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INTEGRATED WATER MONITORING SYSTEM APPLIED BY SIRET RIVER BASIN ADMINISTRATION FROM ROMANIA, IMPORTANT MECHANISM FOR THE PROTECTION OF WATER RESOURCES

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Abstract. The current status of Romania as European Community membership gives, in addition to a number of rights, many obligations concerning especially the implementation and compliance with relevant EU regulations. In the water sector The European Commission considered necessary the development of a new, common, uniform and consistent policy, which takes into account all the aspects linked both to human needs as well as to the existence of ecosystems and to sustainable development of water resources. Back in 2000, after a long decisional process, the European Community approved the Water Framework Directive (Directive 2000/60/EC), which established a policy framework for water management in the European Union based on sustainable development principles and which integrated all water issues, including problems of water's integrated monitoring. In Romania the water's monitoring system has been working since the early twentieth century, but since 1976 when the Water Directorate at basinal level were established this system has been developing into a scientific and defining structure. Water monitoring network has continuously suffered additions and improvements, but since 2002 the question of the modernization and the development of water integrated monitoring system was raised so it could meet European standards and the monitoring requirements and it could run in a dynamic, complex process and with spiral development. In this paper we presented some aspects concerning the synthesis of integrated water monitoring system, important mechanism for water resources management, applied to the Siret Basin by Siret River Basin Administration (ABAS).

Introduction

Water Integrated Monitoring System aims coherent and comprehensive assessment of the status of water bodies and its evolution over time so that programs of measures and their effectiveness can be established, and it involves the crossing of distinct phases:

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- establishing monitoring subsystems;
- establishing the investigating media;
- determining the spatial structure;
- identification of monitoring types;
- establishing the quality elements to be monitored;
- establishing the monitoring frequencies;
- establishing the hierarchy of laboratories.

In Romania, Water Integrated Monitoring System has been operating in a scientific and definite structure since 1976, when the Basin Water Directorates were established. The water monitoring system had been working since the early twentieth century, but at a much lower level, through an insufficient monitoring network and without an integrated quantity - quality approach, and with a greater emphasis on hydrometric measurements at few stations located especially on the major rivers of the first order.

Water monitoring network has continuously suffered additions and improvements, but since 2002 the question of the modernization and the development of water integrated monitoring system was raised so it could meet the European standards and the monitoring requirements and it could run in a dynamic, complex process and with spiral development.

The aims of this study are: **evaluating the quality of the water resources** in the area of activity of Siret River Basin Administration in Romania, in accordance with the Framework Directive 60/2000/CE and **monitoring programs within the National Monitoring System Integrated Management** in Romania (SMIAR). The Framework Directive 60/2000/CE is transposed in different laws in Romania based on the normative definitions of employment quality status. For the evaluation of the water quality specific parameters have been analysed, for which maximum limits have been set for each quality state separately.

1. Materials and methods

1.1. Types, subsystems and specific programs of water integrated mon. In accordance with the Water Framework Directive 60/2000/CE fully transposed into Romanian legislation, the National Monitoring System Integrated Management (SMIAR) includes three types of monitoring:

- Surveillance Monitoring;
- Operational Monitoring;
- Investigation Monitoring.

Surveillance monitoring serves in the assessment of water status within each river basin or sub basin. It provides information for the validation of the impact assessment procedure, for the efficient design of the future monitoring programs and for the assessment of long-term trend of variation of water resources.

Operational monitoring should be conducted for all water bodies, which upon the impact according to Annex II of the Framework Directive, or upon the basis of surveillance monitoring, were identified as not likely to carry out the environmental objectives. It seeks to define the status of aquatic ecosystems at risk or which present risk of failing to meet environmental objectives. This type of monitoring should be conducted for all water bodies in which priority substances are discharged.

Investigation Monitoring is carried out to certificate the causes due to which a water body fails to achieve environmental objectives and to identify the causes of exceeding of limits of quality standards.

Monitoring system provided by the Water Framework Directive and the other European Directives approaches three areas of investigation, namely water, sediment / suspended solids and biota and includes six subsystems: River Subsystem, Lakes Subsystem, Transitional Waters Subsystem, Coastal Waters Subsystem, Groundwater Subsystem, Wastewater Subsystem.

