

IMPACT OF HUMAN ACTIVITIES ON WATER AND THE ENVIRONMENT CASE OF THE EXTRACTION OF ALLUVIAL SAND AND POLLUTION OF THE WATER TABLE IN THE MIDDLE SEBAOU

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Abstract—The Middle Sebaou undergoes significant degradation along its course and becomes a complete dump of industrial and domestic waste as well as agricultural pollution from the use of significant quantities of chemical fertilizers. These factors seriously threaten groundwater resources Sebaou, which are closely related to water surfaces fact that the water table is free in its major part of the aquifer. We also note that in addition to pollution from various releases that knows the water table of Sebaou. The anarchic and uncontrolled extraction of sand and silt from the bed of the wadi; real protector filter the groundwater table was that the web has become very vulnerable to any possible pollution. Several studies have been conducted to try to reach the end of water pollution and to find a harmonious solution of exploitation and conservation of these resources. It is in this context that fits our study of the impact of human activities on the environment and pollution the groundwater table in the Sebaou middle. The objective through this study is based on the interpretation of physicochemical analysis of wadi Sebaou water and assess the evolution of the qualitative aspects of the resource and to highlight the groundwater-surface water interactions and secondly to determine the relationship pollution / sand extraction.

Index Terms—Sebaou, pollution, ground water, sand extraction, anthropogenic Actions.

1 INTRODUCTION

The river systems of Kabylia are faced with a proven danger due to various anthropogenic stresses. Sebaou middle, contains a significant water potential groundwater and surface water. Wadi Sebaou that the primary source of drinking water in the wilaya of Tizi-Ouzou is dangerously threatened by pollution and unbridled extraction of sand. It represents the primary natural drain the water table and serves at the same receptacle of time to the set of domestic or industrial discards of agglomerations in its watershed (Mr. Salah Alioui 2004). It notes that the floodplain is Sebaou preferential deposits sand and gravel including provision the raw material for construction sites and work in the wilaya of Tizi-Ouzou. The extraction of these alluvial materials; real protective filter of the underground water table caused that the water table has become very vulnerable to any possible pollution.

2 CHARACTERISTICS OF THE STUDY AREA:

The plain in question is located in the northern part of Algeria, and is part of the wilaya of Tizi-Ouzou, it is bounded by latitudes $36^{\circ} 46'20''$ and $36^{\circ} 42'$ North and longitudes $4^{\circ} 00'54''$ and $3^{\circ} 52'$ east (Figure 1). This perimeter is subject to a climate described as sub-humid where the marine influence is limited, characterized by a wet winter with average monthly

temperatures ranging from 10°C to 11°C and a hot, dry summer with temperatures vary depending on the year of 18°C and 35°C , with the order of precipitation of 800-900 mm / year.

From a geological point of view the middle Sebaou Valley has a filling basin by the Miocene and the Quaternary alluvial deposits. Alluvial deposits are groundwater reservoirs are drained by the river and its tributaries Sebaou, Bougdoura and sebt.

3WORKING METHOD

To estimate the quality of water Sebaou river, it was inspired by the results of water tests taken at the Sebaou river and its major tributaries, performed by (fig. 5):

- ANRH Bir mouradrais over ten years of 1985- 1995 (and Belloua Bougdoura);
- ANRH Bir Mourad rays of Belloua to Bougdoura (2012);
- Mellal. N in two companions of high and low water (1999/2000),
- Djemai Mohammed over a period of four years (2005-2008).

The physico-chemical analysis of surface water and groundwater is based on the following parameters: pH, temperature, conductivity, the chemical oxygen demand (COD), the biochemical oxygen demand (BOD 5), nitrogen compounds (NO^- , NO_2 and NH_4

+, phosphate (PO₄³⁻), Cl, Na, Ca, SO₄, HCO₃ ...
 For the impact of sand mining, we did a thorough investigation including pits and identify for sand mining impacts on the environment in general and groundwater in particular there were.

4 RESULTS

4.1 PHYSICAL PARAMETERS

a) SURFACE WATER

- 1985-1995, water of the middle sebaou on the level of the station of Balloua and the station of the Bougdoura Wadi present values of pH of 7.8 and 7.7 and values of conductivity of 753 and 1169 mg/l (Table n°1).

