5+5 Water Strategy for the Western Mediterranean.
1sr Workshop. Valencia
25th-26th February 2014

Libyan interim government

Ministry of Water Resources

PRESENTATION
ON
WATER RESOURCES MANAGEMENT AND STRATEGY IN LIBYA

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Feb. 2014

1. Introduction :

This presentation related to the Mediterranean Cooperation for the 5+5 Dialogue for the Western Mediterranean Water Strategy.

2. Objective :

The presentation introduces :

- The water resources conditions and future trends.
- Highlights the strategies of water management and the achieved targets.
- Defines the prominent problems facing future water supply.

3.0 Background Information :

Location of Libya:

- Libya is bordered by Tunisia and Algeria in the west, Egypt in the east and the Sudan in the south east ,and Niger and Chad in the south.

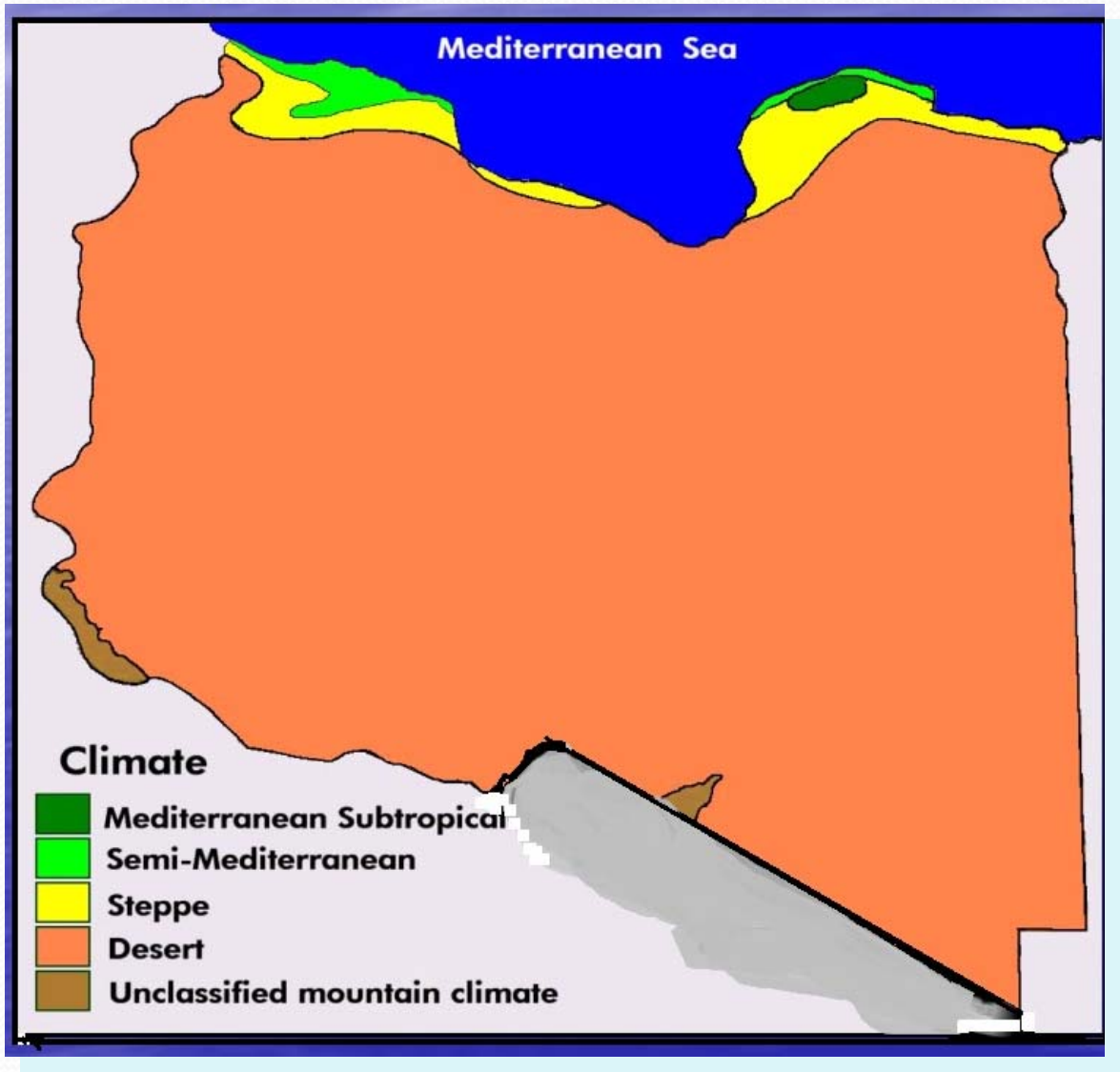
- Libya is generally a flat country south of the Mediterranean Sea.

- Libya has an area of 1.8 Km^2 and coastline of about 1900 Km.

Main Geographical Features:

- Plain.
- Jabal (mountain).
- Plateau.
- Basin.

Climate in Libya



Temperature:

- In the Mediterranean and semi-Mediterranean zones, the sea plays a major role in reducing potentially high temperatures, except where hot and dry winds from the Sahara, called "Ghibli“.
- In Al Aziziyah, 60 km south of Tripoli, the highest world temperature (58^{O}C) was recorded in September 1922.
- The mean July temperature lies between 26 and 41^{O}C while mean January temperatures fall between 8 and 16^{O}C.

Wind:

- Northerly and easterly winds prevail from May to October.
- Northerly and southwesterly winds from November to April.
- Wind speeds are in the range of 5 to 15 knots .

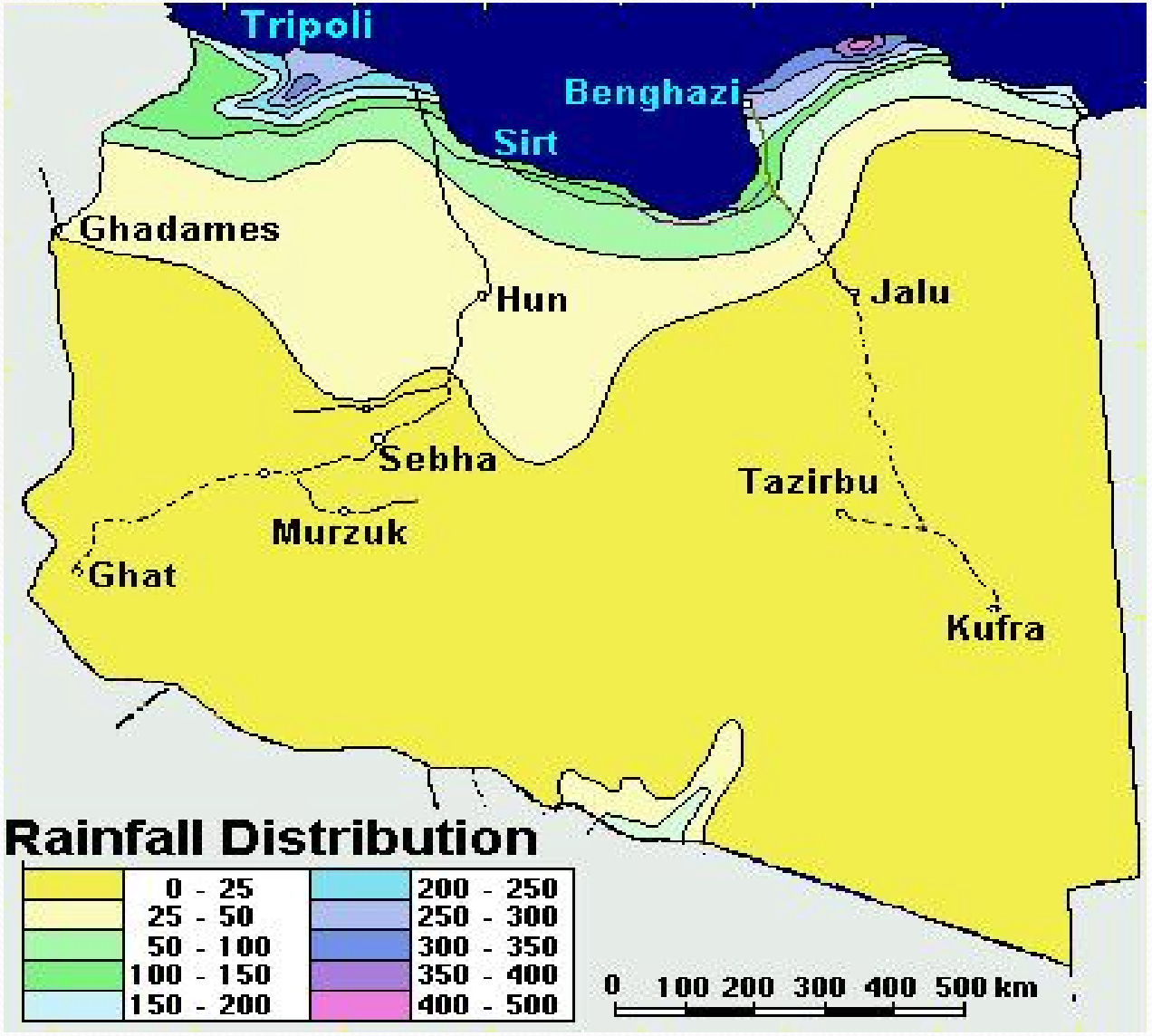
Evaporation:

- Evaporation rates are generally high in Libya.
- The peak is reached in June and July and the minimum in December and January.
- Mean annual values increase gradually from north to south.
- The magnitude of the average annual evaporation in millimeters:

  In North between 1721-2244

  In South between 4341-6119

Rainfall Distribution

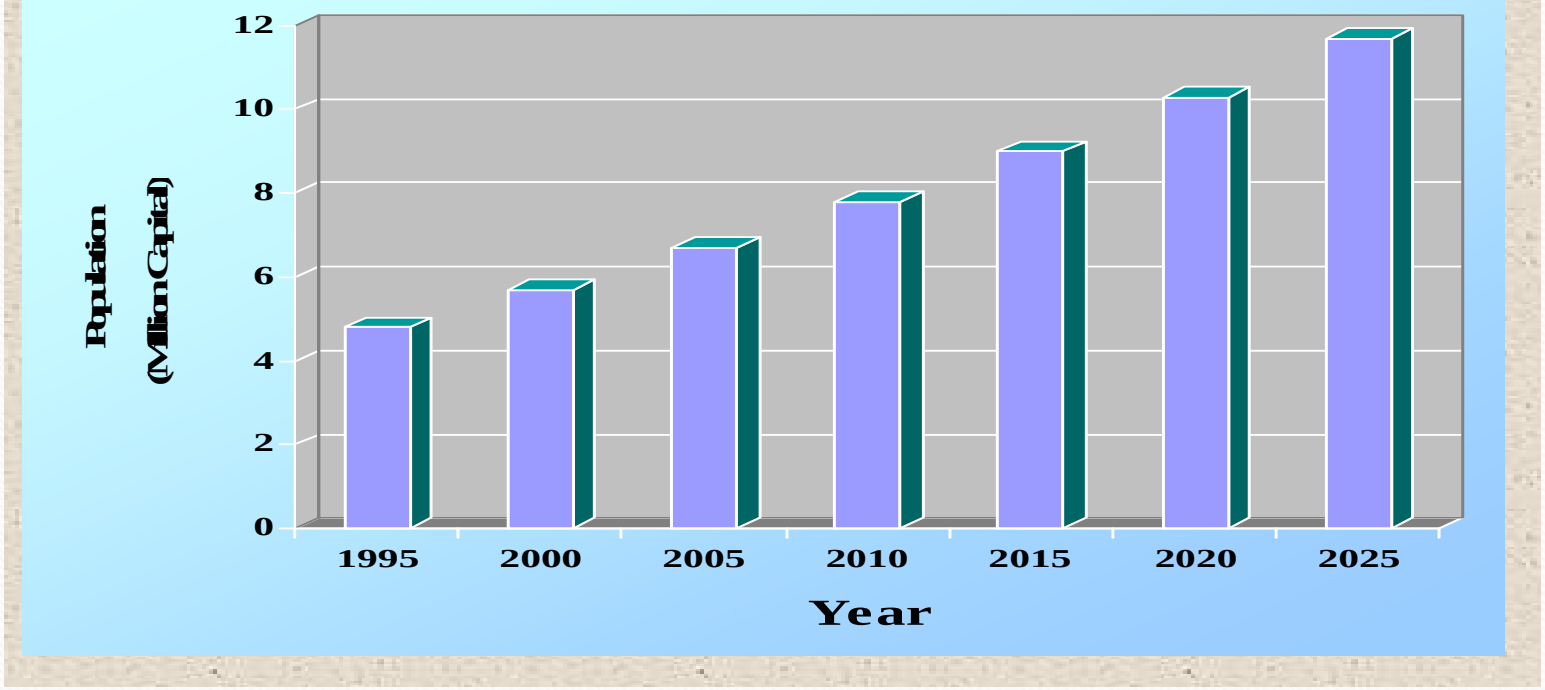


Rainfall:

- Rainfall occurs in the winter with the bulk falling between October and March and decreasing sharply away from the coast.
- The highest annual rainfall, 400 to 600 mm, occurs along the Jabal aLAkhdar.
- Reduced to 200 to 400 mm along the western seacoast up to Misratah and between Ajdabiya and Darnah to the east.
- The 100 mm isohyet is parallel to the Mediterranean coast and becomes very close to the seashore along the Gulf of Sirt and within about 150 km elsewhere.
- Below the 30^{O} N latitude, rainfall becomes negligible or nil .

Population:

- The estimated total population in year 2010 is 7.8 million .
- Around 60% of the population located in Jifarah area NW Libya.
- Growth rate % decline from 4.2% to 2.8% in the period 1984-1995
- Population Growth based on adjusted rate of growth to year 2025.



Year	1995	2000	2005	2010	2015	2020	2025
Population(10^6)* With non Libyan	4.8	5.7	6.7	7.8	9.0	10.3	11.7

Institutional Aspects:

The Ministry of Water Resources (MWR) is formed in 2012 and it is the mean governmental body of the water resources sector , is currently the concern of several departments with regard to development, management and use, namely:

- General Water Authority (GWA).
- Man Made River Authority (MMRA).
- General Desalinization Company (GDC).
- General Water and Wastewater Company (GWWC).
- Water Research Center.(WRC).
- Groundwater Research Center For Africa.