Achieving integrated water monitoring system is currently done through specific monitoring programs, namely:

- surveillance monitoring program (S), applied to surface water and groundwater;
- operational monitoring program (O), applied to surface water and groundwater;
- investigation monitoring program (I) applied to surface water;
- sections of reference program (R) applied to surface water;
- intercalibration program for ecological status (IC), applied to surface water;
- drinking water program (P), applied to surface water and groundwater;
- vulnerable areas program (ZV), applied to surface water and groundwater;
- ichthyofauna monitoring program (IH) applied to surface water;
- habitats and Species Protection Program (HS), applied to surface water;
- international conventions program (CI), applied to surface water and groundwater;
- the knowledge of morphological alterations pressures program (CAPM), applied to surface waters;
- "the best available section" program (CBSD) applied to surface streams.

1.2. Evaluation of the quality of water resources. The evaluation of surface water and groundwater status is achieved in accordance with the Framework Directive 60/2000/CE, transposed in different laws in Romania based on the normative definitions of employment quality status and based on specific parameters for which maximum limits have been set for each quality state separately, as it follows:

a. For grading and classification of **surface water bodies** in ecological states conditions, five regulatory environmental status were defined (very good, good, moderate, weak, poor) in tab. 1.

Tab. 1 - General definitions of ecological status of surface waters

Very good status	Good status	Moderate status	Poor status	Bad status
• There are slight anthropogenic alterations of the values of physico-chemical and hydro-morphological quality elements for the type of surface water bodies, compared with normally associated values with that type in no change conditions. • The values of biological quality elements for the type of surface water body reflect the values normally associated with that type, in unchanged conditions. The indicated deflections are zero or there are few evidences of disturbance. • Conditions are specific to the type and the communities.	Values for biological quality elements for such a surface water body present low levels of modifications due to human activities and deviate slightly from those values associated normally with the body type of surface water in unchanged conditions.	Values for biological quality elements for such a surface water body deviates moderately from those associated with the body type of surface water in unchanged conditions. Values present moderate signs of disturbance due to human activities and are more disturbed than those corresponding to the values of good conditions.	Waters which are showing evidence of major deterioration of values of biological quality elements for such a surface water body and in which the relevant biological communities deviate significantly from the values associated normally with the surface water body type in unchanged conditions are classified as being of poor quality.	Waters showing evidence of major deterioration of the biological values of quality for the type of water body surface and are absent in large parts of important biological communities, which are normally associated with the surface water body type in unchanged conditions are classified as being of bad quality.

According to these definitions, to ensure conditions and supportability degrees of aquatic environments, for each quality indicator were set allowable limits for classification in the five ecological statuses. Using these indicators, based on the principle of the most unfavorable value, is made the classification of water bodies in corresponding states of quality. The quality elements for classification of ecological status of surface waters are:

- biological parameters;
- hydro-morphological parameters supporting the biological elements;
- chemical and physico-chemical parameters supporting the biological elements (general parameters - thermal conditions, oxygenation conditions, salinity, acidification status, nutrient conditions and in lakes transparency analysis and specific Pollutants (pollution with all priority substances identified as being discharged into water bodies, pollution with other substances identified as being discharged in significant quantities into water bodies).

Characterization process of surface flowing water quality implies global assessment of analytical results obtained in systematic campaigns under specific operating manuals. To process the information at the control sections of specific water bodies and specific monitoring programs these steps are followed:

- the estimation of the typical values: maximum, arithmetic mean, minimum, standard deviation, percentile 50% and percentile 90% for each quality indicator;
- characterization of water quality in each monitoring section of the body of water, than the global water quality, considering the cumulative effect (weighted) of all indicators of a characteristic group.

To assess overall water quality in each monitoring section for each quality indicator in part are calculated the mean and percentile values of 90% and 10% for dissolved oxygen, and these values are compared with limit values of quality grades under the regulations (currently limits for the five classes as provided in Order 161/2006). Following these procedures results the classification of each section in one of the five quality categories, namely quality status of each section characterizing surface water body. Normative indicators for the five classes (Order 161/2006) were divided into five main groups namely: system of oxygen, nutrients, general ions, salinity, toxic pollutants and specific natural origin, other relevant chemical indicators.

