Agricultural Journal 1(3): 128-135, 2006

Problems and Particular Characteristics of Algeria's Water Resources

[1]H. Amarchi, [2]C. Cudennec and[3] M. Hamami
[1]Deparment of Hydraulic Badji Mokhtar University, Bp 12 Annaba 23000, Algeria
[2] IRD, UMR G-EAU, BP 434, El Menzah 4, 1004 Tunis, Tunisie
[3]Deparment of Civil Engineering, Skikda University, Bp 26, 21000 Algeria

Abstract: According to the world organization UNESCO in 2025, Algeria will have a deficit of one billion cubic meters of water if good control and management of its non-conventional resources are not made. Rainfall and demographic records over several years of the area around the Seybouse river has enabled the study of the actual water resources in order to develop a new strategy for its storage management and distribution. The quantity of water allowed and its need for social and economic development have shown a great shortage and a huge deficit in the distribution. Therefore, in the long term a better management for an optimal use of these resources has to be established by elaboration for other solutions.

Key words: Water resources, management, provisioning

INTRODUCTION

The deficit of water is a major problem in many countries and if the demand doesn't decrease[1]. The situation will become critical in certain countries till 2025. In the Mediterranean basin countries, where the climate is characterized by a great season variety of precipitation, its flow is concentrated in winter period. This season variety is doubled by annual variety. In the most of these countries water is under risks to become a limiting factor of future development and the object of competition between its different potential sectors. At present in many regions the demand exceeds renewable annual resources. In Algeria, the precipitation falling particularly during winter months affects in general the northern belt and varies greatly from year to year[2] .

This irregularity introduces a risky element and makes difficult the evaluation of real water opportunity cost. It needs expensive storage installations to use season and annual fluxes and mechanisms of systematic intervention to face a drought period. This is a regional peculiarity and that's why huge investments were put in water storage development. Since the independence water needs of the country in consumption, in agriculture and industry. This water need destined to consumption or to productive or service sectors is increased from day to day by growing number of inhabitants and as a result the galloping extension of cities and towns from one side and agricultural and industrial machinery expansion from the other one that engendered evident imbalance of supply and demand[3]. Drinking water shortage touching a great number of cities and towns suffering from that problem in different degrees from one side and agricultural and industrial need are far to be satisfied despite the importance of both these sectors playing predominant role in production augmentation and output improvement especially that our country takes into account its resources and possibilities to realize its development projects.

The present study was inspired by recommendations of the United Nations Conference (Johannesburg 2002) and the works of the 3d Water World Forum (Kyoto 2003) that had underlined the priority of organization of water resource management on scale of natural geographic limits what is pouring basin. It admits a synthetic vision accompanied by regional data inserting in that context . It covers the Seybouse pouring basin permitting the confrontation of water supply and demand in conformity with long-term socio-economic development.

Water in algeria: Water resources used for different needs come from surface waters (representing brook flows fed by the precipitation) that can be mobilized partially in weirs and retained in various dimensions and subterranean waters accumulated in shrouds surcharged by infiltration of some rainfall[4]

The precipitation varies from 2000 mm a year on high relief of the tellien atlas to less than 100mm in the north of Sahara. Rainfall decreases from east to west , it is badly distributed in space and time. About 75% renewable resources are concentrated on 6% of national territory . The hydrographic network is represented only by rivulet, practically dry the most part of the year. In the Sahara

Corresponding Author: H. Amarchi, Deparment of Hydraulic Badji Mokhtar University, Bp 12 Annaba 23000, Algeria

there are deep fossilized shrouds. In the north shroud distribution and geological function correspond generally to rainfall that permits to say that in Algeria water resource is limited. The precipitation falling during a year increases to 12.5 milliards of cubic meters. However insufficient storage potentialities (56 weirs are now in exploitation) allow to exploit only 4,7 milliard of cubic meters, the rest returning to the sea[5].

The potential resources of surface and subterranean waters are estimated in 19.4 milliard of cubic meters, renewable every year. They are localized in the next way:

- 60% in the north are 11.64 milliards of cubic meters
- 13% in the high plateaus are 2.52 milliards of cubic meters
- 27 % in the south are 5.24 milliards of cubic meters.