Table n°1: results of the physicochemical analyses (surface water ANRH 1985/1995)

	physico-chemicalParameters						
	PH			Conductivité			
Stations	moy	max	Min	moy	max	Min	
Belloua	7.8	8.7	7.2	753	1100	475	
Bougdoura	7.7	8	7.5	1169	2320	750	
	Parameters of pollution						
Stations	MES			DCO	DBO5		
Belloua	224			98	65		
Bougdoura	1528			122	240		
	chemicalparameters						
Stations	Ca	Mg	Na	K	Hco	Cl	So4
Belloua	69	29	38	5	221	54	68
Bougdoura	69	31	111	7	221	220	88

Table n° 2: standards of potability of water WHO (1986))

Paramètres	units	guide level	Maximum allowable values
T°	°C	12	25
PH	Unite PH	6.5 < PH < 8.5	9.5
Conductivité	µs/cm	400	1250
Chlorures	mg/l	25	200
Sulfates	mg/l	25	250
Calcium	mg/l	100	/
Magnésium	mg/l	30	50
Sodium	mg/l	20	100
Potassium	mg/l	10	12
Ammonium	mg/l	0.05	0.5
Nitrites	mg/l	0.01	0.1
Nitrates	mg/l	25	50
Fer	mg/l	0.05	0.2
Phosphore	mg/l	70	-

the values of pH which vary from 7.7 to 8.4, concerning conductivity water of the Sébaou means presents an important mineralisation with values

which vary from 657 to 2170 µs/cm and which exceed the standard of potability (table n°2), the temperatures are raised, they about 23 with 26°C by exceeding the standard are fixed has 25°C.

- January 2000, the values of pH and the temperature are in the norms set by France. On the other hand the values of conductivity presents an average mineralisation which exceed 400 µs/cm the standard of potability fixed by OMS.

Table n°3: results of the physicochemical analyses (water Mellal surface).

physico-chemicalParameters									
Basses eaux (juin 1999)				Hautes eaux (Janvier 2000)					
Stat	P H	T° C	Cond	PH	T°C	Cond			
S10	8.3	24	683						
S11	8.3	24	657						
S12	7.8	23	774	8.2	9	585			
S13				8	9	628			
S14	7.7	23	1066	8.1	10	980			
S15	7.5	25	2170	8	11	858			
S16	8.4	24	940	8.2	8	750			
S17	7.8	26	974	8	9	850			
Parameters of pollution									
Low water (June 1999)						High water (January 2000)			
	NH 4	NO 2	NO3	DCO	DBO	NO 2	NO 3	DC O	DBO
S10	0.3	1	1.05	9	15				
S11	0.05	0.9	0.77	29	8.5				
S12	0.2	0.06	1.34	12	0	0.06	5.3	49.2	3
S13						0.07	5	62.5	0
S14	2.21	0.13	0.47	36	4	0.1	5.5	58	0
S15	0.7	0.10	0.16	311.2	24.5	0.07	3.4	46	5
S16	0.3	0	0.08	15.2	2	0.07	1.9	17	4.5
S17	0.5	0	0	20.8	2	0.1	2	12	3
bacteriologicalanalysis									
stations		coliformes		E.C		streptocoques			
Pont de Bougie		>à 240/ml		>à 240/ml		>à 240/ml			
Bougdoura		//		//		//			
DBK		//		//		//			

b) GROUNDWATER:

- In June 1999, the values of temperature and pH respect the set norms of potability by OMS, concerning conductivity it presents an important mineralisation

and which exceed the standard of potability fixed by the OMS, which is of 400 $\mu\text{S}/\text{cm}$ (table n°4).

- In January 2000, the values of pH, temperature respect the norms set by France and they are in the norms of potability set by OMS, conductivity presents one important mineralisation raised which varies from 601 to 1152 $\mu\text{S}/\text{cm}$.