The general quality class is assessed on the basis of the five classes of the representative groups of indicators mentioned. The calculation of global quality index is done with the relationship:

$$i = \frac{1}{n} \times \sum_{1}^{n} \frac{c_m}{c_a} \quad \text{where:}$$

c_m - determined (made) concentrations of quality indicators (arithmetic average, 90% percentile) [mg/l];

c_a - the regulatory concentration limits allowed for the five classes of quality and quality indicators analyzed [mg/l];

n - number of indicators.

Depending on where i>1, similar calculation for the next classis is computed, this calculation being repeated for the limit concentrations related to quality grades, up to the situation in which i<1. Overall quality indicator of the control section is given by the group of indicators with the worst classification.

Water quality data are variable and their values are influenced by many causes. Processing these data is done using statistical-mathematical procedures and has as result the classification of monitoring sections in quality classes, the

distribution of watercourses lengths in quality classes and the comprehensive characterization of the status of water quality on river basins.

Assessing water quality status of lakes is done through the interpretation of analytical data obtained from regional laboratories for water management (quality values of specific indicators analyzed in water samples taken from typical sections of the lakes) using statistical methods in water samples taken from characteristic sections.

b. For determination of **groundwater quality state**, definitions were established for classifying distinct good quantitative and qualitative states (Tab. 2):

Tab. 2 - General Definitions of quantitative and qualitative good groundwater state

Elements	**a. Parameters for assessing good groundwater quantitative status**
Groundwater level	Groundwater levels in the groundwater body are such that the available groundwater resource is not exceeded by an annual average flow captured in the long term. Consequently, groundwater levels are subject to anthropogenic changes that could lead to: - not being able to comply with the environmental objectives for surface water bodies and groundwater and the associated surface water ; - Any significant diminution of the status of such waters; - Significant damage to terrestrial ecosystems directly depending on groundwater bodies; - Changes in direction of flow, due to the level changes that may occur temporarily or continuously in a spatially limited area, but which does not cause penetration or intrusion of salt water and does not indicate a sustained trend of change identified clearly, influenced by anthropogenic activities of flow direction which would lead to the intrusion.
Elements	**b. Parameters for assessing good groundwater quality**
General	The chemical composition of groundwater body is such that pollutant concentrations: - Do not show effects of saline intrusion and other penetrations; - Do not exceed the applicable quality standard; - Do not have as a result the failure of the environmental objectives for surface water bodies and groundwater, for surface water associated, and do not have any significant impact in decreasing the ecological or chemical quality of these bodies of water and do not damage or significant disturb the terrestrial ecosystems directly dependent on groundwater bodies.
Conductivity	Conductivity changes are not characteristic to the intrusion of saline or to other intrusions into the groundwater body.

For classification of quantitative status of groundwater 'The groundwater level" evaluation parameter was established and for the classification of the chemical status of groundwater were established two types of parameters: conductivity and general parameters from which the essential elements monitored in all the groundwater bodies are: oxygen, pH, conductivity, nitrates and ammonium, the list of parameters being supplemented by specific quality indicators for the monitored area.

The knowing process of the groundwater quality at the level of hydrographic basins is conducted on hydrogeomorphological units and within them on aquifers (underground) structures, using the laboratory analysis of water

samples taken from water drilling hydrological observation stations of the national network.

Characterization of groundwater quality in natural conditions shall be based on general indicators covering natural regime and on some specific indicators – determined by the types of existing pollution in the area (industrial sites, human agglomerations, agricultural sources of pollution (pollution by nitrates), mining, etc. In the locations within the perimeters of major industrial sites, potential sources of groundwater pollution, local systems for the monitoring of the groundwater quality are placed. Through these systems both the possible occurrence of a pollution of underground aquifers and also their dynamic evolution are watched, in relation with the measures taken to combat the causes that have produced this pollution.