The major part of flows is 83% situated in the tell 18% in the west, 41% in the east and 24% in the centre. Paradoxically it is the north-west region the least irrigated that disposes one of the best county soil potential.

As a whole water resources are evaluated in 19.4 milliards of cubic meters distributed in:

- 12.5 milliards of cubic meters of surface flows
- 1.8 milliards of cubic meters for subterranean water resources in the north
- 4.9 milliards of cubic meters for subterranean water resources of Sahara.

The first difficulty arises as soon as mobilized activities are not sufficient, the potentiality being reduced to 12.4 milliards of cubic meters. If they consider that actual mobilization hardly reaches to satisfy needs of one half of the population and that alarming prospects in increase of population with demand of 2.4 milliard of cubic meters for 30 millions in present and of 3.6 milliard of cubic meters for 44 millions in 2020. In agriculture at present there are more than 400000 hectares of irrigated surface that needs 2 milliard of cubic meters while supply is only 1.5 milliard of cubic meters while it will be 5 milliard of cubic meters for irrigated surface of seven million hectares. It is easy to conclude the imbalance and tension between using sectors(… agriculture and industry), especially as the part reserved to human consumption is increasing to about 16 % of distributed source that is able to attain 40% in 2025[6]. This increase will inevitably cause damage to agriculture and industry. In his situation Algeria is classified among the countries placed beyond shortage the threshold of water, internationally fixed at 1000 m^3/y/inh

New national water policy: The new national policy concerning water management is essentially based on two important laws, the law “TIAR 97” related to environment protection and the law “Code of water laws” aimed on introducing into practice the policy tending to assure rational water usage. It is based on the following principles:

- Management unity
- Integrant management
- Water economy
- Disconcentration
- Coordination
- Users participation
- Hydrologic cycle unity of hydrographic basin and hydraulic system maintenance
- Compatibility of water management with territory planning policy, environment and nature protection.

The national territory was cut into natural hydrographic units named hydrographic basins to introduce these principles into practice. Qualitative and quantitative conservation of water resources is conceived and ensured on a scale of all large hydrographic basins covering Algeria that are:

- Contantinous-Seybouse-Mellegues
- Algerious-Honda-Soumam
- Cheliff-Zahrez
- Oranie-Chott-Chergui
- Sahara.

The last basin constitutes a special case in compliance with the exclusive existence of subterranean resources in general contained in large fossilized shrouds[7].

The hydrographic basin constitutes a frame of concertation and participation where elected, users and administration representatives debate the water problems in that natural unit inside hydrographic basin committee disposing a management instrument that is the basin agency administrated by an administration council (Fig.1)

The main purpose of this new organ is to ameliorate pouring basin management and integrate adoption in the planning and local culture. This new policy impels us to make an inventory of water resources of the Seybouse pouring basin. Such a total list can be a base in long term planning of water resources exploitation.

Geographic presentation of the seybouse: The Seybouse pouring basin situated in the north-east of Algeria (Fig.2) occupies the third place by its surface after the El-kebir of Rumel rivulet and the Mellegue rivulet.