Table n°4: analysis physicochemical of the Mellal groundwater. NR1999/2000

physico-chemicalParameters								
1999(basses eaux)				2000(hautes eaux)				
st	PH	T C	Con d	PH	TC	Cond		
13	7.4	22. 5	601	7.6	18.9	605		
14	7.2	24	1152	7.3	17	945		
Paramètres de pollution								
st	NH 4	N O2	NO3	PO4	NH 4	NO2	NO3	PO4
13	0	0	0.7	0	0	0	1.5	0
14	0	0	2.2	0	0	0	2.8	0
bacteriologicalanalysis								
stat ion s	Germe totaux à37°C	Germes totaux à 22°C	Colifor mes totaux	colibacille s	Streptocoques fécaux			
13	30	05	00	00	17			
14	15	05	10	00	00			

- In October 2012, the results give an accentuated average mineralisation which varies 428 to 658 $\mu\text{S}/\text{cm}$, a pH respecting the standards and which varies from 7.7 to 8.1 (table n°5).

St	x	y	Nitrates	pH	CE $\mu\text{S}/\text{cm}$
f5	618310	385425	0	7,9	464
f31	613670	384440	65	7,4	1400
p-56	614293	382266	2	8	1086
f89	611080	383900	2	7,9	1500

4.2. PARAMETER OF POLLUTION

a) SURFACE WATER

- during the period 1985-

1995, the analyses of water of Sébaou means give a pollution excessive in MES, DBO5 and DCO and a notable pollution out of NO3.

- June 1999, water of the Sébaou means is characterized by a level of pollution moderated with excessive of DBO5, DCO and NO2, from where the value highest is recorded on the level in Wadi Bougdoura with a value of 24 mg/l for the DBO5 and 331.2 mg/l for the DCO, and 1 mg/l with the upstream of the sewage treatment plant of Boukhalfa (Sébaou Wadi), and a level of notable pollution for NH4 with a value of 2.21 mg/l has the downstream of COTITEX and ORLAC, the values of NO3 are normal.

- January 2000, the analyses show important concentrations in DCO and NO2 from where the level of pollution is moderate with excessive for the DCO with a high value of 62.5 mg/l on the level of the Sebti Wadi, and a pollution moderated with notable for the NO2 with 0.1 mg/l on the level of downstream of Tadmaït and has the downstream of COTITEX and ORLAC, the values of DBO5 and NO3 are in the norms set by the ANRH and France.

- 2005/2008 (high waters), water of the Sébaou middle have significant amounts in DBO5 and DCO with an excessive level of pollution. The period of low waters and characterized by a notable level of pollution of PO4 (table n°6 and 7)

Table 6: COD variation DBO5 period of high water Djemai 2005/2008

stations	PB	CS	RC	RA
DBO5	12	107	95	17
DCO	40	427	210	48

Table n°5: physicochemical analyses of groundwater ANRH 2012

Table 7: physico-chemical analyses period low tide
 Djemai 2005/2008

low water period					
stations	AVPSN	BS	AMCT	AVCT	KE
PO4	0.32	0.23	0.14	0.24	0.24
période des hautes eaux					
Ca	68.6	70.22	69.73	69.25	67.98
Mg	20.42	21.88	19.46	18.19	18.67
Na	38.29	46.02	49.01	48.8	49.3
K	5.18	5.61	5.56	5.62	5.82
Cl	68.2	129.77	73.6	73.18	65.38
So4	69.13	107.81	132.5	96.29	69.13
HCo3	254.37	262.66	254.74	250.22	257.71

B) UNDERGROUND WATERS

-June 1999 groundwater of Sebaou middle give normalcy to NO₃ with values of 0.7 mg / l at Boukhalfa and 2.2 mg / l to Tadmaït.

-January 2000 results show that the values of NO₃ are in the standards laid down by the ANRH where values vary from 1.5 to 2.8 mg / l.

- 2012, the values of NO₃ through Sebaou level range from 0 to 65 mg / l.

4.3 BACTERIOLOGICAL PARAMETERS

European regulations do not authorize the presence of faecal contamination germs (coliforms, E. coli and streptococci) in drinking water while the total germs standard has 37°C is fixed has 10/ml and has 22°C is has 100/ml.

A) GROUNDWATER

- In June 1999, at 22 ° C Station No. 13 and 14 have a lower bacterial flora 100 / ml. At 37 ° C the two stations have a greater than 10 / ml bacterial flora.

- In January 2000, at 22 ° C Station No. 13 has a bacterial flora exceed the established standard 100 cells per ml at 37 ° C the two stations have a bacterial flora of less than 10 / ml.