1.3. Evaluation of the wastewater. The overall quality of wastewater sources is assessed having in mind the following features:

- volumes of wastewater evacuated in natural receptors (rivers), divided on various categories, depending on the workload and how is carried out their treatment (*waste water that does not require treatment; wastewater that require treatment: untreated sewage, poorly treated sewage, sufficient treated wastewater*);
- quantities of pollutants discharged temporarily, monthly, respectively annual;
- the way the wastewater treatment functioned, so called statistical evaluation (*properly functioning of the sewage plants, inadequate functioning of the sewage plants*).

1.4.The Monitoring System of Water Resources in the work area of the Siret River Basin Administration. Siret River Basin Administration (ABAS) administrates the Siret River Basin, which is the largest basin in Romania, with an area of 47,610 square kilometers, of which 42890 km on Romanian territory. In this basin area, Siret River Basin Administration Bacău manages 27,402 km. The density of the river network is 0.35 km/sq. km. Siret River, rises in the Carpathian Woody Mountains, in Ukraine enters in Romania near the city of Siret and flows into the Danube, upstream the Galati city. The total length of the Siret River is 726 km, of which the territory of Romania, 559 km. The main tributaries of the Siret River are Suceava River, Moldova River, Bistrita River, Trotus River, Bârlad River, Putna River, Ramnicu Sarat River and Buzau River, which together with other smaller tributaries, contribute to a multi-annual average flow of Siret River upstream the confluence with the Danube, approximately 240 m^3/s corresponding to a multi-annual average stock of about 7.6 billion cubic meters. The total length of the river system of the Siret River Basin, is 15836 km, of which on the territory

of Romania, 15157 km, and managed by Siret River Basin Administration of 10280 km.

The monitoring system of water resources quality, currently applied by Bacau Siret River Basin Administration is carried out in accordance with the provisions of the Water Framework Directive 60/2000 and the other European Directives transposed into the laws concerning water management in Romania, namely by Water Law 107/1996 with subsequent amendments and completions. This system includes five specific subsystems, namely: Rivers Subsystem, Lakes Subsystem, Groundwater subsystem, Wastewater Subsystem, Coastal waters – Siret River Basin Administration does not monitor the subsystems “transitional waters" and "coastal waters", which are not specific of its area of activity.

Tab. 3 - Monitoring programs implemented by Siret River Basin Administration

No. crt.	Types of monitoring programs	Total number of monitoring sections	Rivers	Lakes	Ground waters	Waste water
1.	Surveillance	318	70	31	556	
2.	Operational	255	37	15	62	141
3.	Investigation	Whenever necessary				
4.	Drinking water	63	13	4	46	
5.	Reference	18	10	8		
6.	Ichthyofauna	114	86	28		
7.	Vulnerable areas	152	21		131	
8.	Habitats and Species Protection	21	7	14		
9.	"The best section available"	6	6			
10.	Intercalibration	21	16	5		
11.	International Convention	1	1			
12.	The knowing of the hydro-morphological deterioration impact on water	15	15			

Siret River Basin Administration is pursuing three areas of investigation, namely: water, sediment/suspended matter, biota and applies 12 types of monitoring programs to characterize these environments depending on the specific monitoring subsystem analyzed. Analysis of water samples is carried out at five own modern and properly equipped laboratories, where for most of the analyzed

indicators the methods have been approved by the certifying body RENAR from 29/01/2007 under ISO / IEC 17025/2005.

Tab. 4 - The activity of hydrological stations at Siret River Basin Administration