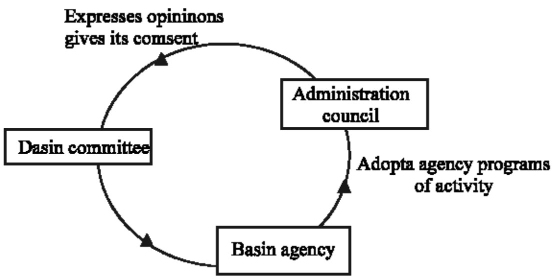

Fig. 1: Hydrographic basin organization and management

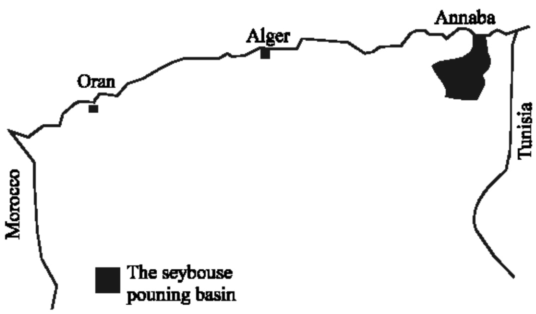

Fig. 2: Situation of the Seybouse pouring basin

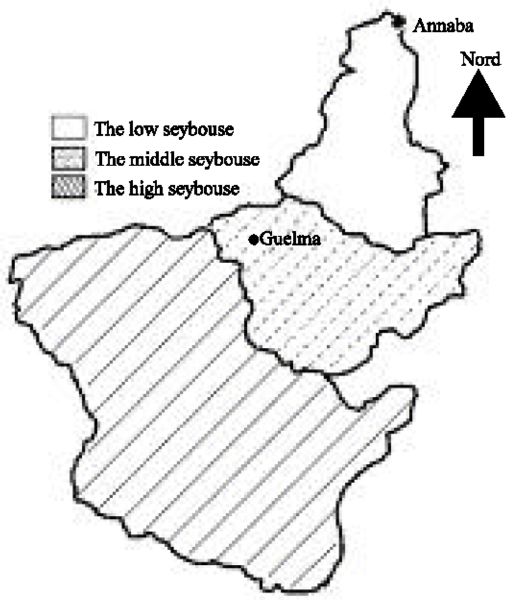

Fig. 3: Map of three Seybouse principal sub basins

The Seybouse, mediterranean rivulet, takes its origin in the high semiarid plains on the southern reverse side of tellien atlas[8]. It flows from south to north. The Seybouse basin comprises three principal zones (Fig. 3):

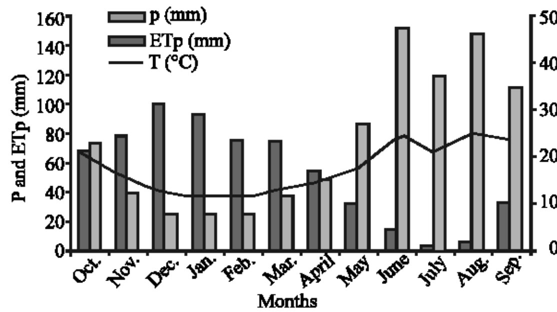

Fig. 4: Pluviothermic diagram

- the high Seybouse sub-basin
- the middle Seybouse sub-basin
- the low Seybouse sub-basin

The high Seybouse consists essentially of Sedrata plain and Tamlouka plain. The middle Seybouse consists of the low Charef, of the Bouhamdane rivulet basin, the Guelma low place and the Maleh rivulet basin. The low Seybouse constitutes principally of Annaba subsidence plain. It embraces the territory of 6570m^2 where the population of more than 1 258 710 inhabitants[9] live and comprises 6 Wilayas and 68 communes, its vegetable covering is 30%. This is a region of agricultural destination with large modern irrigation perimeters (by shrinkling). It includes twenty industrial units, five units being of great importance. The Seybouse basin presents a ramified hydrographic system of more than 3000 km, fourty two rivulets haing the length to 10 km. It presents very heterogenous natural group that engenders different supply and flow ways.

The seybouse climatic context: This basin is characterized by a pluvial season from October to May and by warm and dry summer. The warm season is marked by general temperature augmentation[10]. The pluviothermic diagram (Fig. 4) allows to reconstitute a water cycle in the Seybouse soil, that one is determined in a more or less exact manner taking into consideration the following parameters: Precipitation, temperature, vegetation necessities, evaporation and potential evapotranspiration. Thus they can identify four following stages:

- From October to December precipitation is quite important to have the reconstitution of reserves
- From January to March they register a surplus because of violent rainfalls during the winter period
- Starting in March precipitation having been reduced and higher evapotranspiration, the reserves are not more supplied. Therefore, the necessities are deducted on their levels: stage of reserve using,

Table 1: Average annual contribution of the seybouse

Sub basin	Gauge station	Rivulet	Average annual contribution (Mm^3)1970/71-2002/03
The high Seybouse	Moulin Rochefort	Charef rivulet	28,90
	Medjez Amar	Bouhamdane rivulet	83,30
Maleh rivulet sub basin	Bouchegouf	Maleh rivulet	96,60
Ghassoul rivulet sub basin	Ain Berda	Ghassoul rivulet	12,75
The middle Seybouse	Mirebek	Seybouse rivulet	338,30
Total			559,85

