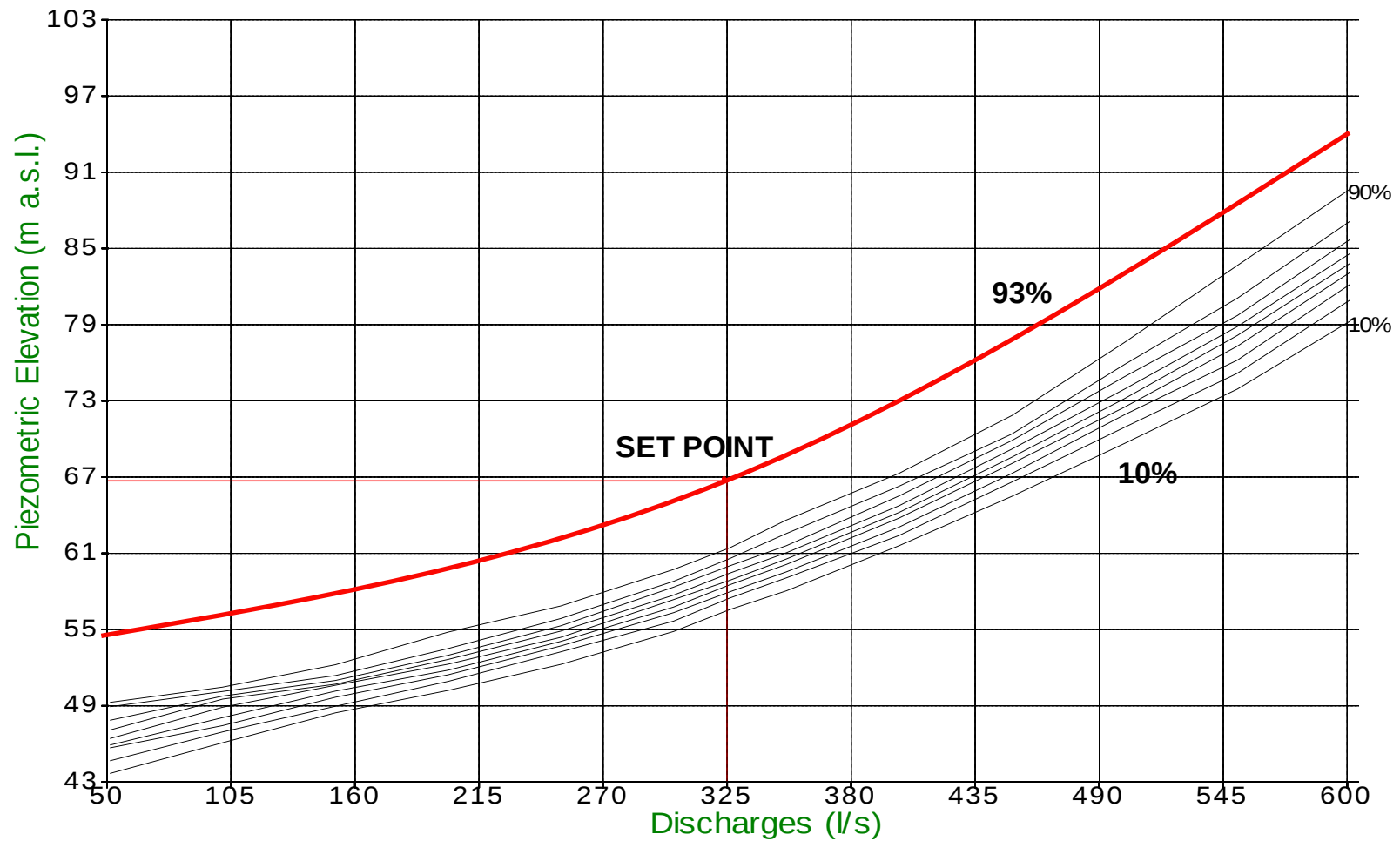


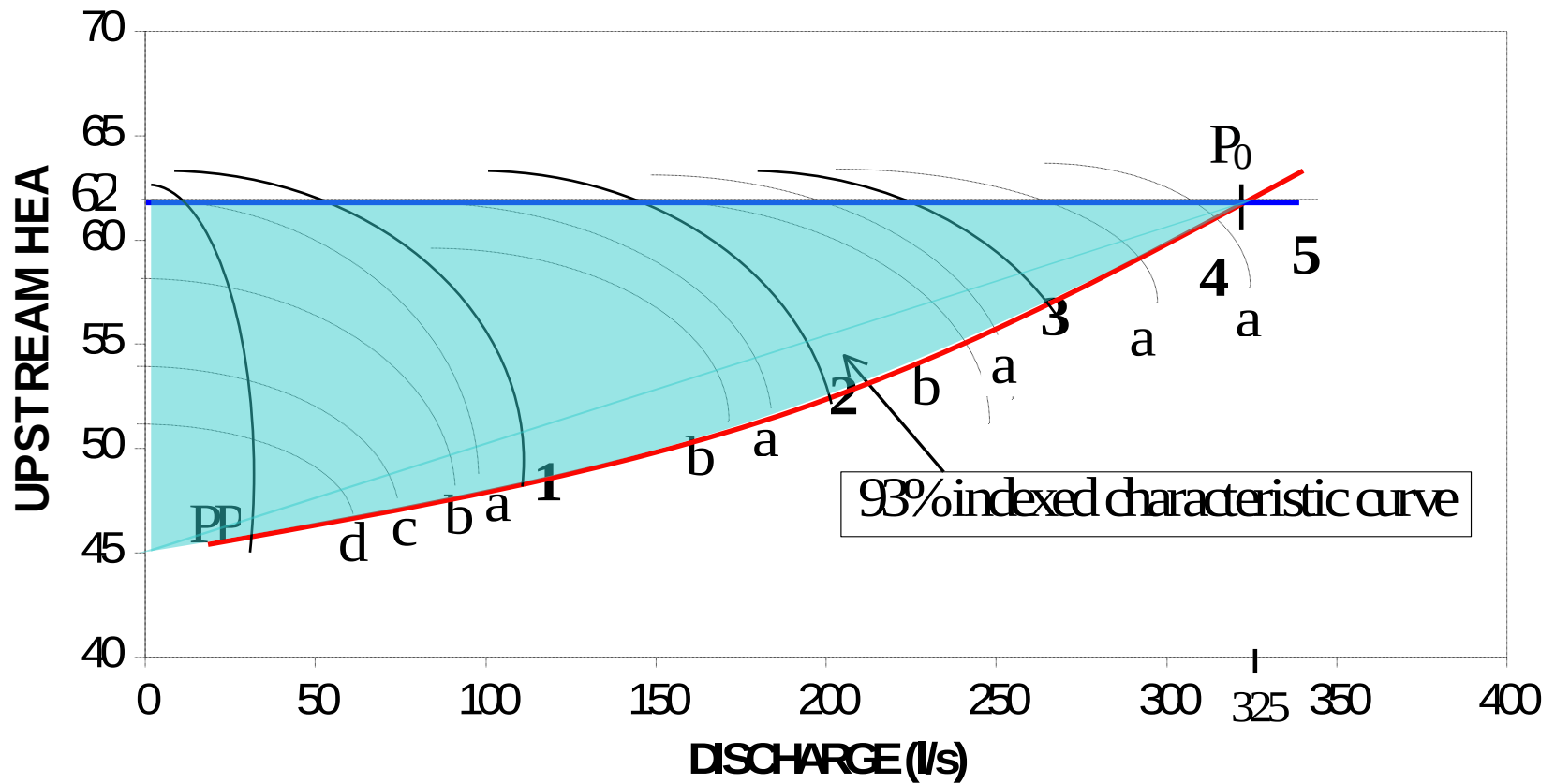






Configuration Analysis





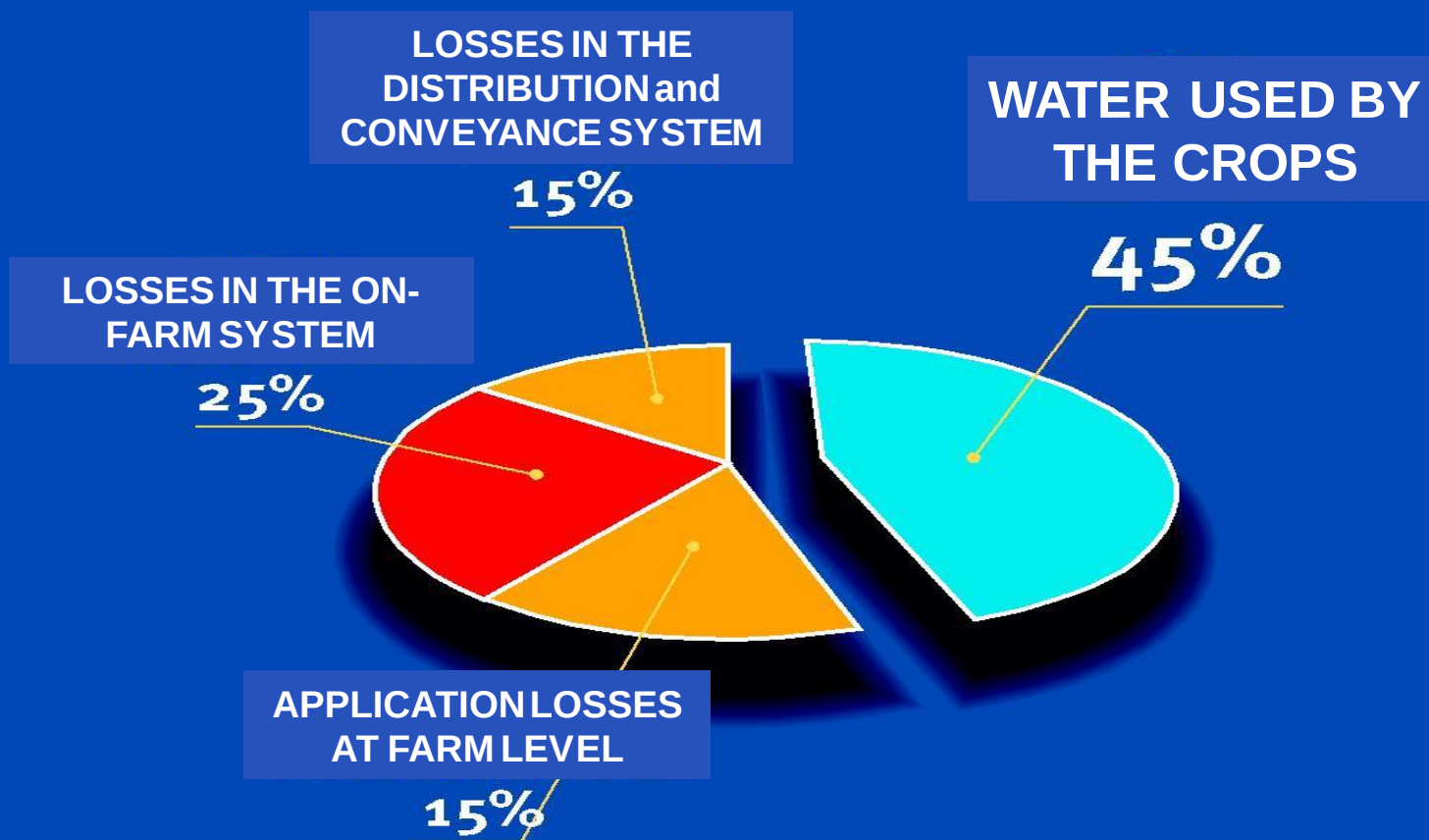


The current policy choices highlighted the importance of Operation, Maintenance and Management activities (DEMAND MANAGEMENT)

- **TECHNICAL APPROACHES** (improving WUE at the whole chain of the system, use of unconventional waters, use of new technologies,)
- **INSTITUTIONAL APPROACHES** (PIM, Capacity Development,...)

TECHNICAL APPROACHES

WATER LOSSES IN IRRIGATION IN THE MEDITERRANEAN BASIN (%)



ELABORATION: CIHEAM/IAMB

SOURCE:
FAO, 1994



**Storage
Efficiency**

**Conveyance
Efficiency**

**Farm
Efficiency**

**Application
Efficiency**

$$\frac{W_{\text{reservoir out}}}{W_{\text{reservoir in}}} \times \frac{W_{\text{farm gate}}}{W_{\text{reservoir out}}} \times \frac{W_{\text{field}}}{W_{\text{farm gate}}} \times \frac{W_{\text{root zone}}}{W_{\text{field}}} = \frac{W_{\text{root zone}}}{W_{\text{reservoir in}}}$$