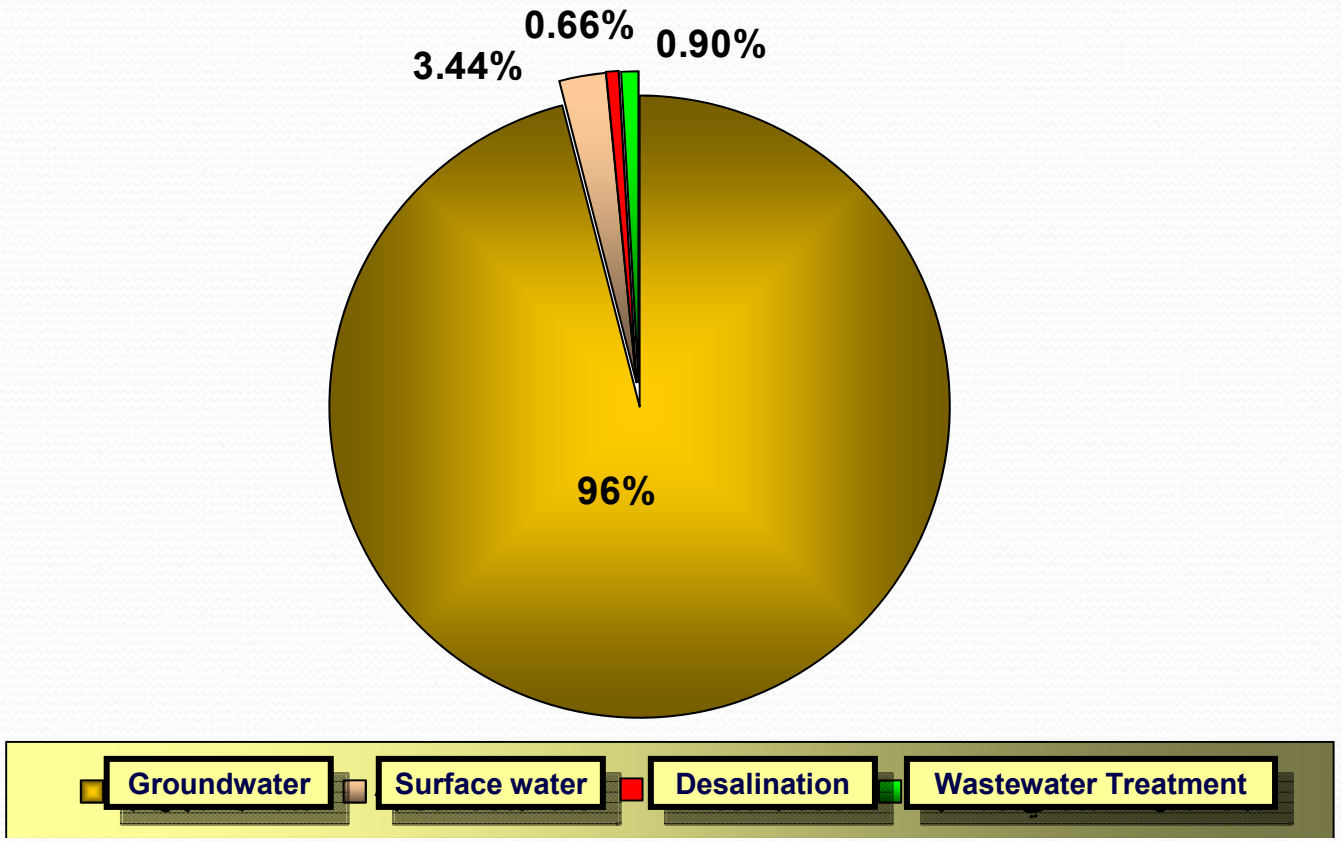
The MWR is initially entrusted with:

- Proposing the general water policy and strategy to the country.
- Conducting studies and research to ensure optimum utilization of available resources,
- Processing applications for water use and deciding on size, location and conditions of use.
- Construction of Dams, Reservoir, Desalination Plants, Water fields and sewages treatment Plants.
- Operate and supervising water exploitation projects.
- Proposing water legislations.
- Capacity Building of human resources in water fields.
- Corporate with international water frameworks.

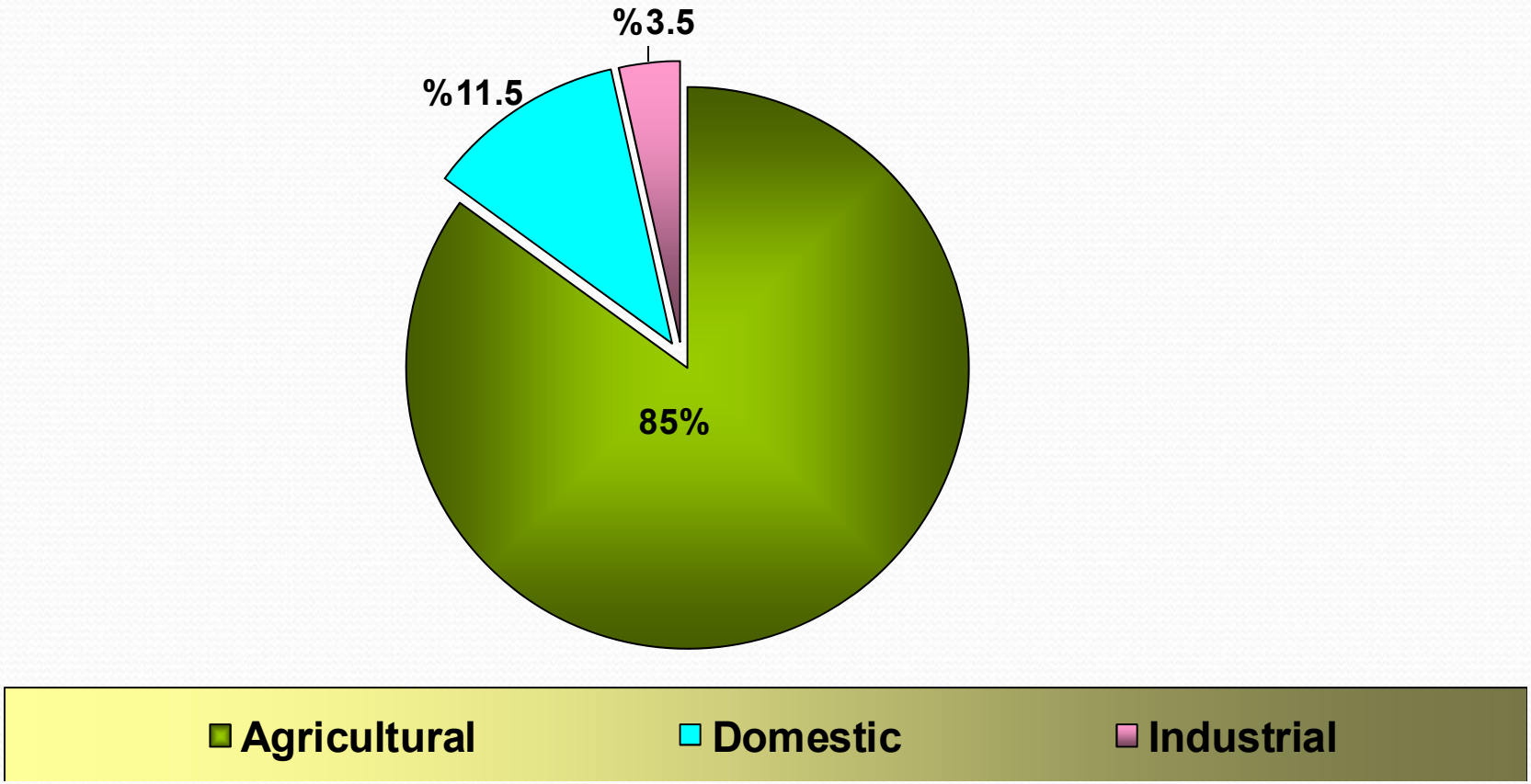
4.0 Current Water Resources in Libya

- Conventional water resources: Groundwater-Surface Water.
- Un-conventional water resources: Desalination – Treatment Water.
- 97 % of the development Water Resources come from Groundwater. 87 % of which is non-renewable.
- It is estimated the annual direct charge is about 650 m^3/year.