Nr. crt.	ACTIVITY	U.M.	TOTAL measurements per year
1.	**Subsystem "surface streams"**	**no.**	**1057**
	-hydrometric stations for levels monitoring (including visual pollution)	no.	174
	- hydrometric monitoring stations for water flow	no.	323
	- hydrometric monitoring stations for silt flow	no.	62
	- hydrometric monitoring stations for air / water temperature	no.	158
	- hydrometric monitoring stations for rainfall	no.	131
	- hydrometric monitoring stations for interfluves evaporative	no.	7
	- hydrometric monitoring stations for nivometer	no.	73
	- hydrometric monitoring stations for daily / special broadcast	no.	110/29
2.	**Subsystem "natural and artificial lakes "**	**no.**	**55**
	- hydrometric stations monitoring for water levels	no.	18
	- hydrometric monitoring stations for air / water temperature	no.	14/12
	- hydrometric monitoring stations for rainfall	no.	10
	- hydrometric monitoring stations for evaporative	no.	1
3.	**Subsystem "groundwater aquifers and springs "**	**no.**	**240/752**
	- hydrological stations / water drillings for levels monitoring	no.	183/534
	- hydrological station / water drillings for flow monitoring / monitoring springs flow	no.	-/-/61
	- hydrological stations / water drillings for water temperature monitoring	no.	**57/157**
4.	**Water users hydrometry**	**no.**	**62**
	- systematic measurements at selected users	no.	15
	- expeditionary measurements at selected users	no.	15
	- users without hydrometry possibility - of which:	no.	32
	- for its own administration works	no.	3
	- for water users	no.	29

In 2010, the application of the 12 types of monitoring programs is systematically made, according to the analyzed subsystem and having the configuration from Table 3.

The monitoring network for the water quality in the area of activity of Siret River Basin Administration for the "rivers" subsystem is systematically covering 2889 km of river from the 10280 km of water courses administered by:

- 88 monitoring water quality sections for streams:

- 10 reference sections;
- 17 drinking water sections;
- 21 vulnerable areas sections;
- 39 sections with other monitoring programs;
- 1 section of the border.

The rest of the river system is monitored depending on the situation by investigation monitoring. In sections with high risk of pollution ABAS seeks the quality of surface water through systematic fast flow (daily or weekly frequency as appropriate). In case of accidental pollution, the monitoring of water resources is carried in special regime, the monitoring frequency in some cases being hourly.

Quantitative monitoring system of surface water in the area of activity of the Siret River Basin Administration is done through six hydrological stations, as follows:

- Suceava Hydrological Station: in the basins of the rivers Siret (up to Lespezi), Suceava and Moldova (until Timişeşti);

- Vatra Dornei Hydrological Station: in the upper catchment of the river Bistrita (up to the confluence with Neagra river Brosteni)

- Piatra Neamt Hydrological station: in the basins of the rivers Siret (Neamt county territory), Moldova (lower sector), and Bistrita (middle and lower sectors);

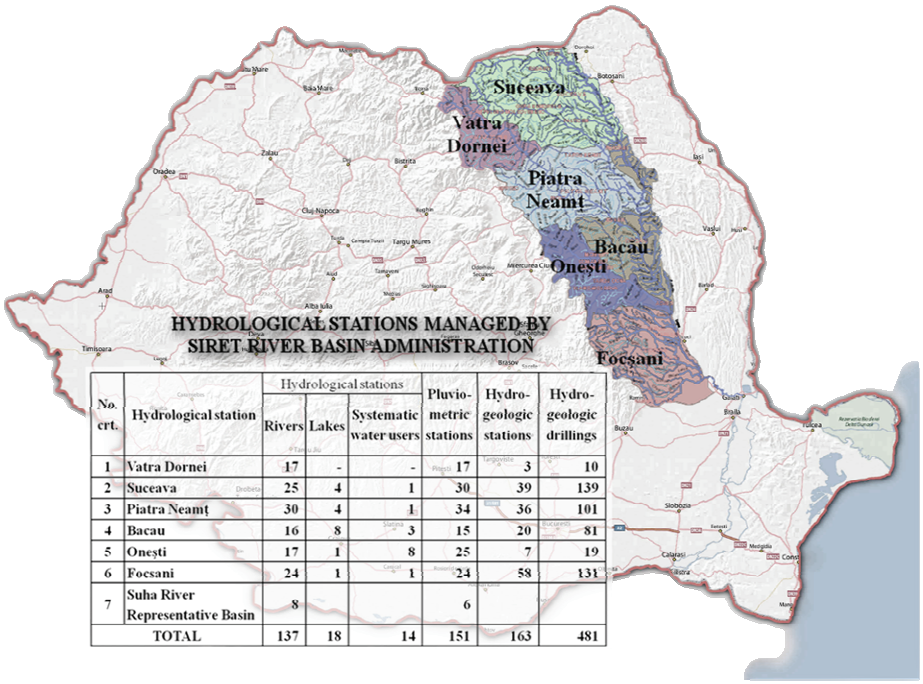
- Bacau Hydrological Station: in the middle basin of the Siret river (across Bacau County) and sub-basin Tazlău;