Table 2: Mobilized water volume in weirs

Sub basin	Name	Capacity (Mm^3)	Regular volume (Mm^3)	Destination
The high seybouse	Tiffeche	5,80	4,00	Irrigation + AEP
	Foum ElKhanga	157	50	Irrigation + AEP
	Medjez Elbgare	2,86	2,00	Irrig. + AEP + AEI
The high Seybouse	Bouhamdane	200	55	Irrigation + AEP
	Total	365,66	111	

Table 3: Mobilized water volume in hill water collectors

Sub basin	Number of hill water collectors	Capacity (m^3)
The high Seybouse	04	200 000
The middle Seybouse	07	118 000
The low Seybouse	20	3 520 000
Total	31	3 838 000

- After reserve using and its exhaust in June this results in the last stage of water cycle that is the water deficit. The issue is negative till reserve reconstitution starting in October.

The basic element coming out of that analysis is in existence of two clearly differentiated periods in a year. Summer period effect (from May to October) is not without consequences, anticyclone air mass stagnation on the Algerian extreme north-east often provokes pluvial deficit and strong evapotranspiration from 890mm in the low Seybouse and from 930mm in the middle Seybouse where water deficit is characterized by sometimes long shoals. The cool season (from November to April) is characterized by sudden temperature lowering followed by intense rainfall, varying from 350 mm to 900 mm that plays role in the Seybouse pluvial supply, contributes to the plain subterranean reserve accumulation, provokes floods and accentuates water management problems

The seybouse surface water

Water potential: The hydrographic network covers heterogeneous region group essentially with the Charef rivulet running into the Guelma basin, the Bouhamdane rivulet continuing in the Zenati rivulet in Medjez Amar in lower place of the Bouhamdane weir and the Maleh rivulet in Bouchegouf and the Seybouse[7]. Despite the importance of flowing volumes about 660 Mm^3/y it is limited water quantity that is giving now volume 111 Mm^3. This surface water potential is limited by Medjez Elbgare, Bouhamdane, Foum Elkhanga and Tiffeche weirs and by hill water collectors (Table 1).

Surface water mobilization: The surface water mobilization of the Seybouse pouring basin is resumed in two types:

Weirs: The Seybouse basin has mobilized water volume in four weirs (Table 2).

Hill water collectors: More than fifty hill water collectors are unitied in the Seybouse pouring basin group, twenty of them being out of exploitation because of their unreliability. Mobilized water volume according to the sub basins is presented in (Table 3).

The seybouse subterranean water

Mobilization and water potential: Lithology and hydrogeology of the basin are characterized by:

The high plain quaternary presents not thick permeable alluvia sometimes discontinued, often covered by impermeable limestone crust that explains temporary flowing violence in this sub basin. As for the middle Seybouse, it consists of rocks where areas of impermeable covering are characterized by a weak retention capacity without regulation action namely in the Zenati-Medjez Amar rivulet sector[11].

Crumbled and dislocated limestone and marl-limestone relatively irrigated come out in the south of the Guelma and in the Maleh rivulet upper basin. These karstic formations have a good retention capacity and can bear water expenditures in shoal periods of the middle Seybouse right bank tributaries. However the existence of many gypsum trias outcrops met due to diaper folds pollute the surface water when passing through.

Table 4: The Seybouse water bearing system

Sub basin	Water bearing	Surface (Km^2)	Efficient porosity %	Renewable reserves (Mm^3)	Mobilization (l/s)	Mobilization (Mm^3/y)
The high seybouse						
Hig charef	Trouch-O.AinSnob rivulet plain	440	0,15	6,00	80	2,50
	Tiffeche rivulet plain	200	0,10	3,00	30	0,90
	Sedrata plain	190	0,10	1,90	20	0,60
low charef	Tamlouka plain	470	0,15	8,40	157	4,95
	Ain hassainia Selaoua zone	120	0,20	3,60	25	0,75
The middle seybouse						
Bouhamdane rivulet	Bouhemdane rivulet	200	0,10	4,00	63	1,98
Guelma basin	Guelma Plain	740	2	22,00	324	10,20
Maleh rivulet	Bouchegouf Plain	101	5	35,00	156	4,90
The low seybouse						
Annaba plain	Recent and actual alluvia	320	13	40,00	494	15,56
	Dunaire vein	10	10	3,00	86	2,71
	Gravel	300	0,20	13,00	173	5,45
	Cipolin	80	0,5	2,00	25	0,75
	Total			141,90	1633	51,25

The low Seybouse is not very permeable in the up-river sector, despite dense vegetation covering soil and rainfall it doesn't practically contain subterranean water. At last quaternary alluvia of the west plain of Annaba are permeable and contain considerable water bearing levels.