Indicators of Water Resources in Libya



Distribution of Water consumption in Libya

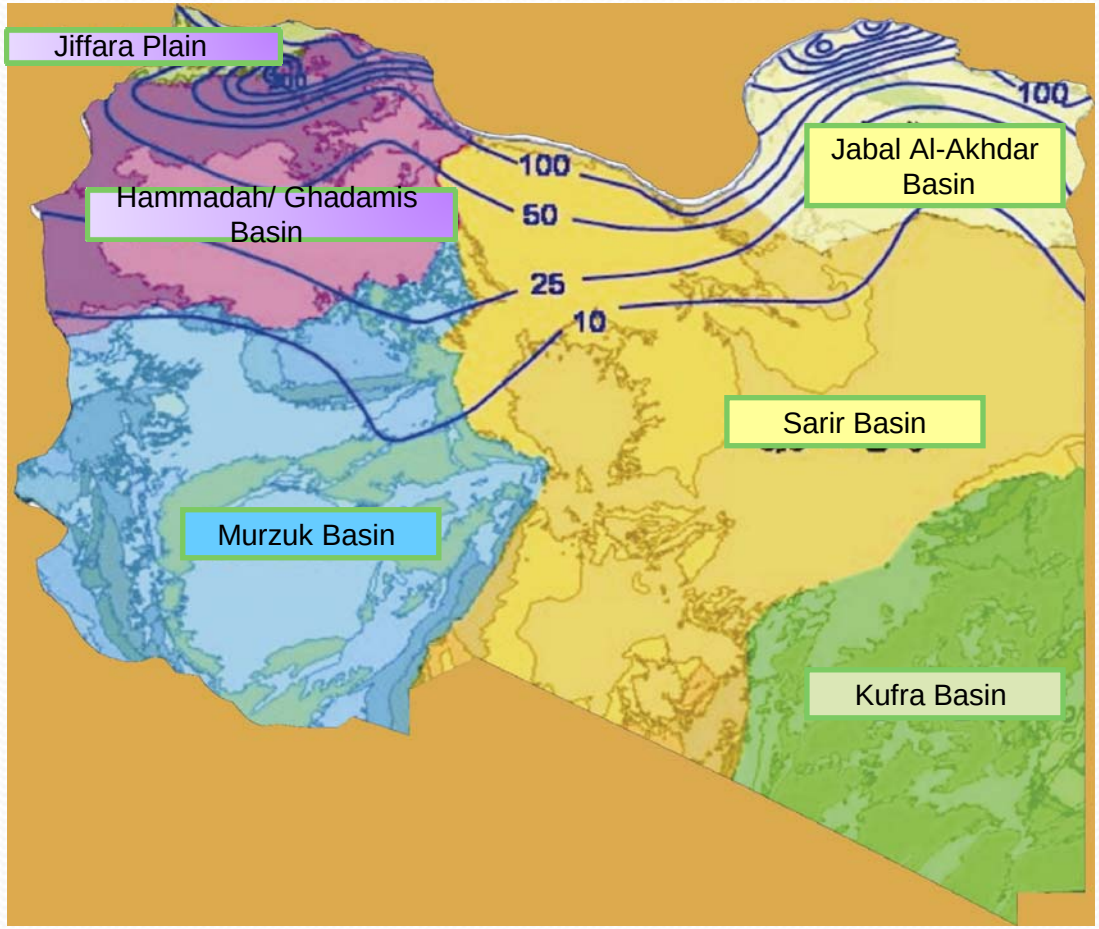


4.1 Conventional Water Resources

Surface Water

- Total recoverable Surface water in NE an NW Libya is estimated with 200 Million m^3/year.
- 61.2 Mm^3/year of surface water is stored by 18 existing Dams. These Dams has design capacity of 375 Million m^3.
- Seven (7) dames under construction with design capacity of 66.02 Million m^3 and expected to store 16.55 Mm^3/year
- Seven (7) dames planned 2014 -2020 to be constructed with design capacity of 29.60 Million m^3 and expected to store 10.47 Mm^3/year

Groundwater Basins and Rainfall in mm/year



Ground Water

- Six (6) groundwater basins of Libya are covering almost the entire surface area of the country**.**
- Libya depends heavily on groundwater which account >85% of the water in use.

- Renewable ground water occurs in northern aquifers. Jifarah, Jabal Al Akhdar and part of Hamada and central costal area.

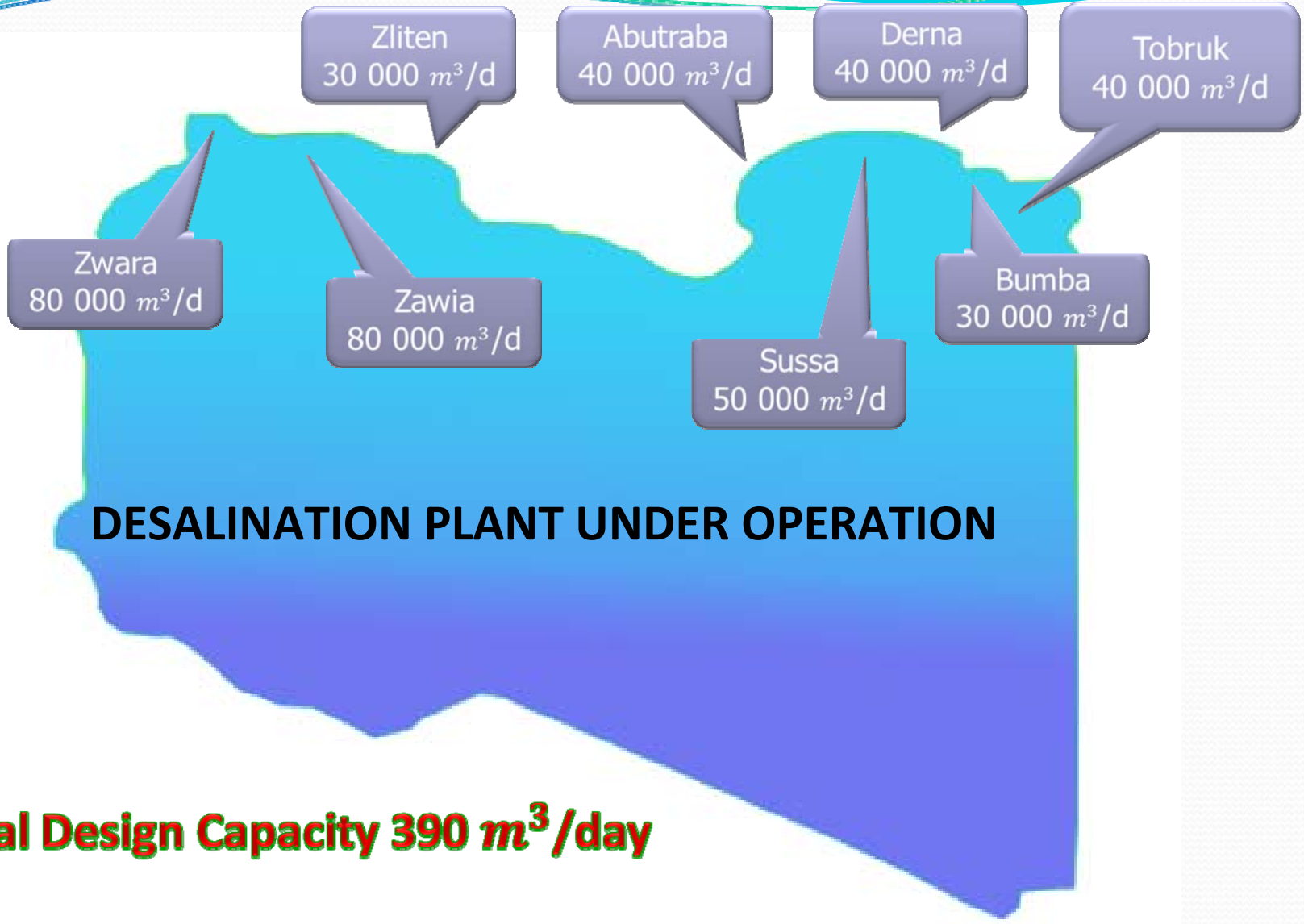
- Non- Renewable ground water occurs in the great sedimentary basins of the Kufra, Murzuk, Sarir and Hamada.