- Onesti Hydrological Station: in the basin of the river Trotus (without the sub basin Tazlău);

- Focsani hydrological station: in the lower basin of the Siret river and in the Putna and Ramnicu Sarat catchments;

- Suha Basin – the representative basin of Suha is organized in the Suha river basin right tributary of the Moldova river.

Each hydrologic station monitors the water resources for a number of parameters for each subsystem: rivers, lakes, groundwater and wastewater (for systemic use), through a network of hydrometer, rain and geological stations, located in characteristic sections with hydromorphological, hydrogeological and use of water flow specific. This network is presented briefly in Fig. 1, separately for each hydrological station.



No. crt.	Hydrological station	Hydrological stations			Pluvio-metric stations	Hydro-geologic stations	Hydro-geologic drillings
		Rivers	Lakes	Systematic water users			
1	Vatra Dornei	17	-	-	17	3	10
2	Suceava	25	4	1	30	39	139
3	Piatra Neamț	30	4	1	34	36	101
4	Bacau	16	8	3	15	20	81
5	Onești	17	1	8	25	7	19
6	Focsani	24	1	1	24	58	131
7	Suha River Representative Basin	8			6		
TOTAL		137	18	14	151	163	481

Fig. 1 - Map of areas of activity of hydrological stations in the Siret River Basin Administration and the main monitoring parameters

The activity of the hydrological stations in Siret River Basin Administration is presented in Tab 4. divided on subsystems.

2. Results and discussion

2.1. Studied surface water categories and short summary of their classification in ecological states, based on biological and physico-chemical monitored elements in 2009 in the area of activity of Siret River Basin Administration. As part of quality assessment of surface water (rivers and lakes) were studied 382 water bodies located in the Siret River Area (Fig. 2). Of these, only 64 water bodies have been systematically monitored through physico-chemical and biological analyses, as follows:

- 53 surface water bodies – rivers;
- 9 surface water bodies - artificial lakes;
- 2 surface water bodies – natural lakes.

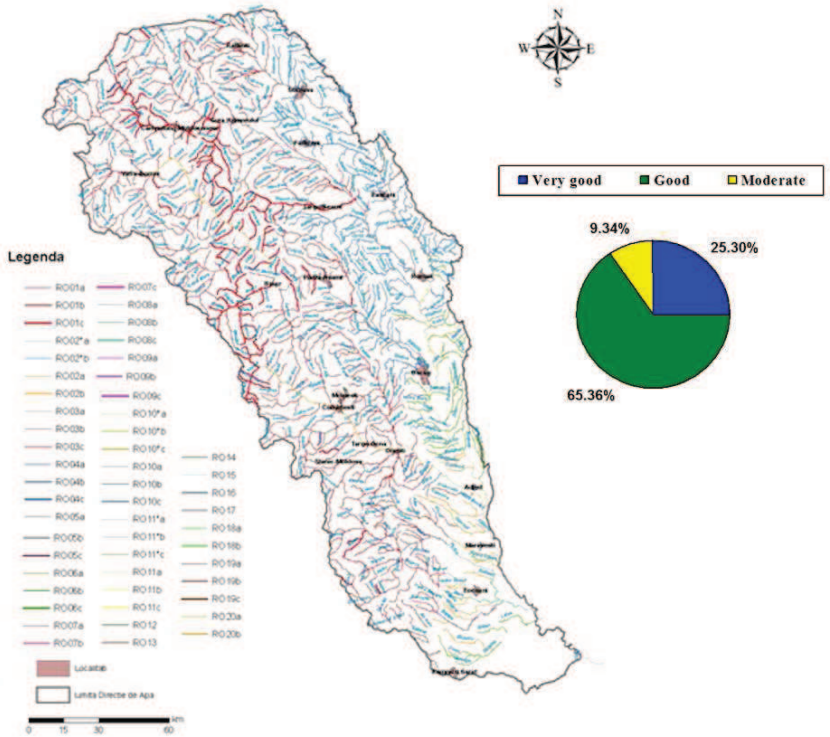


Fig. 2 - Typology of water courses B.H. Siret and total length distribution of ecological status of surface water bodies (rivers) administrated by Siret River Basin Administration

The remaining 318, low-risk or no risk at pollution, surface water bodies, were evaluated by similarity based on the expert's opinion and also on the investigation monitoring results.