- 2005-2008, the Bacteriological analysis of underground water shows that all stations have a total contamination by germs, from which the bacterial flora vari 10 To- 450 germs per ml, while coliform contamination and streptococcus Draa Ben Khedda station has the highest values. (Table 8)

Table 8: bacteriological analysis period 2005/2008
 Djemai low water (water underground)

st	T AS	SN	M TI	DB K	M O	A F	TA D	ICH
Ger	70	35	450	10	20	10	350	45
colif	33	4	2	9	0	0	240	38
colib	0	0	5	0	0	0	0	38
Stre	13	0	240	0	0	0	120	0

4.4 CHEMICAL PARAMETERS

The results show that different companions mineralization and largest underground waters and surface water.

Table 9: chemical analysis period 2005/2008 Djemai low water (groundwater)

sta	TAS	SN	MTI	DBK	MO	AF	TA D	ICH
Ca	108. 2	131. 5	114. 6	106. 6	124. 2	96.1 9	93.7	117. 8
Mg	26.7 4	41.3 2	41.3 2	38.3 9	39.3 8	32.0 8	33.5 4	35.9 7
Na	32	49	60	90	90	110	70	54
K	6	4	4	4	5	4	4	4
Cl	63.3 2	87.4 4	18.5	174. 9	148. 5	165. 7	90.3 6	129. 1
HCO 3	290. 4	359. 8	35.3 8	374. 5	256. 2	70	70.2	102. 2
So4	61.2	125	101. 8	105. 8	202	286. 7	305	367. 2
No3	8.36	18.3 3	4.64	4.43	8.1	7.88	4.82	0.93

5 SAND MINING

The middle Sebaou undergoes for over three decades the negative effects of uncontrolled activity of extraction of aggregates. The opening of a sandpit in an alluvial aquifer is likely to cause impacts on the aquifer itself, but also on wadi related to it. At the outputs from the different performed throughout Sebaou wadi, we found this:

- Extraction of alluvium;
- Exposure of the water table in many places;
- Cratering reaching great depths and diameters;
- Disappearance places the aquifer;
- Destruction of banks fixing gabions and trees along the wadis (photo No. 1);



- Bank erosion causing the loss of agricultural lands (photo 2);



- Enlargement of the major bed of the wadi Sebaou;
- Collapse of the old bridge SidiNaaman and threat of collapse of several hydraulic works (photo 3);



- Waste discharges of liquid and solid waste in the wadis

6 INTERPRETATION AND DISCUSSION

6.1 INTERPRETATION OF RESULTS ANRH (1985-1995)

Successful results which have the analyzes of Wadi Sebaou at

Belloua and Bougdoura on a ten-year period, were used to estimate the quality of surface waters and make the following observation, the higher the conductivity value is recorded at Bougdoura with a value of $2320 \mu\text{S} / \text{cm}$ this high value implies significant mineralization (table 10), the PH of the water is slightly basic, analysis of pollution parameters revealed high concentration of COD ($122 \text{ mg} / \text{l}$) and BOD5 ($240 \text{ mg} / \text{l}$) at Bougdoura, chemical analysis revealed high levels of various ions at Belloua and Bougdoura particular HCO_3 , Cl, SO_4 , Na and Ca.

Table 10: Relationship conductivity / mineralization

Conductivity ($\mu\text{S} / \text{cm}$)	Appreciation
Conductivité < 100	very low mineralization
$100 < \text{conductivités} < 200$	low mineralization
$200 < \text{conductivités} < 333$	average mineralization
$333 < \text{conductivités} < 666$	accentuated average mineralization
$666 < \text{conductivités} < 1000$	significant mineralization
Conductivités > 1000	high mineralization

6.2 INTERPRETATION OF RESULTS MELLAL. N (1999/2000)

Analysis of physico-chemical parameters along the middle Sebaou shows that the temperature varies by season, the waters are characterized by a high average mineralization or conductivity varies from $657 \mu\text{S} / \text{cm}$ to $2170 \mu\text{S} / \text{cm}$ at low water and $585 \mu\text{S} / \text{cm}$ at $980 \mu\text{S} / \text{cm}$ high water, from which the highest value is recorded at Bougdoura (S17), all stations have a $\text{pH} > 7$, the waters are therefore incrusting. The values of COD varies from $9 \text{ mg} / \text{l}$ to $311.2 \text{ mg} / \text{l}$ in low water and $12 \text{ mg} / \text{l}$ to $62.5 \text{ mg} / \text{l}$ in high water, this value far exceeding the standard of $50 \text{ mg} / \text{l}$ is recorded level Bougdoura.