- 3850 Mm^3/y is the available fresh water quantities for annual use from ground water basins.

4.2 Non – Conventional Water Resources

Desalination :

- Desalination technology was introduced to Libya more than thirty-five years ago.
- Eight (8) Desalination plants in operation in 2012, with a Capacity of 140 400 (m^3/day) and produce 71.5 M m^3/y.
- Five Desalination plants to be built between 2014-2018 with a design capacity of 625 000 (m^3/day).
- Ten (10) Desalination Plants out of Operation, with a Capacity of 135,400 (m^3/day).



DESALINATION PLANT UNDER OPERATION

Total Design Capacity 390 m^3/day

Treated Sewage Water:

- A number of sewage treatment plants are built and other are in the plan.
- 55 plants are existing varying in capacity from 3,000 m^3/day to 120,000 m^3/day.
- Total quantities of water produced from treated water sewage in year 2010 is about 145,800 m^3/day.
- About 11% is treated and the rest is disposed to the sea or to the ground surface.
- When all the plants become in operational, the output will be 1,320,000 m^3/day.

5.0 Water Supply

- The Total Water Supply 3850 Mm^3/y

Total Water Supply (Mm^3/y)

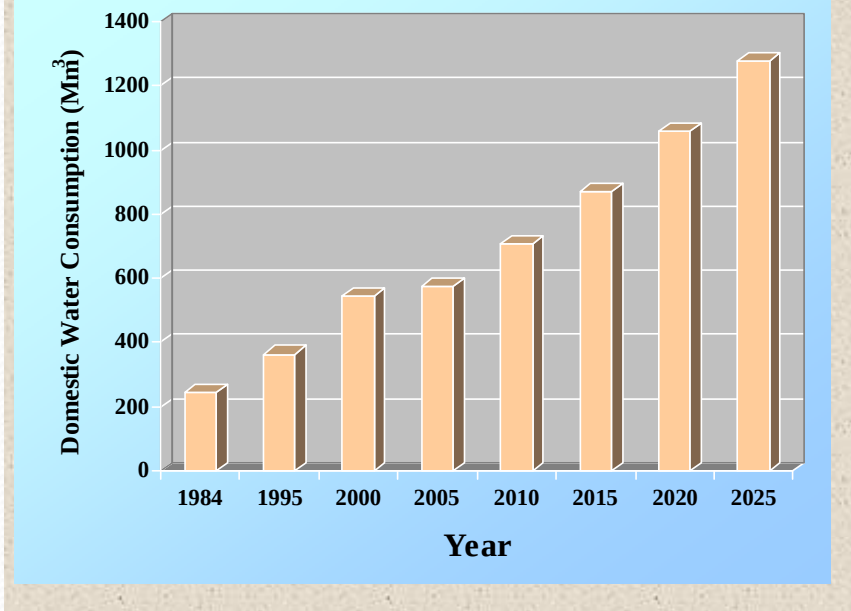
Source	Basin					Total
	Jifarah	Hamada	Jabal Al Akhdar	Murzuk	Kufra and Sarir	
Surface water	52	48	92	.	.	**192**
Groundwater	250	400	250	1200	1500	**3600**
Unconventional sources	30	17	11			**58**
Total	**332**	**465**	**453**	**1200**	**1500**	**3850**

6.0 Current and Future Water Demand:

6.1 Domestic Use

- 85 % of the Libyan population lives in urban center, varying in size from 3000 to 1,000,000 inhabitants.
- Average water consumption ranges 150 to 300 l/c/d.
- The existing and projected domestic water consumption in 1984 through 2025 .

Domestic water consumption

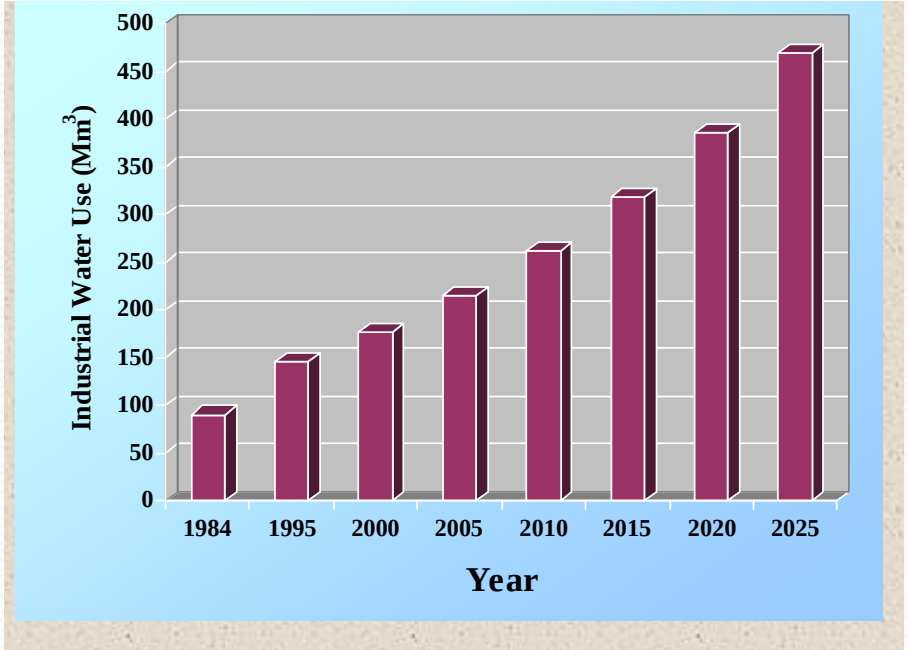


Year	1984	1995	2000	2005	2010	2015	2020	2025
Population(10^6)*	3.6	4.8	5.7	6.7	7.8	9.0	10.3	11.7
Domestic water consumption (Mm^3)	246.8	364	457	573	708	870	1060	1280

6.2 Industrial Use

- In 2010 the total industrial water use was estimated at 266 Mm^3.
- For future industrial water demand, 4% increment is estimated as shown in table below.

Industrial water use



Year	1984	1995	2000	2005	2010	2015	2020	2025
Industrial water use (Mm^3)	90	145	176	214	266	318	387	470

6.3 Agriculture use

- Agriculture being the major consumer and account of more 85% of the water consumption.
- The present irrigated area is estimated between 350,000 to 400,000 ha.
- The water requirement per Hectare vary from < 10,000 to > 20,000 m^3/ha/year, depending on location, type of crop and irrigation method.
- The extraction for ground water for agriculture is presented as in the table below.