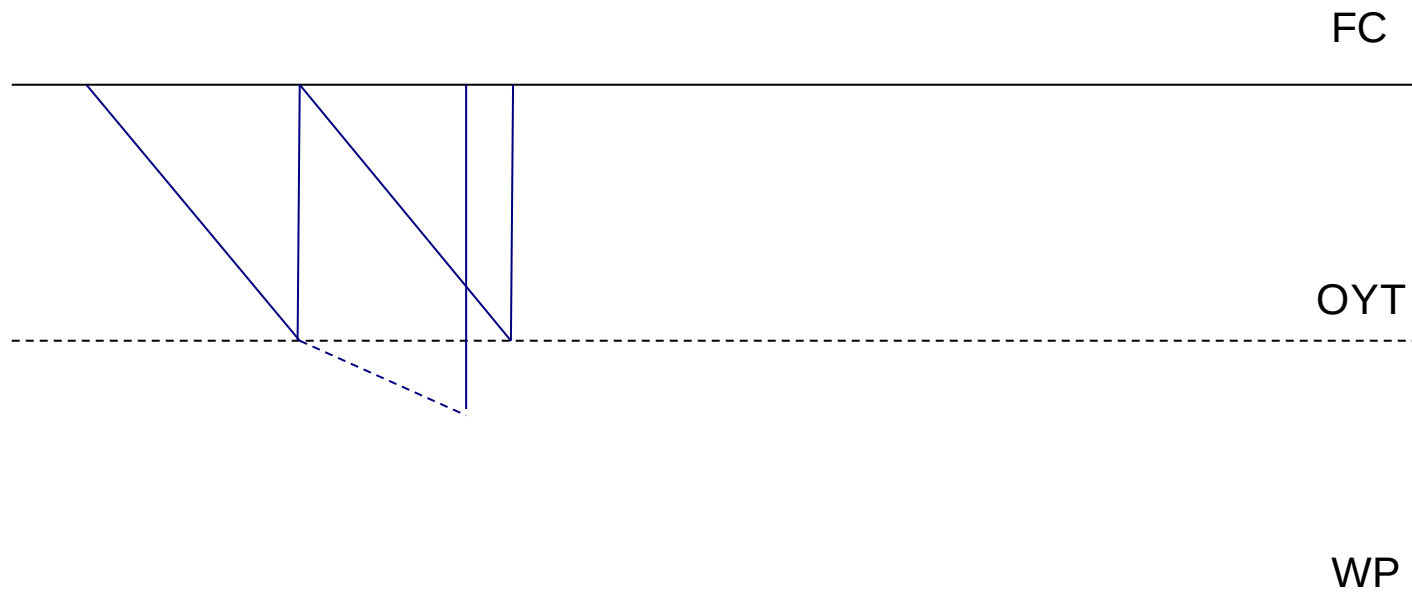




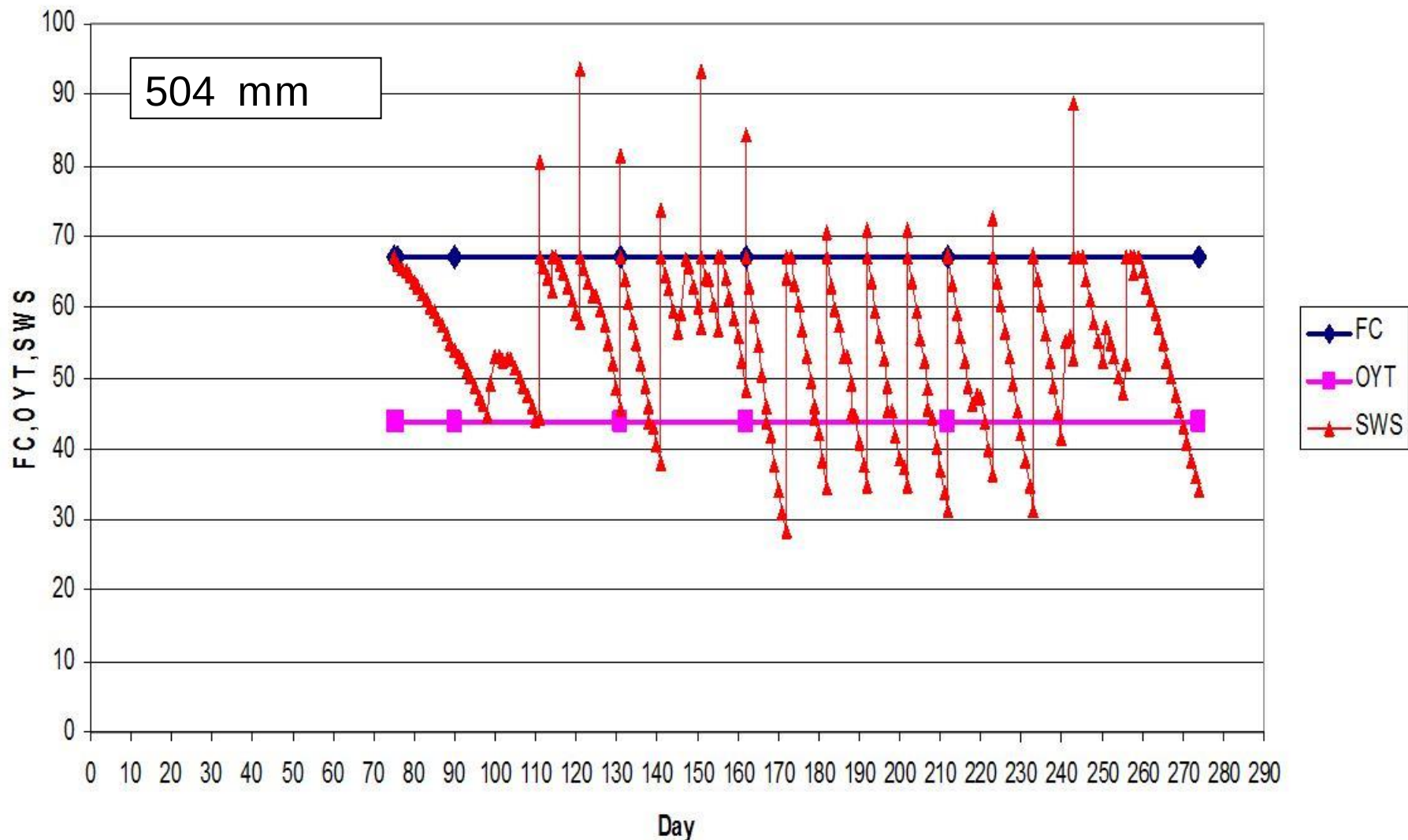


**TO PREFER THE ON DEMAND
DELIVERY SCHEDULE RATHER
THAN THE ROTATION**

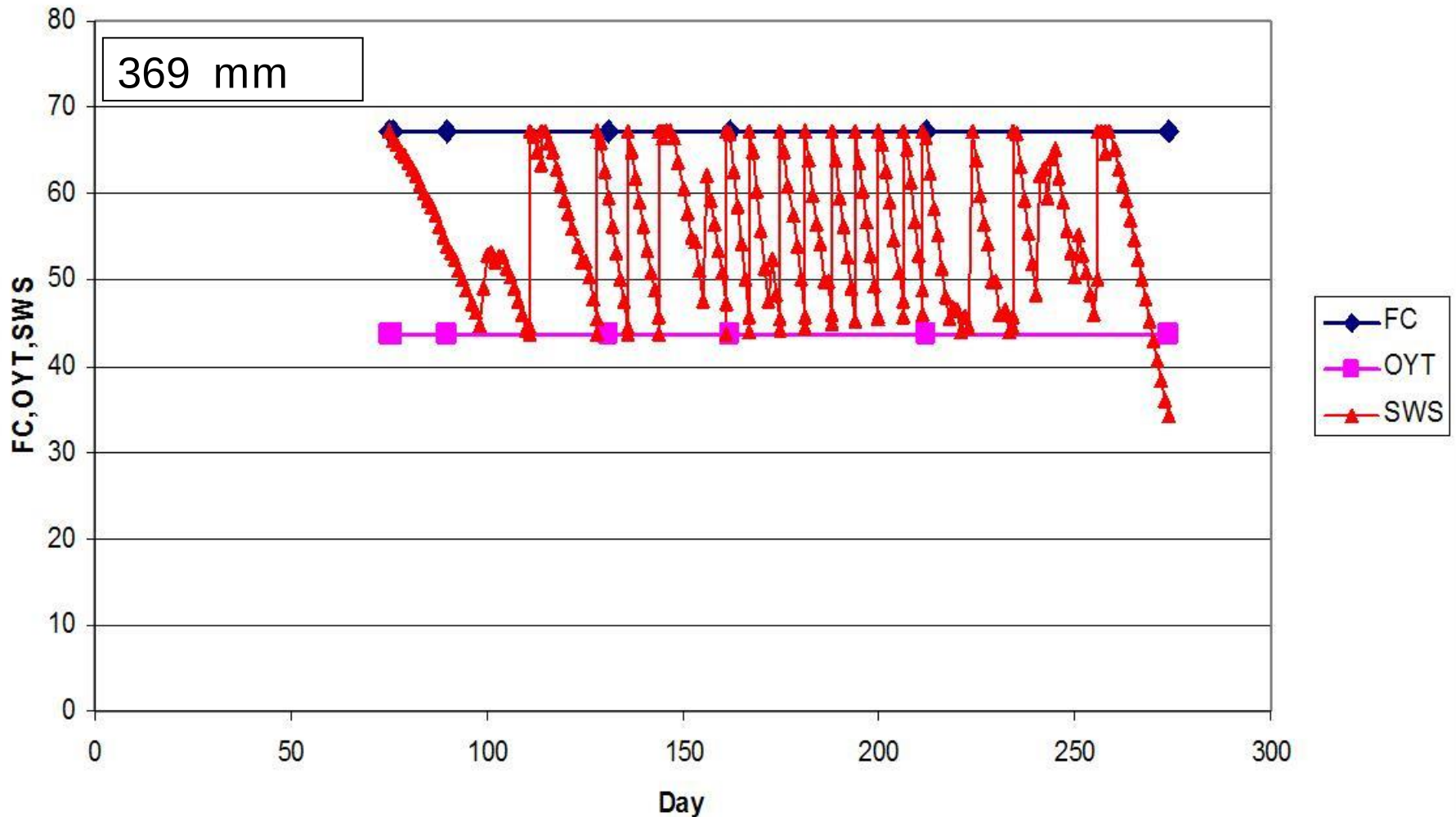
SOIL-WATER BALANCE



Simulated soil-water balance for TABLE GRAPES according to the rotational delivery schedule conducted by the Water Users Association



Simulated soil-water balance for Table grapes according to the on-demand delivery schedule