The surface water quality of Sebaou middle markedly deteriorating in part from the bridge plug to Tadmait. Germs encountered faecal contamination in surface waters from sewage discards. Groundwater is characterized by significant mineralization, the conductivity varies from $601 \mu\text{S} / \text{cm}$ A1152 $\mu\text{S} / \text{cm}$ at low water and $605 \mu\text{S} / \text{cm}$ at $945 \mu\text{S} / \text{cm}$ high water on pollution by the product cycle of the nitrogen, the water quality is good. The raw water from the alluvial aquifer of Sebaou is threatened by microbial pollution in fact the presence of coliforms and faecal streptococci show fecal contamination, the number of germs at 37°C undergoes fairly significant variations which is evidence of poor natural protection of groundwater and reflecting contamination of surface water infiltration.

6.3 INTERPRETATION OF RESULTS DJEMAI (2005-2008)

Through analysis of the results of physico-chemical parameters, chemical parameters and finding pollution parameters that surface waters are home to a mineral pollution of all kinds (organic nitrogen, phosphorus ...) reaching or exceeding locally the standards set by the ANRH (table 11) such as BOD5 that reaches 107 $\mu\text{s} / \text{cm}$ and COD which reached 427 $\mu\text{s} / \text{cm}$, the physico-chemical analysis is bacteriological groundwater reveal the presence abnormally high pathogenic bacteria.

Table 11: Presentation and definition of the four classes of quality of surface water (from ANRH, 2000).

Parameters	I normal situation	II moderate pollution	III significant pollution	IV excessive pollution
DBO5 mg/l	< 5	5- 10	10-15	>15
DCO mg/l	< 20	20- 40	40 - 50	>50
MES mg/l	<30	----	-----	30à 70
PO4 ³⁻ mg/l	≤ 0.01	0.01- 0.1	0.1 - 3	> 3
NH4 ⁺ mg/l	≤ 0.01	0.01- 0.1	0.1 - 3	> 3
NO2- mg/l	≤ 0.01	0.01- 0.1	0.1 - 3	> 3
NO3- mg/l	≤ 10	10 – 20	20 – 40	>40

7- SAND EXTRACTION IMPACT ON HYDROLOGY AND HYDROGEOLOGY

The rampant sand mining in the Sebaou middle to cause changes and degradation of surface runoff and destruction of the roof of the aquifer and cause:

- The outcrop of the water table: The overexploitation in the wellfield and the excessive extraction of alluvial deposits in the aquifer horizon resulted:
- The roof of piezometric drawdown of the water table, the average groundwater level of the water table rose from -3 m from the ground to about -8 m in 30 years.
- Contacting with the open air of the groundwater level of the aquifer that causes severe pollution during low water, the considerable water loss by evapotranspiration, a decrease in of aquifer storage capacity which causes a chute of regulatory reserves of the aquifer. (It should be remembered that the dam Taksabt supplies only 30% of the population of the province remaining 70% get their water drilling from the groundwater table).
- The training excavating reach the depth of 4 to 6 meters and diameters 100 to 400 m, these cavities are so

important that they become visible on satellite images.

- Waterproofing: Siltation of the aquifer and the destruction of the layer protective; alluvial operations use water pumped directly from the wadi for washing materials extracted (photo 3), the wash water is discharged directly into river and after decantation this cloudy water suspensions in particles form a layer of mud that settles to the bottom of the wadi preventing infiltration.

Further extraction of deep wadi riverbed Sebaou a cause bed deepening process; This resulted in a accentuation of the water line slope, causing an acceleration of the flow that is resulted in the bottom erosion, amongst other devastating effects caused by illegal sand mining, behind the irregularity of the wadi bed favoring the formation of powerful floods.