Basin	Year				
	1978	1984	1995	2005	2010
Hamada	173.1	241.2	260	350	350
Jabal Al Akhdar	79.5	150.5	469	480	480
Kufra and Sarir	216.5	335	335	650	905
Jifarah	435	500	965	1110	1110
Murzuk	372.5	551	751	1848	2077
Total	1276.6	1777.7	2780	4438	4922

6.4 Water Transport (Man-Made River Project):

The project is nearly completed, will be able to convey more than 6.5 Mm^3/day at a cost per unit of water much below the cost of desalination. It will secure domestic water supply for a great number of coastal and inland cities.

7.0 Future Water Demand

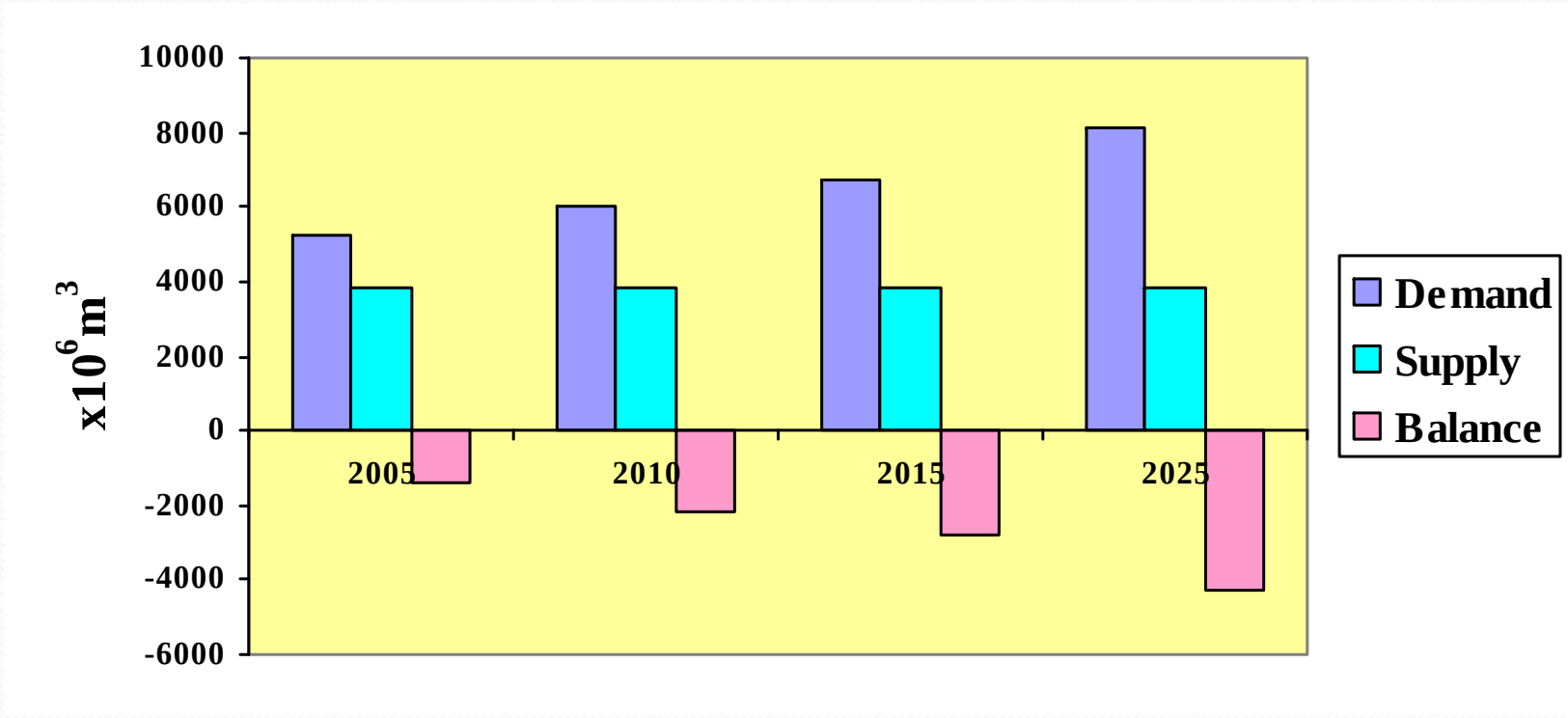
• The current rate of abstraction from the various groundwater aquifers is estimated at 6,000 Mm^3/yr. as shown table below:

Estimated Water Demand (Mm^3/yr))	2005			2010			2015			2025		
	Agr.	Dom.	Ind.	Agr.	Dom.	Ind.	Agr.	Dom.	Ind.	Agr.	Dom.	Ind.
	4438	573	214	4992	708	266	5307	1064	318	6272	1405	470
Total Demand	5225			5996			6689			8147		
Total Supply*	3850			3850			3850			3850		
Total Deficit	-1375			-2146			-2839			-4297		

* The available water supply of safe yield is estimated of about 3200 Mm^3/y from non-renewable water from the basins plus 650 Mm^3/y is attributed to direct recharge from rainfall in Jifarah Jabal Akhdar and Hamada basins.

8.0 Estimation of Current and Future Water Balance

Total water deficit in year 2010 is estimated as (-2146 Mm^3/ year)

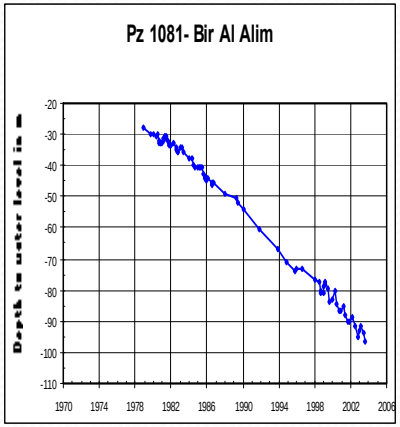


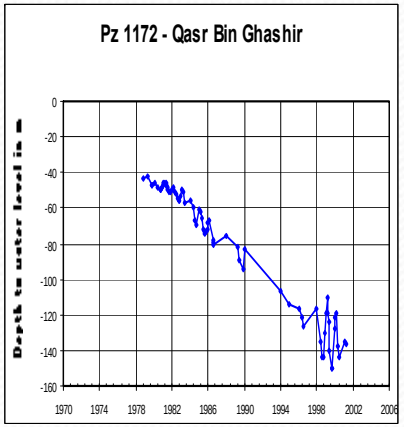
9.0 Water Supply Problems :

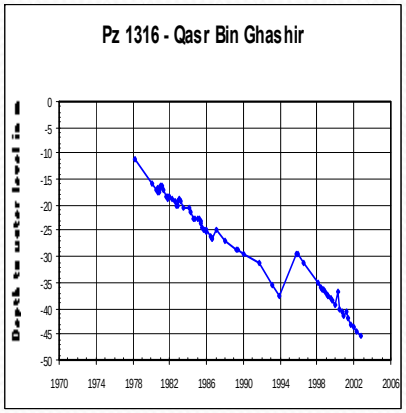
The present water supply shortage has led to:

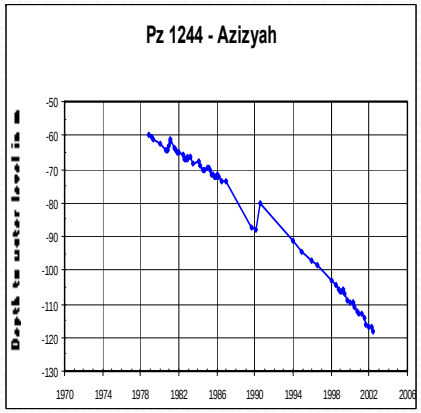
- Continuous lowering of the groundwater table.
- Depletion of several fresh water aquifers.
- Deterioration of groundwater quality.
- Seawater intrusion.