MADFORWATER

IRRIGATION EFFICIENCY TECHNIQUES



Reservoir

$$E = W_{\text{out}} / W_{\text{in}}$$

Distribution Network

On-Farm Network

Crops

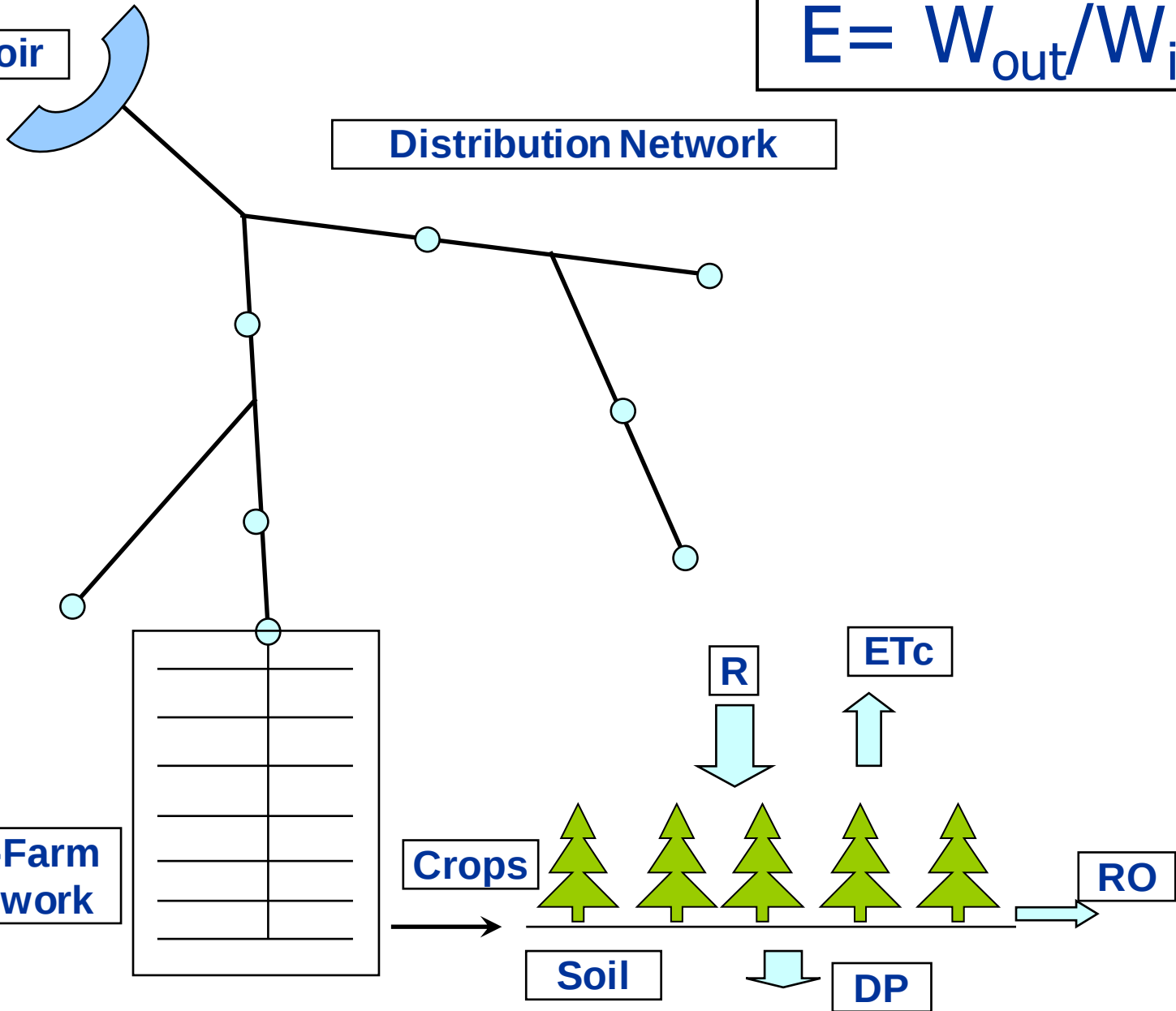
Soil

ET_c

R

DP

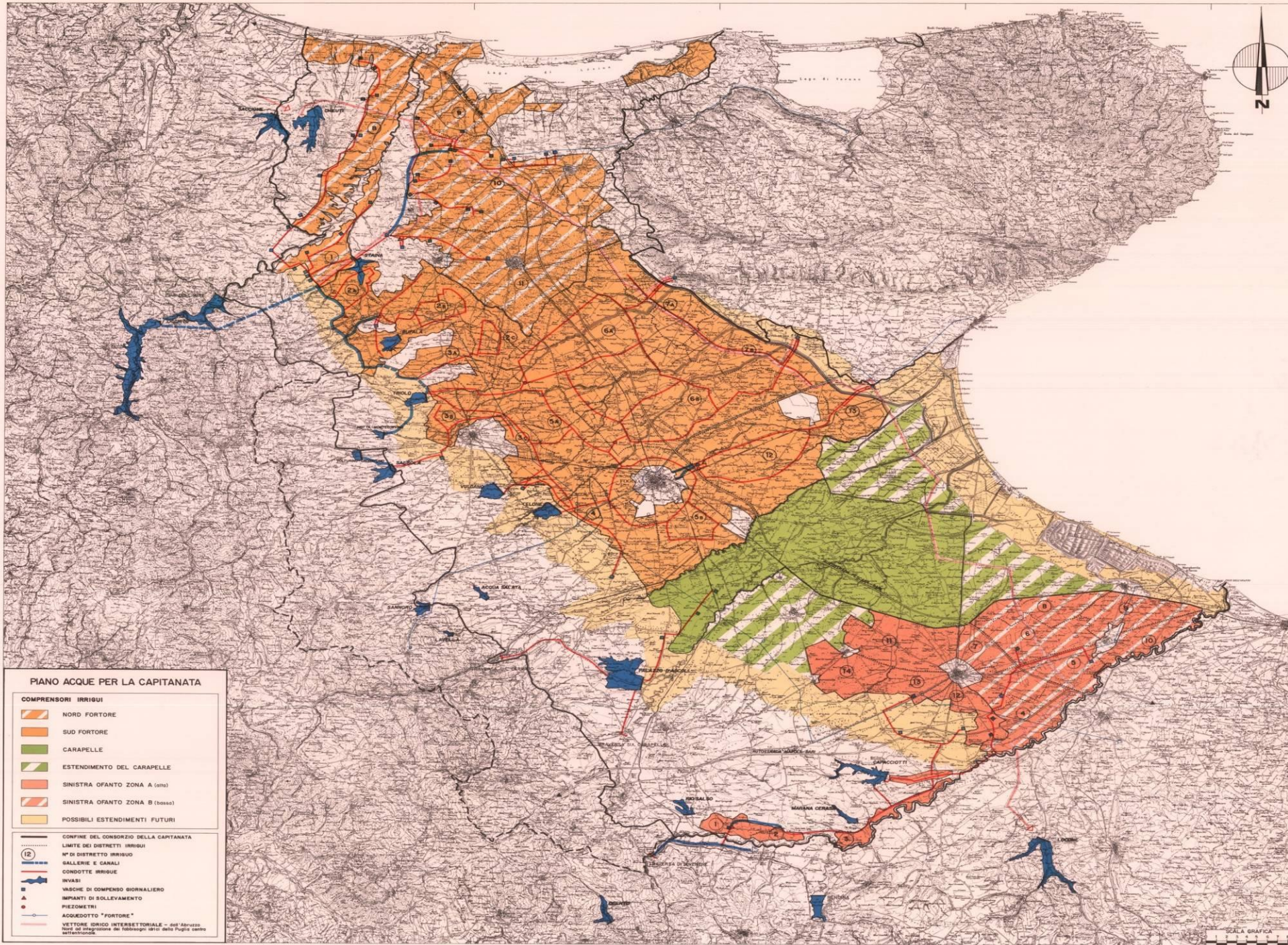
RO





Roma

CAPITANATA WUA

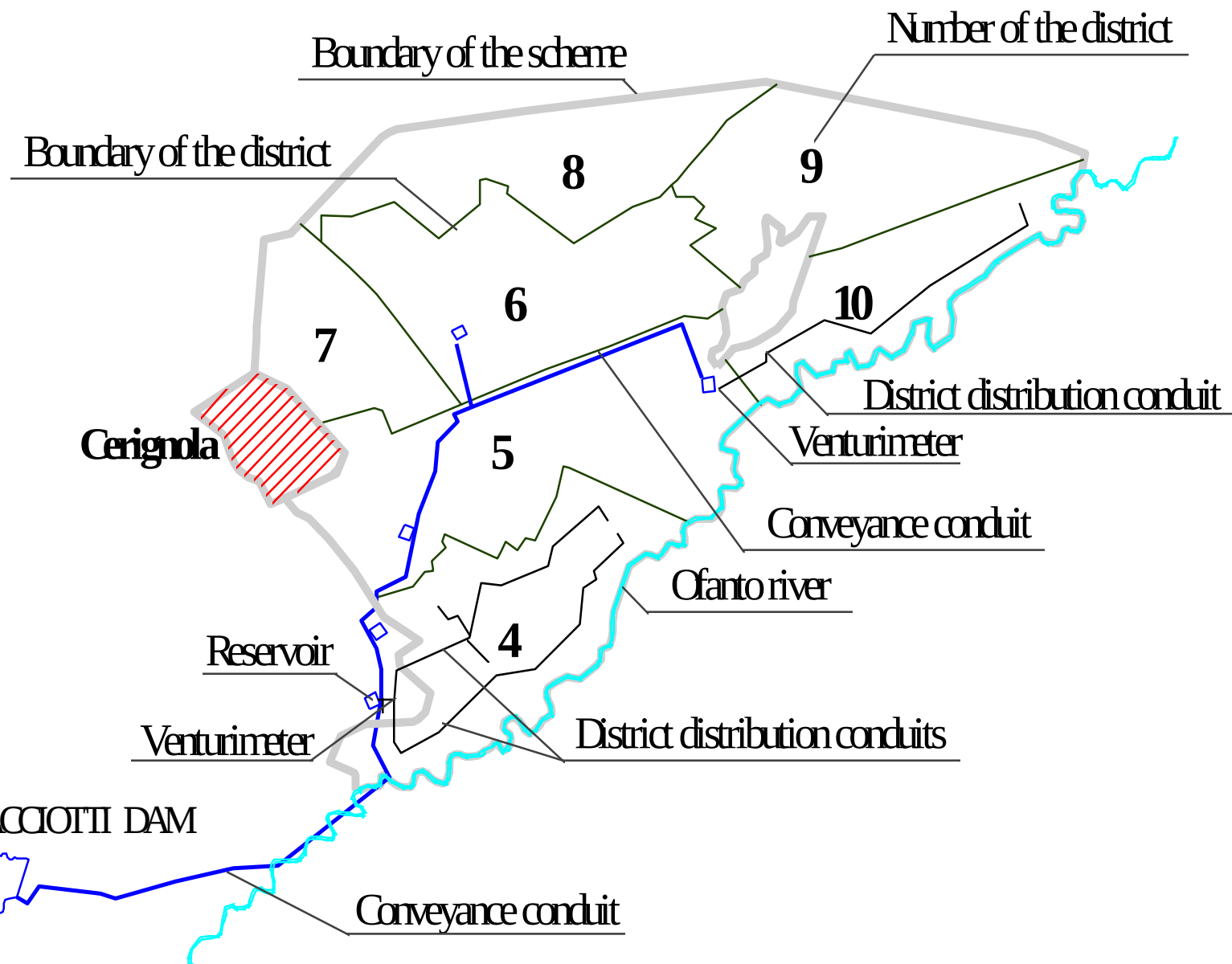


PIANO ACQUE PER LA CAPITANATA

COMPENSORI IRRIGUI

- NORD FORTORE
- SUD FORTORE
- CARAPELLE
- ESTENDIMENTO DEL CARAPELLE
- SINISTRA OFANTO ZONA A (setta)
- SINISTRA OFANTO ZONA B (bosca)
- POSSIBILI ESTENDIMENTI FUTURI

- CONFINE DEL CONSORZIO DELLA CAPITANATA
- LIMITE DEI DISTRETTI IRRIGUI
- N° DI DISTRETTO IRRIGUI
- GALLERIE E CANALI
- CONDOTTE IRRIGUE
- INVASI
- VASCHE DI COMPENSO GIORNALIERO
- IMPIANTI DI SOLLEVAMENTO
- PIEZOMETRI
- ACQUEDOTTO "FORTORE"
- SETTORE IDRICO INTERSETTORIALE - del fiume
- Scatole di irrigazione del territorio sotto la Puglia sotto
- irrigazione