In 2009, the 382 water bodies with a total length of 10280 km, were classified in the next ecological states:

- Very good: 43 bodies of water, representing 11.26%;
- Good: 322 bodies of water, representing 84.29%;
- Moderate: 17 bodies of water, representing 4.45%;
- Poor: no water body;
- Bad: no water body.

In 2009 the classification in ecological states of the 10280 km lengths of natural water bodies (rivers) in the Siret River Area (Fig. 3, tab.6)

- Very good: 2600.57 km water bodies, representing 25.30%;
- Good: 6719.30 km water bodies, representing 65.36%;
- Moderate: 960.13 km water bodies, representing 9.34%;
- Poor: 0 km water bodies, representing 0%.
- Bad: 0 km water bodies, representing 0%.

Tab. 5 - The ecological status of the 10280 km of rivers

(km) 10280,00	All rivers, from which	(%) 100,00
4421,90	Km watercourse through systematic monitoring	43,02
5668,78	Km of watercourse through study of similarity	55,14
187,42	Km of watercourse related to 2 accumulation lakes	1,82
1,90	Km of watercourse related to two natural lakes	0,02

Tab. 6 - Synoptic length of water bodies (rivers) cumulated according to the assessment of the ecological status in 200

Nr. crt.	Catchment	Total length (km)	Distribution of lengths according to the ecological status evaluation										Distribution of lengths according to the chemical status evaluation			
			Very good		Good		Moderate		Poor		Bad		Good		Bad	
			km	%	km	%	km	%	km	%	km	%	km	%	km	%
1	Siret	10280	2600,57	25,30	6719,30	65,36	960,13	9,34	0	0	0	0	-	-	-	-

Tab. 7 - Distribution of reservoirs according to the assessment of the ecological potential and chemical status in 2009

No. crt.	Catchment	Total number of reservoirs	Distribution reservoirs as assess the potential environmental						Distribution of reservoirs in accordance with chemical status assessing			
			Maximum ecological potential		Good ecological potential		Moderate ecological potential		Good		Bad	
			No. Water bodies	%	No. Water bodies	%	No. Water bodies	%	No. Water bodies	%	No. Water bodies	%
1	Siret	9	4	44,44	1	11,12	4	44,44	7	77.77	2	22.23

Subsystem "lakes" is monitored by 31 water quality monitoring sections for 11 representative lakes in the area of activity, of which 9 artificial lakes and 2 natural lakes (Tab.8)

Concerning the ecological status of lakes was found that 44% of the 9 monitored accumulation lakes are in moderate state, the remaining 56% being in good and very good ecological status, while from the two natural lakes, 50% are in moderate state and the remaining 50% are in good and very good ecological status.

Tab. 7 shows the distribution of the 9 lakes according to the assessment of ecological potential and the chemical quality in 2009.

Tab. 8 - Systematically monitored lakes in the area of activity of Siret River Basin Administration

Nr. crt.	Watercourse	Monitorated lakes	
		Accumulation	Natural
1	Siret	Rogojesti	
2	Siret	Bucecea	
3	Solcuta	Solca	
4	Dragomirna	Dragomirna	
5	Bistrita	Izvorul Muntelui	
6	Bistrita	Bâtca Doamnei	
7	Siret	Răcăciuni	
8	Uz	Poiana Uzului	
9	Siret	Călimaneşti	
10	Bicaz		Lacu Rosu
11	Lala		Lala

Generally the lake water quality is answered with the required service (water supply, habitat for aquatic ecosystems, etc.).