8 RELATIONSHIP SAND EXTRACTION / POLLUTION

The exposure of the sheet of Sebaou middle and especially during periods of low water to cause physical and chemical changes of surface and groundwater and an evolution characterized by:

- A reduction of calcium (Ca ++), phosphate (PO4) for all years.
- An increase in the upstream to downstream conductivity.
- An increase in the SO4- and Mg
- Na contents +, K +, Cl-, PO4 --- remain roughly stable,
- An increase in bacteria germs,
- A variation of the values of certain parameters, the seasons and years. In periods of low water, there is the temperature increase of organic matter, NH4 +, NO2,
- Seasonal variations in the HCO3 Sebaou middle may be related to variations in intensity of photosynthesis phenomenon.
- Risk of pollution by extractions due to the resuspension of fine particles (turbidity) and accidental discharges of oils and hydrocarbons from vehicles. The exploitation of sand and cause eutrophication by making it water unfit for consumption, vegetable anarchic proliferation is due to an excess of fertilizing substances (the important fertilizer in the form of nitrates and phosphates).

9 CONCLUSION

Interpretation of the results of physico-chemical and bacteriological analyzes of samples of groundwater and surface water taken from upstream to downstream of the Sebaou through the valley and its

tributary the river Bougdoura show that: surface waters are characterized by physical parameters (pH, conductivity), which increase from upstream to downstream and conferred on them a character incrustant and an average strong mineralization which also increases from upstream to downstream. Variants: Mg, chloride, sulphate ... reflect the origin of the outcome mineralization from leaching geologic facies of the watershed. The groundwater in the alluvial aquifer, generally from above surface water through direct or indirect infiltration, have the same qualitative and evolutionary characteristics. However, the quantitative point of view, their mineralization is more important due to their movement and stay in the alluvium. As this underground resource area that is not free of impacts of human activities in the valley and its surroundings. Indeed, Sebaou wadi is threatened by pollution from industrial, urban and agricultural lesser degree, mining of alluvial sand affects not only the reserves of the water table, but it also causes the deterioration of the quality of groundwater a result of the spills of hydrocarbons and oils of gear and the destruction of the alluvial layer that protects the water table and ensures the self-purification of water. The analysis results performed on different levy companions of natural waters (high and low water), provides information on the vulnerability of the alluvial aquifer fed by the surface water bacteriological analysis detects the presence of germs has fecal contamination in surface waters that contaminate in their turn result in groundwater infiltration mechanized, this vulnerability the water table is accentuated by the uncontrolled extraction of aggregates, excavations caused by this extraction are real foci proliferation of pathogens. This bacterial contamination is the result of untreated urban waste, Sebaou receives all urban effluents and industrial processed or not. During the period of high water, the flow of wadis is important therefore dissolved elements and pollutants are diluted, for against low water the flow is low minerals are very concentrated and pollutants, pollution is accentuated during this period and the risk becomes major. authorities to make such orders concerning sand mining ban on all the wadis of the province including Sebaou middle are now still relevant and more threatening, because the extraction of sand in conjunction with other not less important events such as the drying up of wadis, scour beds, shoreline erosion degradation of agricultural land and floods, increase the risk of contamination of groundwater. But this pollution problem urgently necessitates a global solution that would cover

different types assault, and their negative consequences for ground water, engineering structures and water and agriculture are:

- 1) uncontrolled sand extraction;
- 2) domestic remediation discharges;
- 3) Releases and industrial waste;
- 4) public landfills and uncontrolled landfill. Whence recommending the following:
 - Application of existing regulations for sand mining and environmental protection;
 - Immediate stop of all mining everything from wadi;
 - Termination of sand and their immediate dismantling;
 - Obstruction of access leading to Wadi;
 - Orientation companies exploiting the sand to the mountain quarries (the proposal to open quarries side TalaMalek (Sidi Ali Bounab) remains to discussed because nuisance of such a transfer may be as important as those that we wish to avoid at the water table);
 - Restoration destroyed banks, installation gabions and planting trees adequate for their protection;
 - The craters are to be filled by aggregates, and covered by a layer of sand
 - Setting up protection wellfield areas;
 - Prohibit all solid or liquid discharge in Wadi;
 - Sensitization of local communities for the establishment of municipal or inter landfills, as appropriate, for the storage and treatment of household waste and industrial sludge;
 - Regular monitoring of the chemical and bacteriological quality of water;
 - regulate the use of pesticides;
 - Launching an hydrogeological study for a better management of potential Sebaou Valley;
 - Police Strengthening water in human and material resources and their integration into a corporate body with full powers for a better management of the river area;
 - As a priority eliminate upstream the problem by the establishment of settling ponds and filtering all discharges released into the wadis.