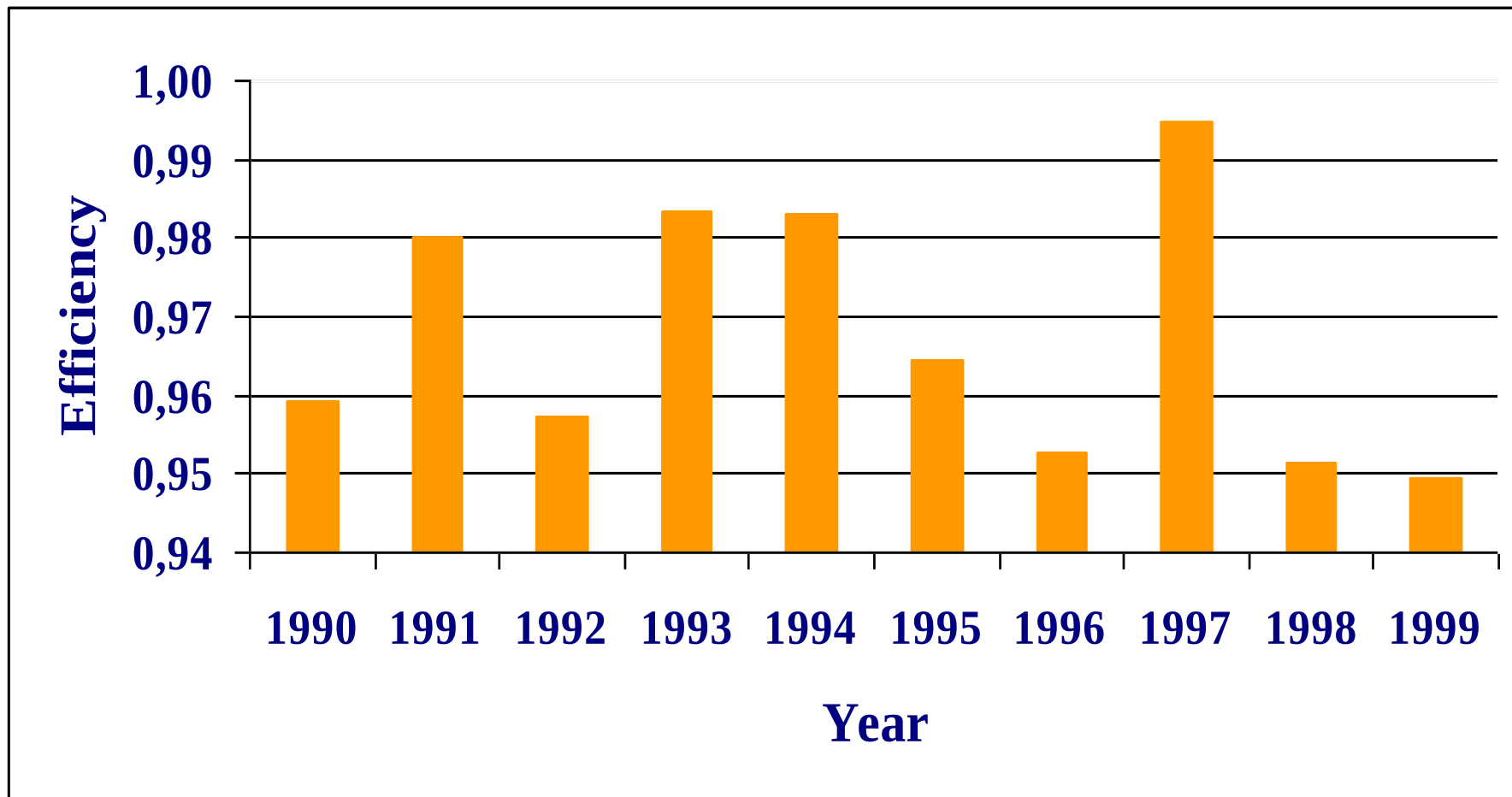








DISTRIBUTION NETWORK EFFICIENCY





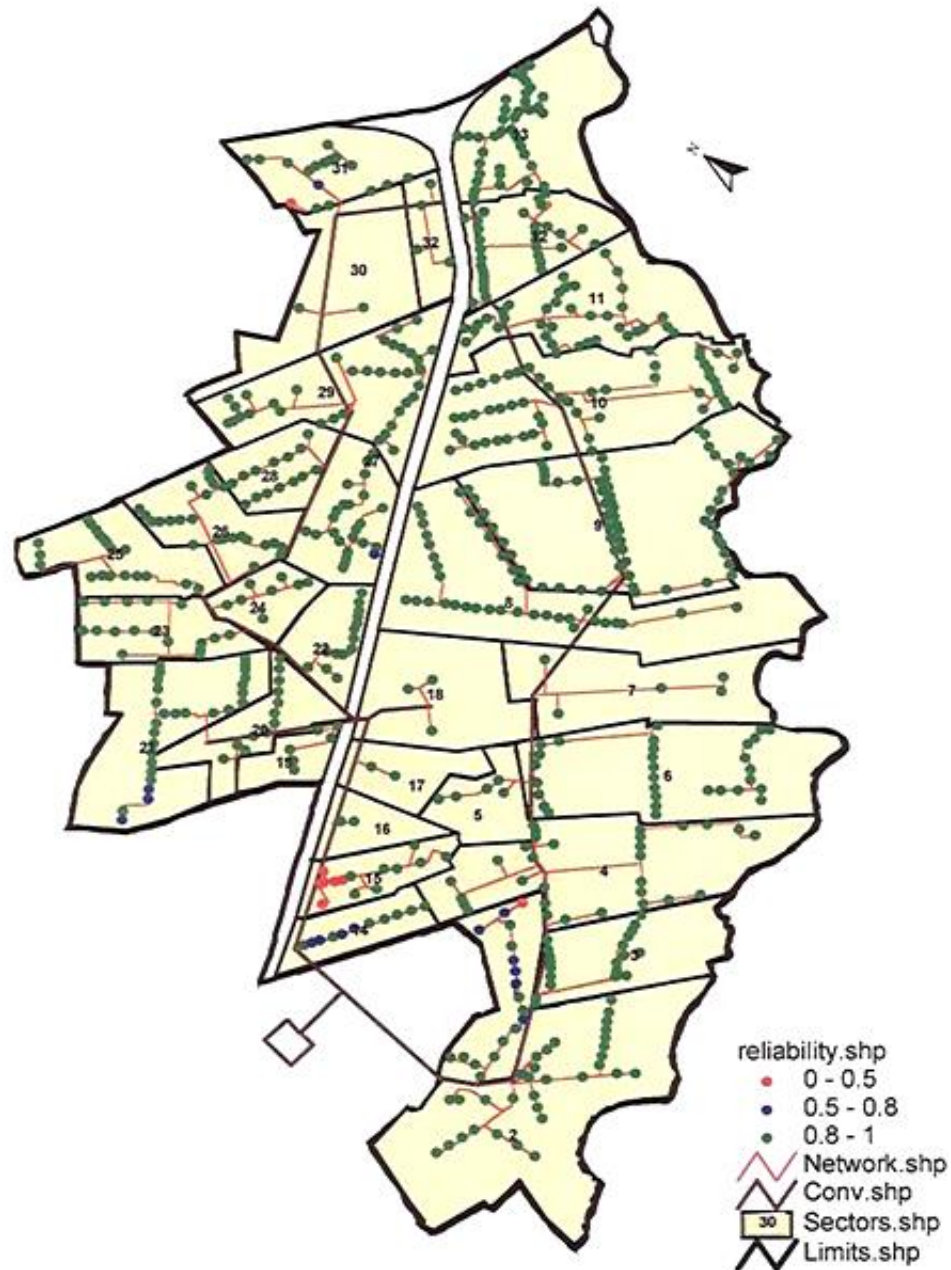
Pressure Deficit:

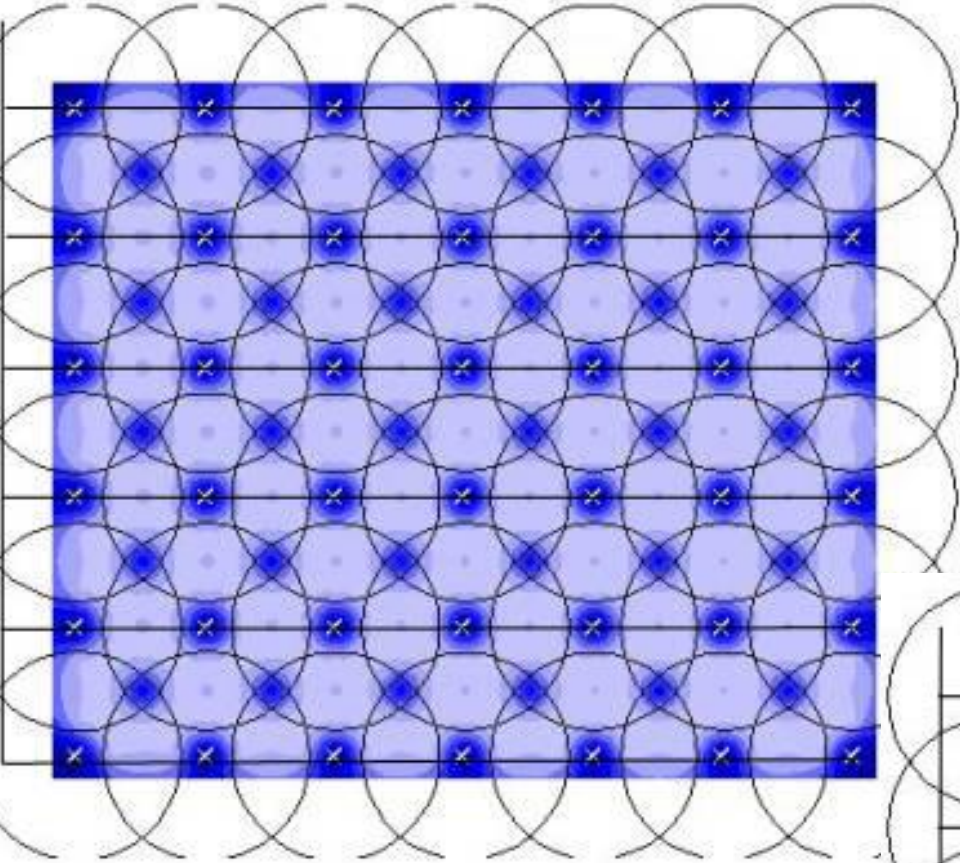
$Q = 1200 \text{ l/s}$