Lowering of the groundwater table

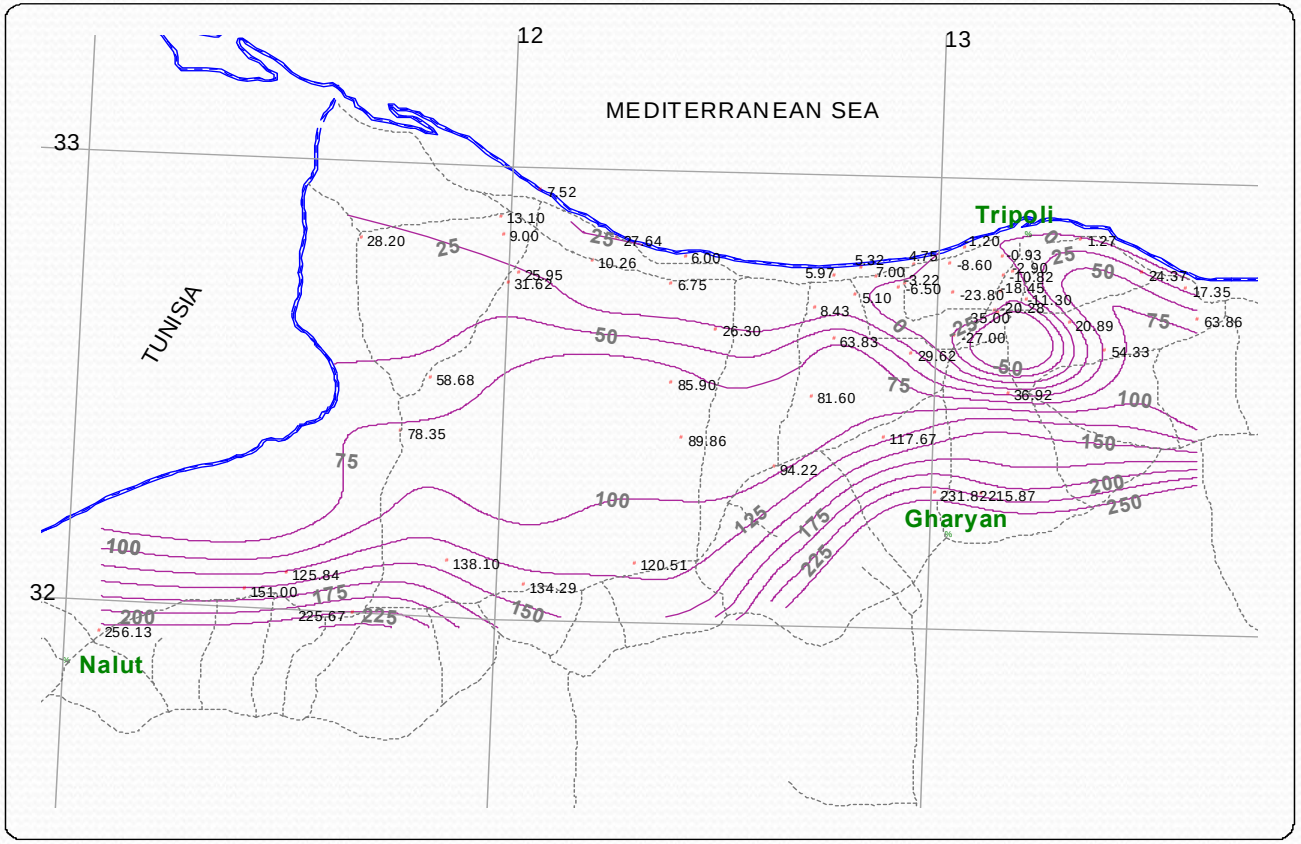




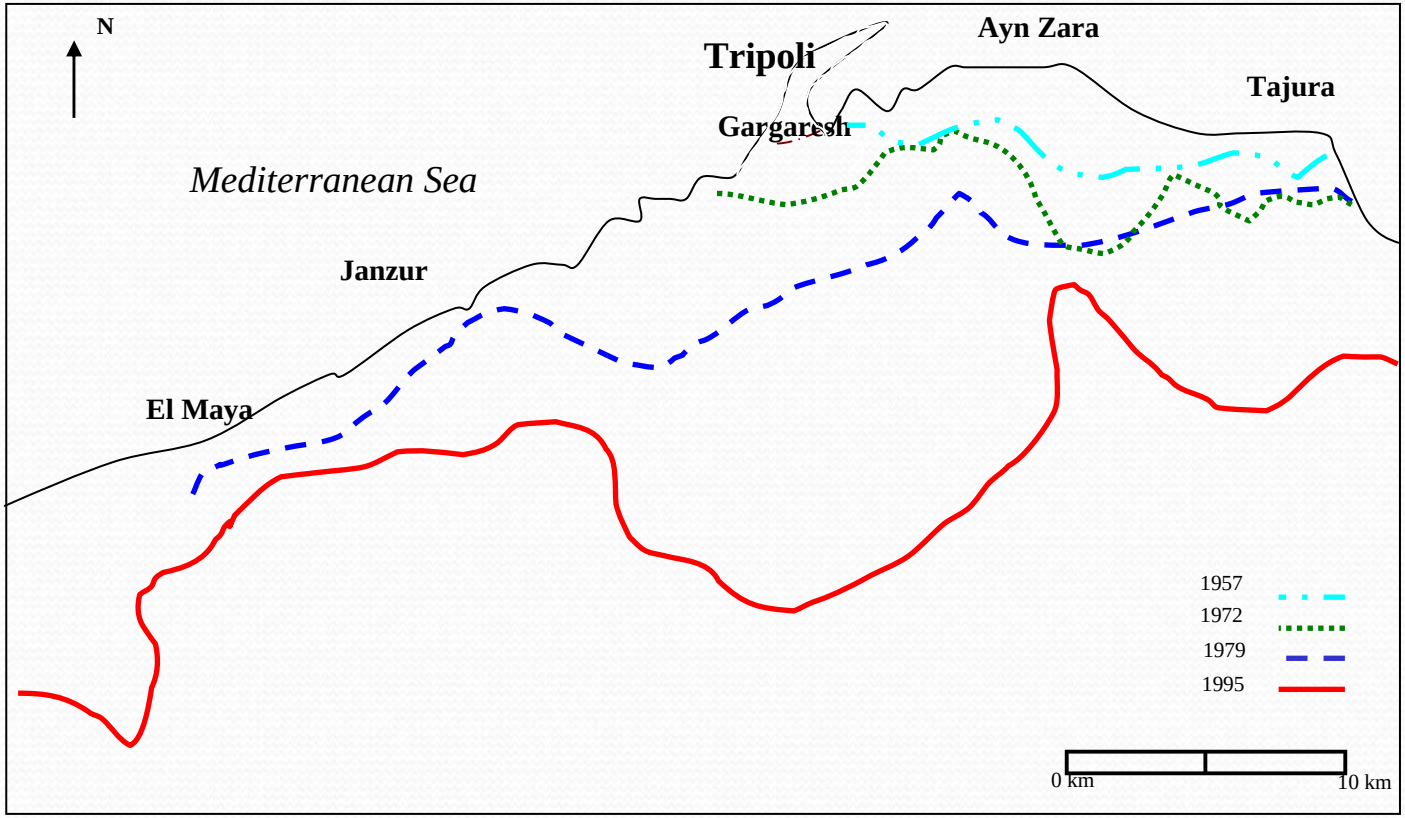




Lowering of the piezometric head in Jiffarh Plain



Sea water intrusion in Tripoli area



10.0 Water Strategy:

A national water strategy covering the period 2000-2025 was prepared and presented for endorsement in 1999. The main target of the strategy is:

- Minimize current trend of water budget deficit.
- Minimize the water quality deterioration.
- Lay foundation for a sustainable development.
- Enhance capacity building programs to human resources and institutional capacity.