REFERENCES

- [1] A. and S. AssousZiane (1996-1997): Statistical Study maximum flow rates of coastal basins (Algiers and Constantine) and Interior (case of Oued Sebaou basin)
- [2] Akpamoli B. (1989) -Study morphological parameters and the hydroclimatological Sebaou watershed and coastal basins. contrive memory, USTHB.
- [3] Alioui S. (2004) - Methodology of vulnerability mapping to pollution Sebaou. contrive memory, FSTGAT, USTHB

- [4] A. Moussaoui (1996): The damage of the related physical environment is uncontrolled sand mining in the lower Sebaou. contrive memory, FSTGAT, USTHB
- National Agency of Water Resources (A.N.R.H., Algiers) (2000): Grid quality of surface water.
- [5] Agence Rhône-Méditerranée - Corse (2000) impact of gravel extraction alluvial on iddle
- [6] B. Kamal and C. Belaid (1996): impact of sand mining on the environment if low Sebaou axis Tadmaït / Baghli. contrive memory, FSTGAT, USTHB.
- [7] B. Aïcha and B. Nora (1999): Water Pollution average Sebaou contrive Brief, FSTGAT, USTHB
- Baraka s. (1990) - Summary of hydrogeological studies of the valley of Wadi Sebaou (Large Kabylie). Engineer memory FSTGAT, USTHB.
- [8] Benhassaine M. (1980) - embossed patterns on search and surficial in the Wadi Sebaou (Kabylie). Thesis 3ème cycle.
- [9] Boumaza N. (2001) hydrogeological - Mapping of Sebaou Valley. Thesis magister, FSTGAT, USTHB.
- [10] Bouzar I. (1980) - Hydrogeology top Sebaou. Engineer memory FSTGAT, USTHB.
- [11] Shadrin Y. (1973) - hydrogeological study of the alluvial aquifer of Sebaou (Great Kabylie). INRH, Algiers.
- [12] Dahollièsse 2012: study of local potential aggregates for optimal use p 124
 University aboubekr Belkaid - Tlemcen.
- [13] Djamel Mimoun (2004): realign water alluvial gravel in the middle. P382. University Jean Monnet Saint - Etienne
- [14] Djemai M. (1982) - Hydrogeology of Sebaou means. Engineer memory FSTGAT, USTHB.
- [15] Djemai M. (2008) Chemical Balance of waters of the river valley and its Sebaou immediate environment: Impact of urbanization, industry and agriculture on quality water in Great Kabylie. (Algeria), geology state thesis, applied option: hydrogeology, UMMTO, 188 pages
- [16] Doukhi Mr. Sadio and O. (2006). Analysis and mapping of the risk of floodability Basin
 pouring wadi Kniss. Engineer memory FSTGAT, USTHB.
- [17] Haddihine H. (1996) - the water balance approach Watershed Sebaou. Engineer memory USTHB.
- [18] Hocine. H 1996: Approach the water balance of the catchment Sebaou Hydrogeology. Engineer memory FSTGAT, USTHB.
- [19] Maryse Mouyendi Kanga (2012), physico-chemical characterization of industrial water
 the factory of the laundry: Relationship mining and natural sources of university, Lorraine
- [20] MELLAL N. (2001): Study of the quality of natural waters of the Sebaou watershed. Pollution, protection and conservation of these waters. Magister thesis Univ. Tizi-Ouzou, 227p
- [21] Nabil R., Saadi M. (2006) - Contribution to the hydrogeological study of the alluvial aquifer
 Sebaou impact of the activity. Engineer memory FSTGAT, USTHB.
- [22] Sais and Si Mohand (1993) - Contribution to the hydrogeological study of the alluvial aquifer of Sebaou. Engineer memory FSTGAT, USTHB.
- [23] OBV YAMASKA, 2010. Quality Report 2010 river water from the territory of Saint-Hyacinthe, for the city of Saint-Hyacinthe, Watershed Organization of Yamaska, 69 pages
- [25] Ouear Zabira (1999) - contribution to the impact assessment prior environment effecting the transfer of drinking water (section: Tizi Ouzou - Draa ben Khedda) .A engineering, FSTGAT, USTHB.