Pressure Deficit:

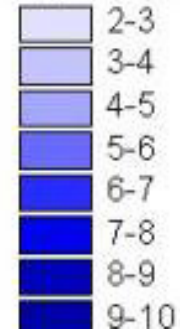
$Q = 700 \text{ l/s}$





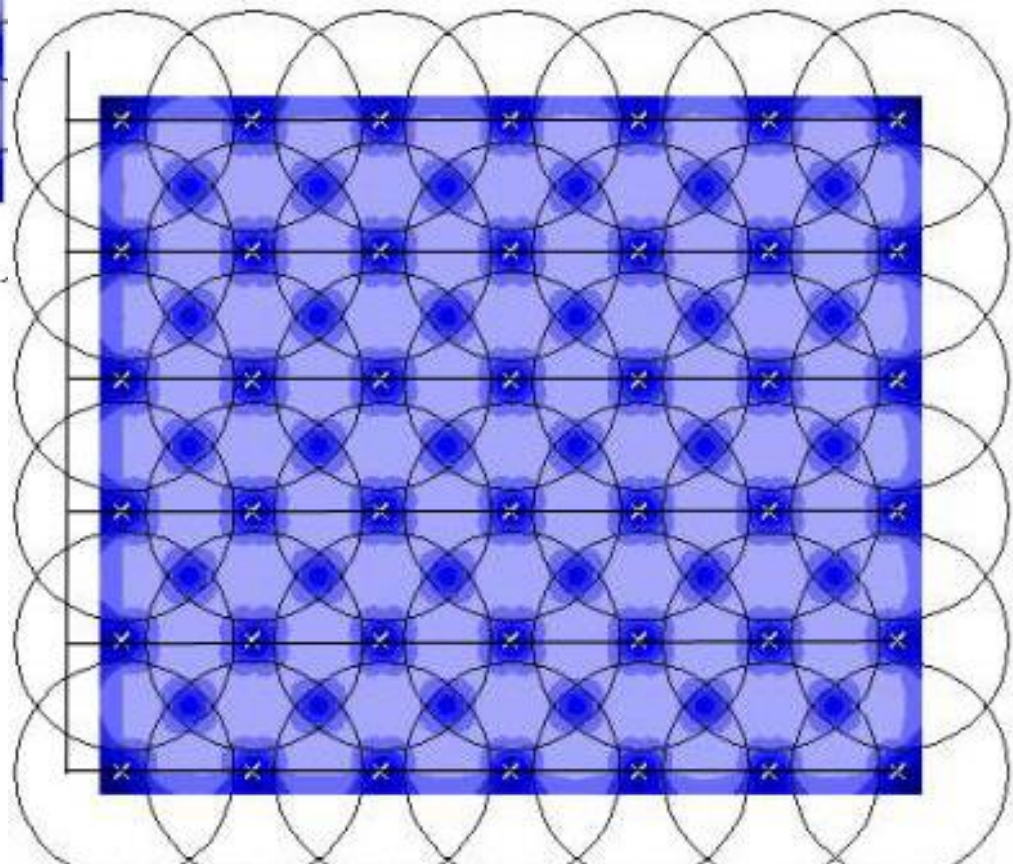
$H = 23$ m
 $CU = 63\%$
 $DU = 67\%$
 $DE_{90} = 62\%$
 $dn_{90} = 3\text{mm/h}$