In the whole the Seybouse basin is poor in subterranean water. Taking into consideration great rock lithology and permeability, there are many small scattered shrouds and those of limited supply in the basin (Table 4).

In the high Seybouse phreatic shrouds presenting not deep water reserves in sedimentary materials with interstice permeability being exploited by 13 bore holes and wells, where the expenditures vary from 2 l/s to 20 l/s, can be found. In the middle Seybouse or more precisely in Guelma low place there are two shrouds. The first is formed by gravels, sands and pebbles. It can be noticed that this valley substratum is constituted of gypsum and clay marls in the western part of the plain and of clay and numidien sand stone in the eastern part. This shroud depth increases to the east, it is about 8 m in the north of Guelma town and reaches 16 m in the north-east of Boumahra. The second shroud is presented by an important water bearing system situated in the south of the Seybouse rivulet, it is formed of plio-quarternary alluvia (pebbles, sandstone, gravel, sand and some clay levels). The surface stratum shows pure clay affinity while quaternary alluvia are thickened and less raised than pliocene ones. On the contrary the formations constituting the substratum are the miocene part. They are spread on the surface for 330 km^2. These two shrouds are drained by 23 bore holes and wells, their expenditure varying from 71 l/s to 23 l/s.

The other very important subterranean water reserve is situated in the Maleh rivulet basin named Bouchegouf shroud, its water is generally manifesting sodium chloride that corroborates strong salinity of this subterranean water represented by a shroud with average water bearing thickness 70 m, 5% efficient porosity and 101 km^2 surface. This shroud is exploited essentially by 11 bore holes and wells with expenditure varying between 3 l/s and 30 l/s that supply Bouchegouf town and close agglomeration.

In the low Seybouse there are two shroud types situated in the west plain of Annaba town. They are located in plio-quaternary alluvia and dunaire massif. The first is situated on the metamorphic massif flank of Annaba, with thickness 15 m, drained by 34 bore holes and wells with expenditure varying from 3 l/s to 22 l/s. The second is a free shroud of dunaire vein, its thickness varying from 15 m (in Annaba) to 120 in the east, exploited by expenditure varying from 3 l/s to 25 l/s[12].

It seems that water bearing system of the low Seybouse globalizes the subterranean water potential of 58 Mm^3. That one of Bouchegouf plain totalizes a potential renewable reserve of 35 Mm^3, unfortunately it is characterized by strong salinity. As for Guelma low place water bearing system, it shows a potential volume of 22 Mm^3. These reserves are situated in plio-quaternary formations with volume of about 142 Mm^3 with extracted subterranean mobilization of different bore holes and wells of 51,25 Mm^3 that is 36% of the renewable reserve of the Seybouse basin water bearing system. That illustrates well this large basin poverty in exploited and renewable subterranean water.

Actual situation of drinking water supply: The estimation of need is based both on socio-economic realities of each locality and annual natural increase rate of population. In the evaluation of need there are no distinction between pure water of home use and municipal need. All delivered water is drinkable or used. Urban and rural population concerned by this research essentially consists of

Table 5: Industrial water need and given volume

Sub basin	Name	Actual need m^3/d	Actual need Mm^3/y	Volume alloué m^3/d	Volume alloué Mm^3/y	Déficit observé m^3/d	Déficit observé Mm^3/y
The low Seybouse							
	Sidérurgie El-Hadjar	45200	16,50	30000	10,95	15200	5,55
	Asmidal	18648	6,80	7000	2,55	6720	2,45
	Production et distribution de gaz industriel	1060	0,39	890	0,33	170	0,06
	ENATB	967	0,35	660	0,24	307	0,11
	ENCG	1245	0,45	873	0.32	372	0,14
	ERIAD	900	0,33	610	0,22	290	0,11
	ORLAIT	1860	0,68	1500	0,55	360	0,13
	Transformation de tomates	780	0,28	460	0,17	320	0,12
	Autres petites unités industrielles	980	0,36	450	0,16	530	0,19
	Raffinerie de sucre	2560	0,93	1680	0,61	880	0,32
	Céramique et réfractaire	964	0,35	670	0,24	294	0,11
	SONACOM	820	0,30	625	0,23	195	0,07
The middle Seybouse	Fabrication de levure sèche et fraîche	960	0.35	482	0.18	478	0,17
	Elevage Avicole	160	0.06	144	0.05	16	0,01
	Autres petites unités industrielles	345	0.13	230	0.08	115	0,04
The low Seybouse	Fabrication de Serrures	45	0.02	25	0.01	20	0,008
	Fabrication de cahiers	20	0.008	15	0.006	5	0,002
	Autres petites unités industrielles	115	0.04	85	0.03	30	0,01
	Total	77629	28,33	46,399	16,93	26302	9,60