2.2. The quality status of groundwater in the activity area of Siret River Basin Administration in 2009. Water quality of the subsystem "groundwater" is monitored through:

- 46 operating water drilling wells (water supply);
- 2 surveillance water drillings located on industrial areas;
- 556 study water drillings owned by National Grid of Hydrogeological water drillings of Romania (including 131 wells located in vulnerable areas).

In general, the groundwater from the retention pools used for public water supply corresponds to the maximum permissible limits for drinking water set out in Law 458/2002 and Law 311/2004.

Concerning the groundwater related to the industrial platforms, they are tracked by monitoring wells, which still show (in most cases), the continuous trend of maintaining historical pollution from prior periods. Generally these waters have not suffered degradation in the past recent years, however in some cases, there was recorded a slight tendency to improve quality (eg. Platform Roznov, Dărmăneşti Refinery), due to the reducing of industrial platform activity (closure), to natural drainage and to directed drainage measures of groundwater affected by pollution.

Generally, the groundwater quality related to industrial platforms has an improvement due both to the measures taken by economic agents to reduce and stop pollution and to the reduction of their economic activity. The same trend of improvement is found in groundwater from vulnerable areas affected by nitrates

from agricultural activities, mainly due to the reducing of the quantities of nitrogen fertilizers applied onto agricultural land.

2.3. The quality status of wastewater discharged into the receptors by economic agents in the activity area of Siret River Basin Administration in 2009. Wastewater subsystem includes 136 pollution sources (of which 107 pollution sources with sewage plants discharge and 29 discharges from rain and sorting stations of mineral aggregates).

From the total volume of wastewater discharged in 2009 - 106.254 mil.sqm in the activity area of Siret River Basin Administration, 43% were sufficiently treated and 57% insufficiently treated. Insufficient treatment of sewage water resulted from the majority of human congestion is mainly due to depreciation of the municipal treatment plants and due to very limited sources of funding for the development of modern treatment plants. However, the effects of historical pollution of groundwater is still most common, both on the premises of former industrial sites as on the areas where lands have been heavily polluted by chemical fertilizers.

Conclusions

The permanent knowledge of water resources status is an objective requirement which can not be adequately achieved without a modern integrated water monitoring system. As part of water resource management, monitoring activity has an important place, representing a major mechanism for quality and quantity water protection. The Siret River Basin Administration, permanently makes particular efforts to knowledge the status of wastewater quality discharged and of the impact of these on water resources, namely to decrease until stopping the quantities of pollutants discharged into water resources. The Administration also acknowledges and takes measures against the economical agents that pollute so they reduce pollution, so they establish self-monitoring programs and so they achieve high performance treatment facilities to protect water quality in accordance with quality standards set by the water legislation.

A positive aspect in recent years is the efficient application by operators of the self-monitoring programs and of the programs to prevent and control accidental pollution, under the direct coordination and supervision of qualified staff of the Siret River Basin Administration. As a result of these measures is the reduction of the number of accidental pollution from more than thirty accidental pollution cases occurring annually until year 2000 to below 10 accidental pollution cases occurring annually after 2005.

Among the measures to improve water quality, which Siret River Basin Administration always pursues are noted:

- completion of master plans for the building of wastewater treatment plants for human agglomerations;
- funding allocation (budget, structural funds, equity) for the development of new treatment plants for municipalities in B.H. Siret;
- further action to detect polluters who discharge hazardous substances into sewage systems and natural receivers;
- further studies and action programs in the basin and punctually, so that the impact of pollution sources on water bodies to be known;
- continuous acquisition of materials and installation for the water depollution;
- continuously improvement of the Integrated Monitoring Network at punctual and overall level.

Making the self-monitoring system for treated wastewater discharged into natural receivers by operators.

All these mentioned measures, and others, are primarily aiming to achieve a good ecological status of water bodies and a sustainable development of water resources.

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*** *River Basin Management Plan,* D.A. Siret Bacau, in 2009.

*** *Synthesis of BH cadastral Siret,* Siret ABA.

*** Directory of Water Management in B.H. Siret - 2009, ABA Siret Bacau, in 2010.