Applied water (mm/h)



6 0 6 12 18 24 30 Meters

$H = 48$ m
 $CU = 74\%$
 $DU = 80\%$
 $DE_{90} = 80\%$
 $dn_{90} = 4.5\text{mm/h}$

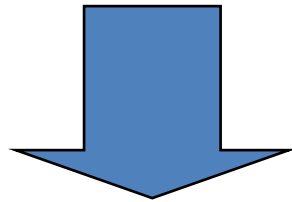


CAS 1:

$$E_{G,1} = 0.95 \times 0.60 = 0.57$$

CAS 2:

$$E_{G,2} = 0.95 \times 0.80 = 0.76$$



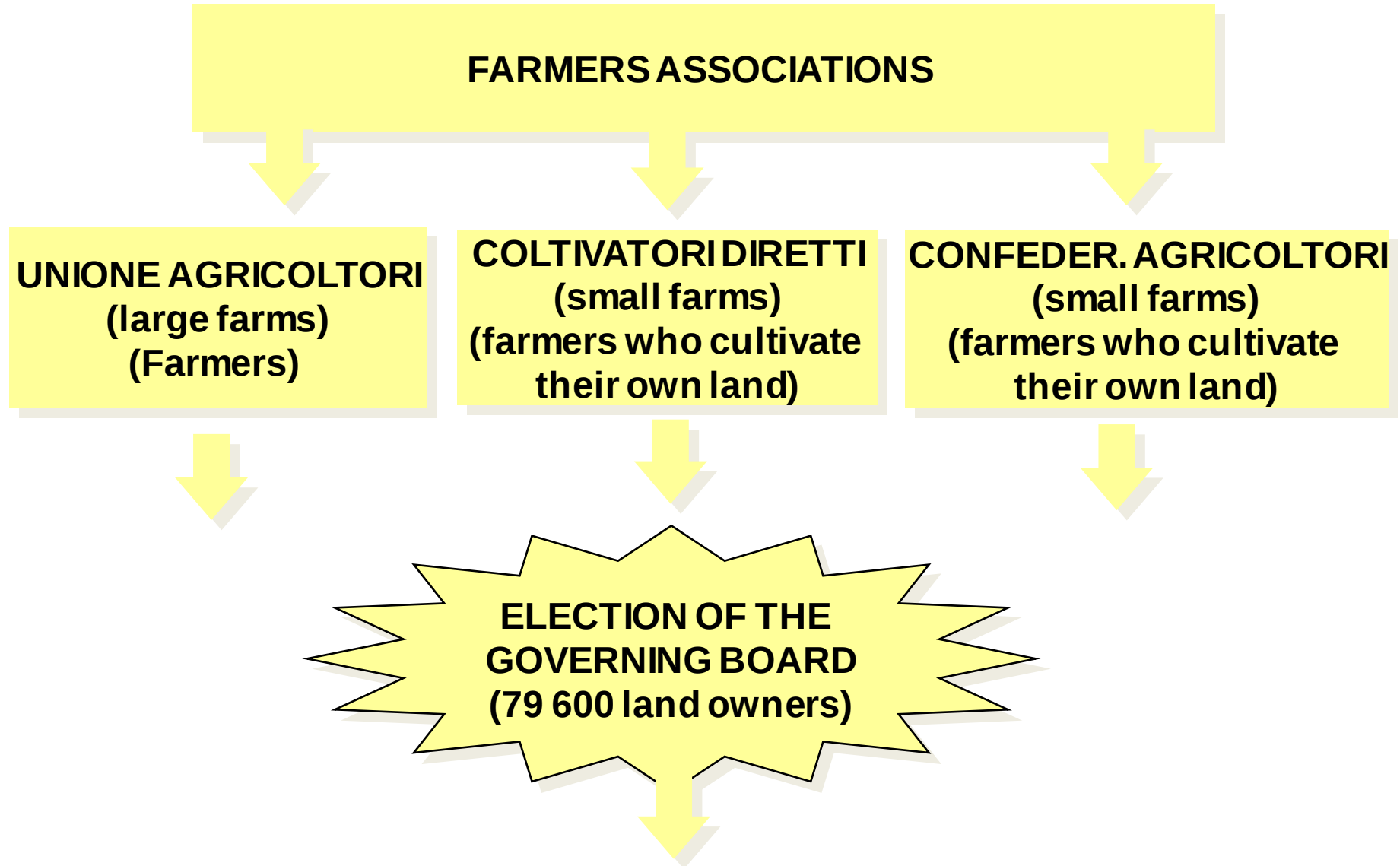
$$\Delta E = (0.76 - 0.57)/0.57 = 0.33 = 33\%$$

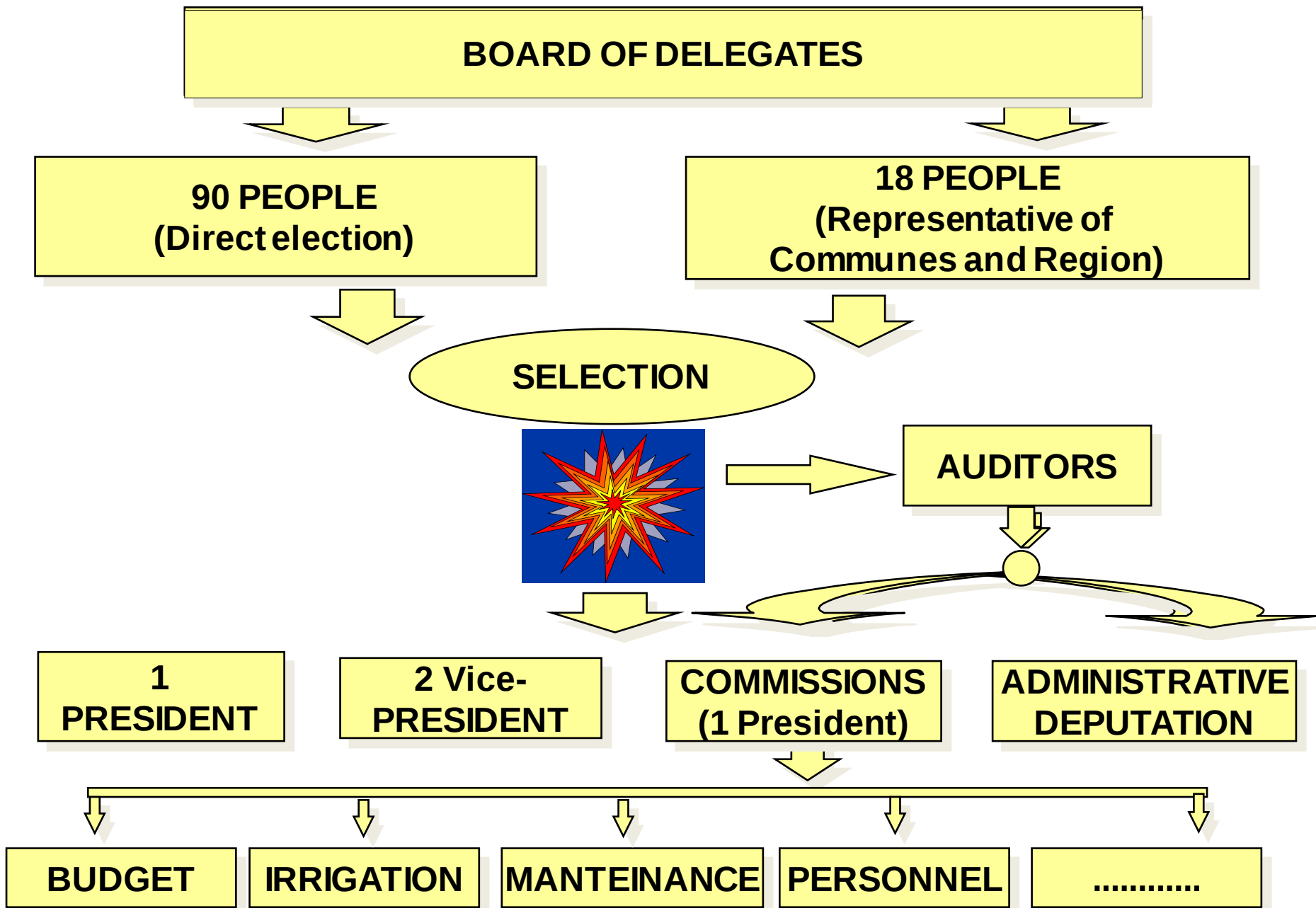
ISTITUZIONALE APPROACH

PARTICIPATORY IRRIGATION MANAGEMENT (PIM)

- Involvement of irrigation users in all **aspects** and at all **levels** of irrigation management.
- Transfer of irrigation systems from public organizations (Gov'ts) to WUAs.