Table 6: Irrigation dose for a crop type

Type of crop	Industrial crops	Vegetable crops	Fallow	Fodder crops	Grain crops	Horticulture
Necessities (m^3/ha)	4300	3700	4000	7800	7500	8200

Average dose for a hectare (theoric necessities) (m^3/ha/y) = 5617

Annaba and Guelma towns. It is increasing with actual average rate of 18,02% for Guelma region and 18,51% for Annaba region[7,13].

At present net subsidy in the high Seybouse localities varies between 36 l/d/inh in Sellaoua (25 km in the south-wast of Guelma) and 309 l/d/inh in Ain Trab (Zenati rivulet) with average subsidy in this area 105 l/d/inh. In the middle Seybouse (Guelma-Bouchegouf) net subsidy varies from 13 l/d/inh in Bendjerah (village situated in 10 km to the south of Guelma) and from 270 l/d/inh in Dahouara (village situated in 20 km to the north-est of Guelma). It is from 49 l/d/inh in Guelma, the main town in the region which counts 122 955 inhabitants at the moment. Average subsidy in this sub basin is 86 l/d/inh. In the low Seybouse net subsidy is 43 l/d/inh in Ain Berda, 151 l/d/inh in Bregougua (locality situated in 15 km to the south of Annaba town) and 83 l/d/inh in Annaba town that counts the population of 276 516 inhabitants[9]. Average subsidy in that sub basin is 57 l/d/inh. Average subsidy in the whole Seybouse basin is 85 l/d/inh[13]. In the most towns and villages of the Seybouse basin the problem of water supply is not solved and the satisfaction of need is in constant evolution and demands urgent interventions. This deficit state is aggravated in summer period that is from June to September when the demand is maximum.

The industries and water using types in the seybouse: The new industrial implantations clashed with the problem of water delivery as in any part of Algeria. The implantation of metallurgical works in the low Seybouse in 12 km to the south of Annaba town engendered the creation of other industrial units in this basin such as phosphate fertilizer complex, between the old and the new mouth of the Seybouse rivulet, treating on the place phosphate from Djebel Onk, ceramic works treating kaolin from djebel Debagh, sugar refinery, the Sonacom of Guelma and many other agro-food units (Table 5), because the industrial development is very marked in this basin thanks to the privatization policy in this sector without any doubt[13,11].

Citing the case of metallurgical works supplied by water of Bounamoussa weir, by hill reservoir of 24 000 m^3 capacity and by seven bore holes with global absorbing expenditure is 220 l/s and 7 Mm^3/y but extra exploitation of shroud in summer results in general level abatement and increases salinity. All these sources are not sufficient and observed deficit is satisfied partially by irregular throwing of Bouhamdane dam. The present mobilized volume is 30 000 m^3/d and 10,95 Mm^3/y while necessities exceed 45 200 m^3/d and 16,50 Mm^3/y while the recycled volume is insignificant because of purification station damage which is situated inside of that one.

The conclusion can be drawn that present industrial water necessities are 28,33 Mm^3/y while given volume is 16,93 Mm^3/y covering only 60%.