11.0 Future Supply Options:

Future water supply will originate from the following main sources:

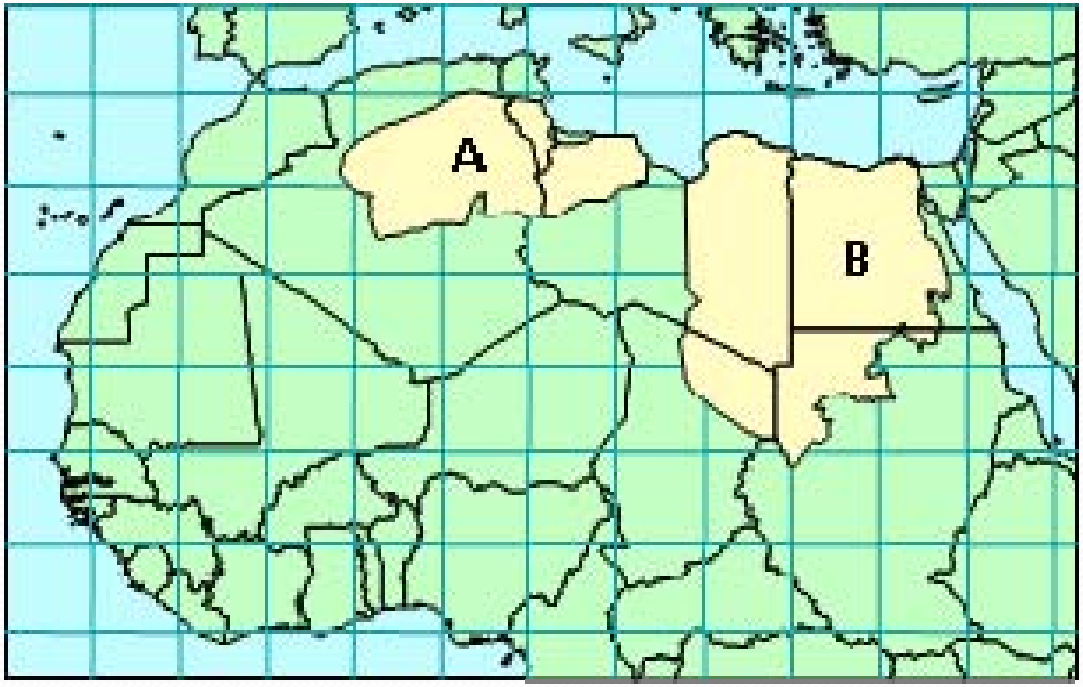
- Deep groundwater from large sedimentary aquifers in the south in addition to the currently exploited ones.
- Construct more Seawater desalination plants.
- Maximizing surface water resources by constructing more dams and reservoirs.
- Operating all sewage treatment plants at full scale and constructing additional ones.

12.0 Water Management Policy:

In fact a number of the proposed measures are in their way to implementation. The following are representative examples of such measures:

- Improving water use efficiency in the agricultural would by saving of approximately 2 billion m^3/year.
- Importing agricultural products as virtual water.
- Initiating an effective billing system based on regular readings of water meters.
- Charging the real cost of power and establishing a progressive tariff system to encourage water saving in irrigation.
- Enforcing water and agricultural legislations.
- Promote technical cooperation in the field of water resources management.

Shared Groundwater Basins



A- North Sahara Basin extends over a surface area of over one million Km^2, of which 700 000 Km^2 are in Algeria, 60 000 Km^2 in Tunisia and 250 000 Km^2 in Libya.

B- Nubian sandstone Basin extends over a surface area of over 2.2 million Km^2, of which more than 760 000 Km^2 are in Libya, 828 000 Km^2 in Egypt, 376 000 Km^2 in Sudan and 235 000 Km^2 in Libya.

The North Sahara Basin Study Project

- The North Sahara Basin contains two main groundwater aquifers: the Upper Jurassic–Lower Cretaceous sandstone, known regionally as the Continental Intercalaire (CI).
- The study of the basin started in July 1999 upon an agreement with IFAD for financing and other donars.
- The Observatory of Sahara and Sahel (OSS) was selected as an executing agency
- Tunis was chosen for hosting the project management team, which consists of representatives of the three countries.

The North Sahara Basin Study Project (continue)

- The first phase of the project was successfully completed, which represent the hydrogeological studies of the Continental Intercalaire (CI). Several workshops and training courses covering different activities of the project were organized, in addition to the supply of equipment, software and shearing database.
- The second phase of the project is financed mainly by the United Nations Food and Agriculture Organization (FAO) and partly by the concerned countries. This phase is concerned with the establishment of a consultation mechanism among the basin countries. It includes a review of current water resources legislation and proposing necessary amendments for better management of the shared resource. It will also improve the administrative systems and initiate a framework to realize free flow of information to meet development objectives. Implementation of this phase has already started and still working a head.

The Nubian Sandstone Basin

- A Joint Commission for the coordination between Libya and Egypt in managing the shared groundwater aquifer was established in 1989. Both Sudan and Chad joined the Commission at a later stage and became full members.
- The Nubian Sandstone Aquifer System Study Project started in 1998 with the Centre for Environment and Development in the Arab Region and Europe (CEDARE) as an executing agency.
- The project is financed in its first phase by the International Fund for Agricultural Development (IFAD) and with contribution from the concerned countries.

The Nubian Sandstone Basin (Continue)

- It aims at reviewing previous studies, establishing a regional data base and preparing a mathematical model capable of representing the aquifer condition and simulating its future behavior in response to planned development schemes.
- The model is prepared to predict the effect of future withdrawals on water levels and the extension of drawdown cones in neighboring countries.
- The project also aims at training national teams in different activities including the application of the mathematical model, databases, GIS, and the use of advanced monitoring equipment.

Vision of Libya
On Joint Spain and Algeria initiative for water Strategy in the western Mediterranean basin

Feb.2014

Libya has examined the initiative and make sure the approval of its importance in the implementation of the human right to access the clean water , sanitation and clean environment for the countries of the Western Mediterranean basin.

To achieve the goals of the initiative , Libya has a vision as follows:

1. The establishment of an agency or organization concerned with water resources and sustainability of the basin states west of the Mediterranean , to be its headquarters in Spain , and a branch office in Algeria , or vice versa .
2. The agency or institution should has a Board of Directors consists of a members from the countries of the western Mediterranean basin, donors and other agency interested in water .

3 . The agency or institution should has a general manager and his deputy , the administration are rotated every two years among the members of the countries of the western Mediterranean basin .

4 . Preparation workshops twice a year related to water resources and the experiences of countries in solving the problems of water scarcity , to be hosted by each state only one workshop .

5 . Start processing Website cares water affairs of the 5+5 countries .

6 . Preparation of a common database of water resources for the 5 +5 countries .

7 . Preparation of specialized training courses for the staff of institutions interested in the water of the 5 +5 countries .

8 . Exchange of experts between the countries, and to encourage them to work and knowledge transfer between the institutions of the 5 +5 countries interested in water resources.

9 . Field visits to projects concerned with the preservation of water wastage .

10 . Introducing the modern technologies in the research, development and exploitation of water resources in the 5+5 countries .

11 . The province on the Mediterranean Sea shores from any types of pollution by the 5 +5 countries .

THANKS ALL