CONSORZIO DI BONIFICA OF CAPITANATA (Italy)





GENERAL DIRECTOR



**DIRECTOR OF
AGRICULTURAL SERVICE**



**WATERSHED
MANAGEMENT**



**EXTENSION
SERVICE**



IRRIGATION



PERIFERICAL OFFICE (1 each 10 000 - 15 000 ha)
1 Head + 1 Assigned at the office job +
3 Workers (in charge for repairing)
2-3 Groups of 2 Workers (in charge for controlling
and maintenance)



**DIRECTOR OF
ENGINEERING SERVICE**



BIG WORKS

- Design
- Supervision
- Maintenance

.....



**DIRECTOR OF
ADMINISTRATION**



LEGAL SESSION

PERSONNEL

ESPROPRIATIONS

CONTRACTS

.....



- 1 pick-up for each
group of workers
- 1 Truck
- 1 Excavator

TARIFF RULES

BUDGET

COST OF MAINTENANCE
(on the base of the
previous Year Budget)

FIXED RATE
(€/ha)

Cost of maintenance
Irrigable Area
=
15.5 €/ha

OTHER COSTS
(on the base of the
previous Year Budget)

VARIABLE RATE
(€/m³)

Other Costs
Available Water Volume
=
Contribution - P (€/m³)

WATER AVAILABILITY

Available water volume
Irrigable Area
=
2000 m³ /ha

⇒	0.09 €/m ³	0 - 2000 m ³ /ha
⇒	0.18 €/m ³	2000 - 3000 "
⇒	0.24 €/m ³	> 3000 "

IMPORTANCE OF THE TRAINING: FROM THE CLASSROOM TO THE FIELD



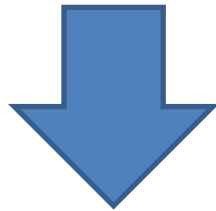
EXTENSION SERVICE



WASTE OF FOOD

=

WASTE OF WATER.....



Drivers of Water Demand

1. Population Growth

Basic Water Needs

(Liters d^{-1} p^{-1})

Drinking 2-4

Domestic 40-400

Food 1000-5000

On average, 1 Kcal per liter



4. Diet



Product	(liters per Kg)
---------	-----------------

Beef meet	15000
-----------	-------

Sheep meet	10000
------------	-------

Pork meet	6000
-----------	------

Chicken meet	2800
--------------	------

Eggs	4700
------	------

Cheese	5300
--------	------

Milk	900
------	-----

Cereals	1500
---------	------

Fruit	1000
-------	------

Legumes	1000
---------	------

THE EXAMPLE OF THE APULIA REGION

Population : 4.000.000 ab

Surface : 20.000 Km²

Calories requirement: 2000 kcal/ab/d

Media: 1 kcal = 1 litro acqua (stima FAO, 2010)

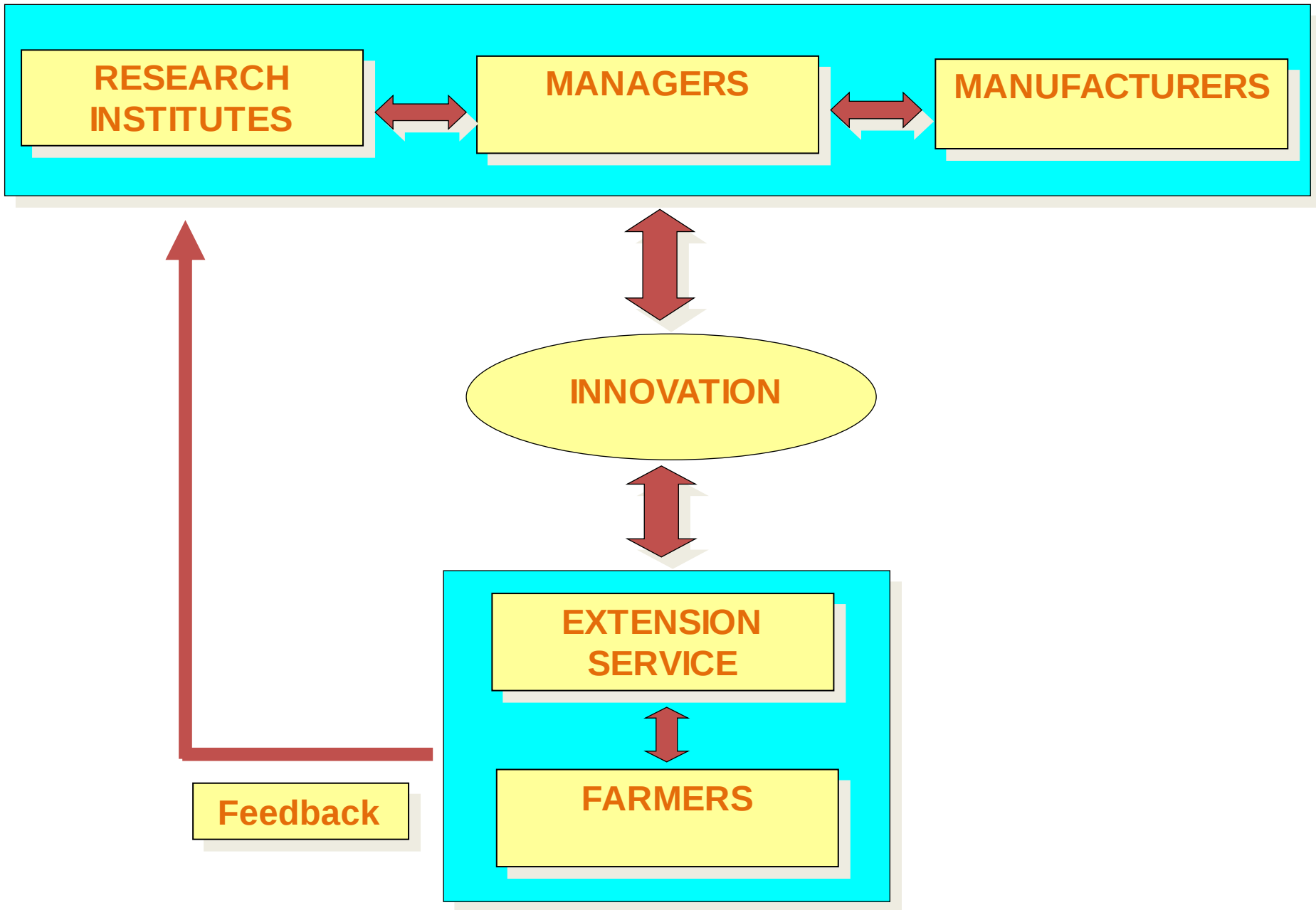
In the world an average of 30% of food is wasted. Therefore, in terms of (virtual) water, in Puglia the waste is (on average):

$$2000 \text{ l/ab/d} \times 0.30 = 600 \text{ l/ab/d}$$

$$600 \times 4.000.000 : 1000 = 2.400.000 \text{ m}^3/\text{d}$$

$$2.400.000 \times 365 = 876.000.000 \text{ m}^3/\text{anno}$$

EQUAL TO THE ENTIRE IRRIGATION REQUIREMENT OF CROPS IN APULIA !!



THANK YOU