Agricultural water and its using in the seybouse basin: The necessity of developing irrigated agriculture was always one of the main tasks. In Algeria, the water priority

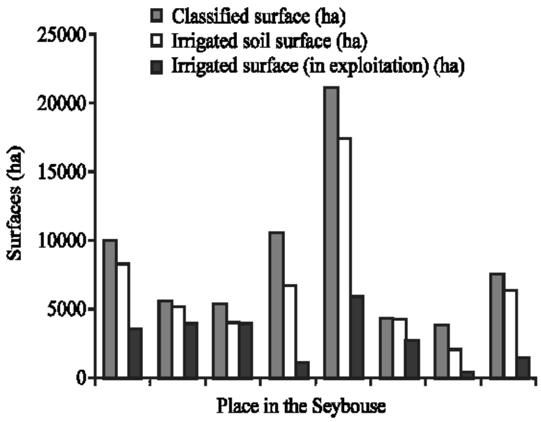

Fig. 5: Irrigated soil potential of the seybouse

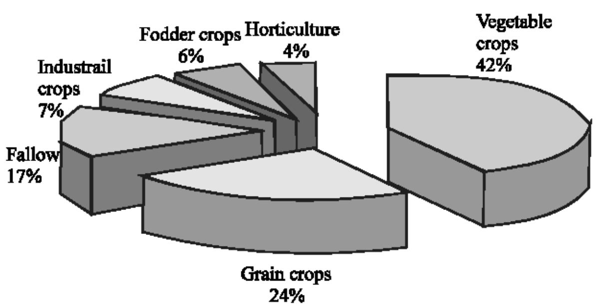

Fig. 6: Crop distribution in the Seybouse pouring basin

being given essentially to home using and then to industrial using, the irrigation is often sacrificed to the profit of those two last sectors and benefits weaker guaranty level of quantitative water needs[14]. Moreover it constitutes the most difficult calculated sector as for surface and water effective needs (Fig. 5)

In the whole irrigated agricultural surface in the Seybouse basin registered a small evolution despite accommodations such as the construction of four dams, two of which are of great capacity.

In present there are 23 182 ha presenting a proportion of 43% of irrigated surface and 34% of classified surface. Irrigation water needs vary according to the type of a crop, irrigated surface, climatic conditions and used irrigation techniques. The Table 6 resumes actual situation of grown crops:

From the point of view of soil occupation by different crops, vegetable crops go in the first rank with 41,93%, grain crops 23,86%, fallow 16,90%, industrial crops 6,92%, fodder crops 6,01% and horticulture 4,37% (Fig. 6)

The irrigation in the high Seybouse is performed by 54%, in the middle Seybouse by 26% and in the low Seybouse by 20% on total irrigated surface of the basin. Water need for irrigation in the high Seybouse counts the surface of 12 616 ha, increases to 70,86 Mm^3/y, in the middle Seybouse increases to 33,40 Mm^3/y for 5947 ha of the surface and in the low Seybouse 25,95 Mm^3/y for 4619 ha of the surface.

In the total annual irrigation water necessities in the Seybouse with the standard of 5617 m^3/ha are 130,2 Mm^3/y, this figure being relatively very important as for actual mobilized resources. They considered that it is necessary to revise these needs, taking locally practiced norm of 5000 m^3/ha, giving total need of 115,91 Mm^3/y. The irrigation in this basin is done in 100% because surface and subterranean water contributes greatly to the drinking and industrial water supply.

RESULTS AND DISCUSSION

Subterranean resources and their relation with surface water present great differences, 142 Mm^3 for the first and 560 Mm^3 for the second. The surface water is better controlled but hardly used, except accommodation, especially in the low Seybouse where necessities in drinking, industrial and agricultural water grow.

Table 7 shows important insufficiency in 2004 (year of reference). We mean at the first place the deviation between drinking water consumption for inhabitants of that region (150 l/d/inh) and given volume. The deviation increases to 27,85 Mm^3. The deviation between industrial water need and given volume is 11,40 Mm^3, for irrigation need it greatly exceeds given volume.

Total need for three using sectors (Fig. 7) in 2004 is 208,50 Mm^3/y while for the same year the mobilization is only 166,09 Mm^3/y, the deficit is 42,41 Mm^3/y.

In all the studies mobilization capacity is very weak before hydric potentialities if this basin with important increase of total need. Accumulated and forseen necessities deficit for different users oblige to elaborate other solutions such as:

- Maximum mobilization of surface resources and its objectif priority
- The fight against disforestation and its deep penetration into culture allow to decrease evapotranspiration and flowing
- Decrease of alluvium work
- Strong management of water capacity and drop irrigation technique
- Decrease of waste due to drinking water supply network
- Decrease of rivulet water and environment pollution by purifying stations of used water implantation, having known that there is such a station in Annaba in the Seybouse

Table 7: Evolution of need in millions of cubic meters (Mm³/y) in the seybouse

	Year						
Necessities (m³/y)	1998	2004	2010	2015	2020	2025	2030
AEP (150l/j/hab)	57,69	64,26	71,57	78,29	85,65	93,69	102,5
AEA (5000 m³/ha)	51,25	115,91	162,5	195	225	269	293,75
AEI (740 m³/EI/an)	22,85	28,33	35,25	44,85	49,4	55,9	62,35
Total	131,79	208,50	269,32	318,14	360,05	418,59	458,6

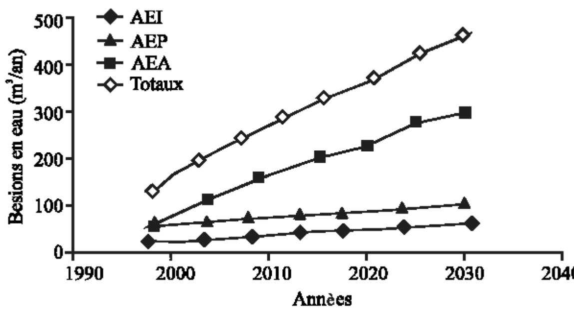

Fig. 7: Evolution of total need in AEP, AEA, AEI

- Utilization of purified used water in industry, irrigation and shroud supply.
- Mediterranean water dissalinity as soon as the technology is mastered and the cost is considerably reduced.

CONCLUSION

In the most of towns and villages of the Seybouse basin the problem of water supply is not solved and urgent interventions must be done to satisfy increasing necessities. This deficit state is more aggravated in summer season from Juin to September when there is maximum demand. That's why there are many things to do in surface water mobilization, surface treatment of the Seybouse pouring basin to reduce alluvium phenomena because the last present weak vegetable covering. It is important to start rational managing of distribution and purification networks having known that practiced management revealed itself very insufficient in water waste and pollution of the Seybouse by different home and industrial waste water. We must notify that the cost of a cubic meter is practically symbolic. It is time to be oriented to the development of used water recycling and sea water dissalinity methods.

REFERENCES

1. Review of hydraulic establishments activity, 1992. Investment program center of cooperation, Rome, FAO world bank. Issue 4/92 (Algeria) pp: 36-20.
2. Water in Algeria from imperialism to the development, 1985. (1830-1962), RENE ARRUS. OPU Edition, Alger, ¹ 81-OF-1184.
3. Water in Algeria challenge of tomorrow, 2000. Before project of evaluation . National Economic and Social Council. XVth plenary session. Juin.
4. Mebarki, A., 1984. Water resources and planning in Algeria: The Rhumel basin. OPU Edition, ¹1212-09-84. Alger, pp: 302.
5. Ruighi, M., 1987. Hydrology: Key Sector. Minister of Hydrology, environment and forests. Daily El Moudjahed.
6. Benmouffok, B., 2003. To take the responsibility of irrigation in Algeria. A.G.I.D. 4th Forum of water demand management. Cairo, Egypt.
7. NAHR, 2004. National Agency of Hydraulic Resources. Regional direction, Constantine. Data.
8. Ghachi, A., 1986. Hydrology and water resources utilization in Algeria. OPU Edition. Alger.
9. National Office of Statistics (NOS), 1977. General census of the population and the habitat (GCPH).
10. National Office of ONM Metrology Data, 2004.
11. Hydraulic direction of Guelma region Data, 2004.
12. Bousnoubra, H., N. Chettab, N. Kherici and C.L. et Rousset, 2004. Evaluation des ressources en eau dans le système aquifère sud méditerranéen exemple de Annaba-El-Tarf (Nord Est de l'Algérie).RST Synthèse N°13.
13. Algerian Waters, 2004. (AW): Annaba Direction. Data.
14. Mechebbek, M.A., 1993. Water resources, irrigation, food production, summary presentation of Algeria. Ministry of Equipment CIHEM-AMB, (Mediterranean Option copy-books V.1(1)), pp: 237-280.