MONITORING PROGRAMMES FOR THE GROUNDWATERS IN ROMANIA

MIHAI BRETOTEAN, RODICA MACALET, TUDOR MUNTEANU

NATIONAL INSTITUTE OF HYDROLOGY AND WATER MANAGEMENT
BUCHAREST

SURFACE AND GROUNDWATER MONITORING IN ROMANIA

For the management of the surface and groundwaters in Romania 11 units (Water Directions) have been created.

In Romania there were delineated a number of 3497 of surface water bodies. For these bodies the situation regarding the monitoring programmes is presented in the table 1.

Table 1. Surface waters – bodies and monitoring sections

Water bodies/sections	Rivers	Natural lakes	Accumulations	Transitory waters	Coastal waters	Total
Water bodies	3497	53	165	6	3	**3724**
Water bodies at risk	453	21	165	6	3	**648**
Water bodies possible at risk	357	14	0	0	0	**371**
Surveillance sections	1517	102	381	18	39	**2057**
out of which: physical-chemical and biological elements	847	102	361	18	39	**1367**
Operational sections	642	78	232	18	39	**1009**
out of which: physical-chemical and biological elements	397	78	212	18	39	**744**

GROUNDWATER MONITORING IN ROMANIA (1)

In Romania there were delineated a number of 129 groundwater bodies, out of which 20 groundwater bodies at risk and 7 groundwater bodies possibly at risk.

The situation of the groundwater bodies monitoring is presented in the table 2.

GROUNDWATER MONITORING IN ROMANIA (2)

Table 2. Groundwater monitoring

Monitoring points	Wells	Springs	Total
Qualitative programme	3166	1116	**3282**
Chemical programme Suivellance	2035	80	**2115**
Chemical programme Operational	1274	49	**1323**

GROUNDWATER MONITORING IN ROMANIA (3)

I. GROUNDWATER MONITORING NETWORKS

- **National Hydrogeological Network**

a. Objectives:

- knowledge of shallow and depth aquifers structures spatial development and of their aquifer potential
- knowledge of groundwater levels regime
- knowledge of groundwater physical – chemical properties

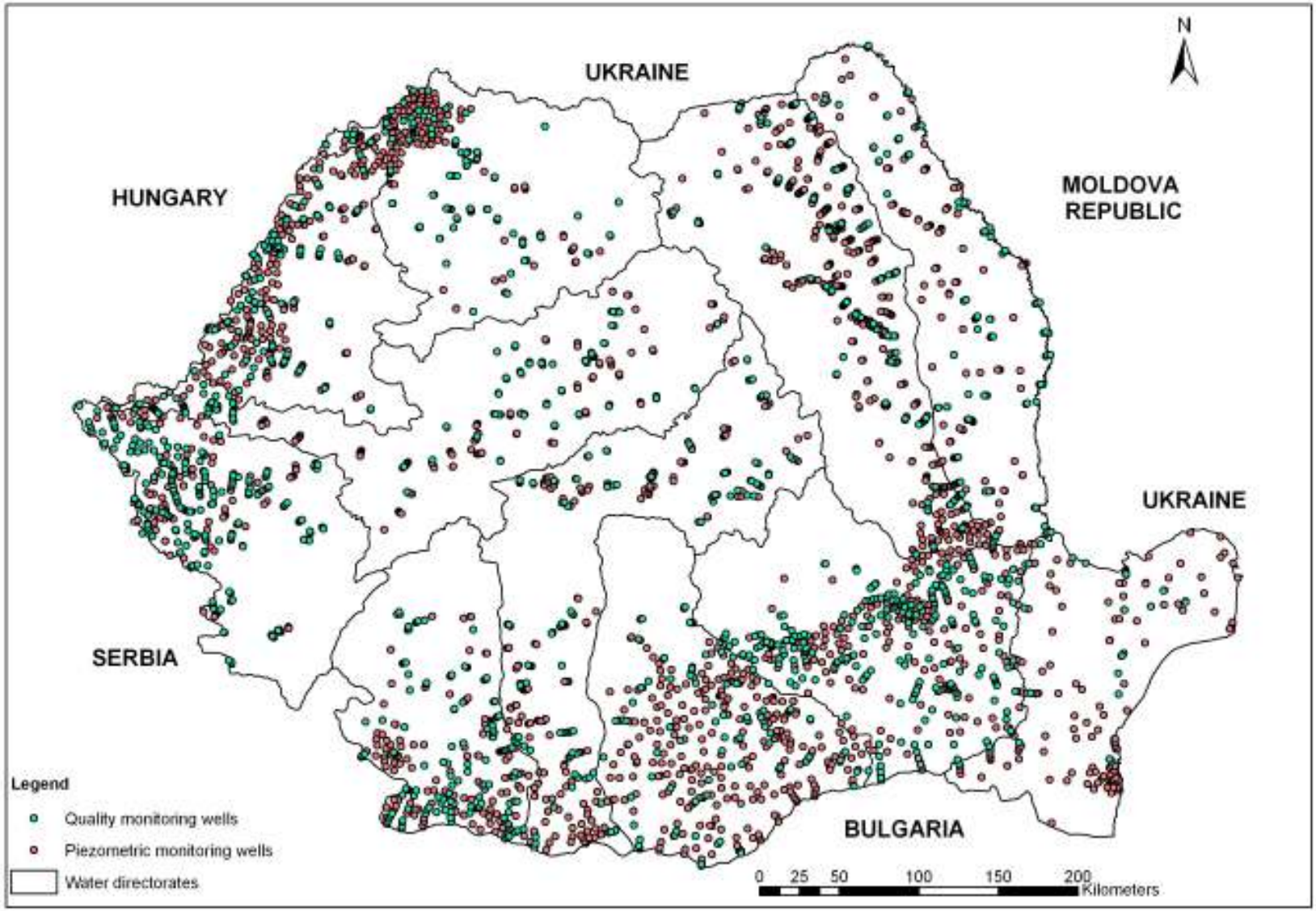
b. Wells types:

- for shallow aquiferous strata (until 20 –50 m)
- for depth aquiferous strata (50 – 400 m)

c. Responsible: it is at the "Romanian Waters" National Administration orders, by Water Directorates

GROUNDWATER MONITORING IN ROMANIA (4)

The National Hydrogeological Network



GROUNDWATER MONITORING IN ROMANIA (5)

I. GROUNDWATER MONITORING NETWORKS

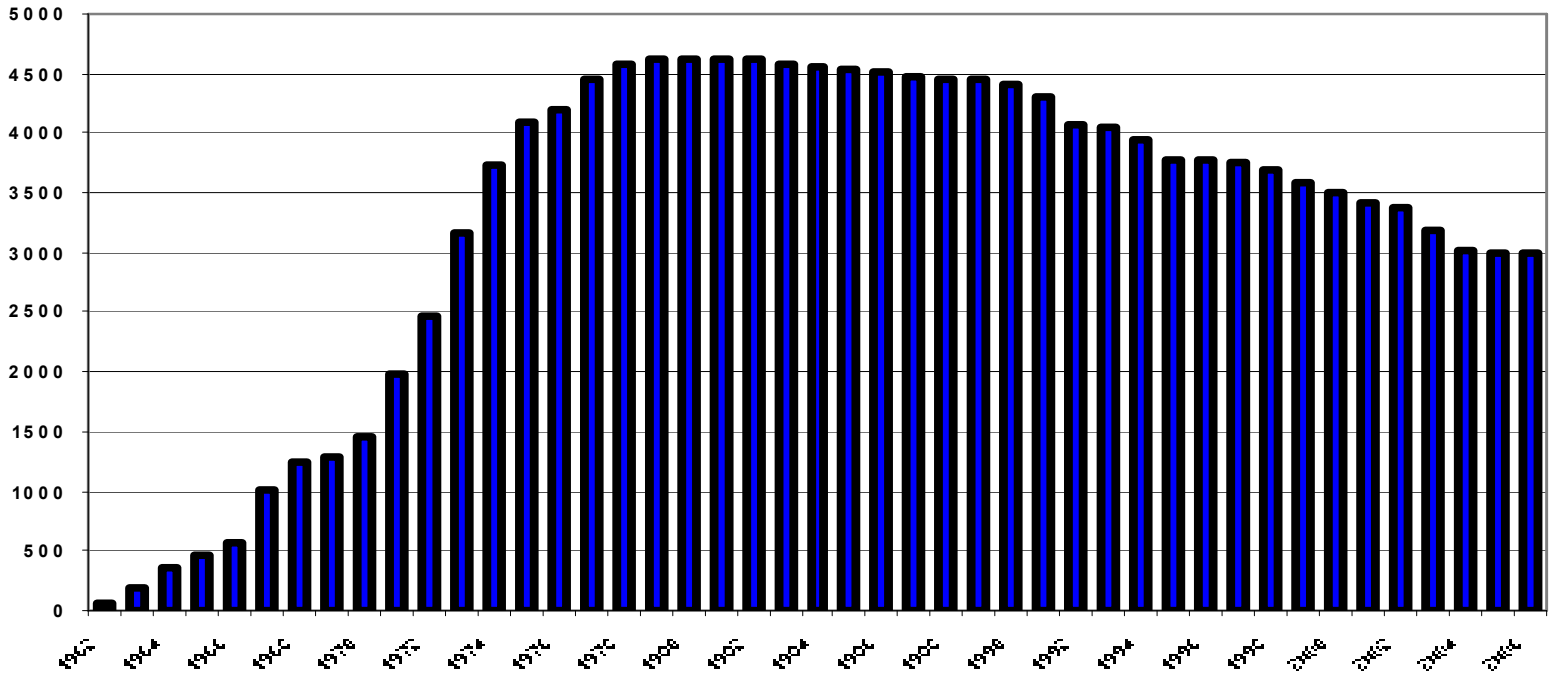
A. National Hydrogeological Network

1. For shallow aquiferous strata (until 20 – 50 m)

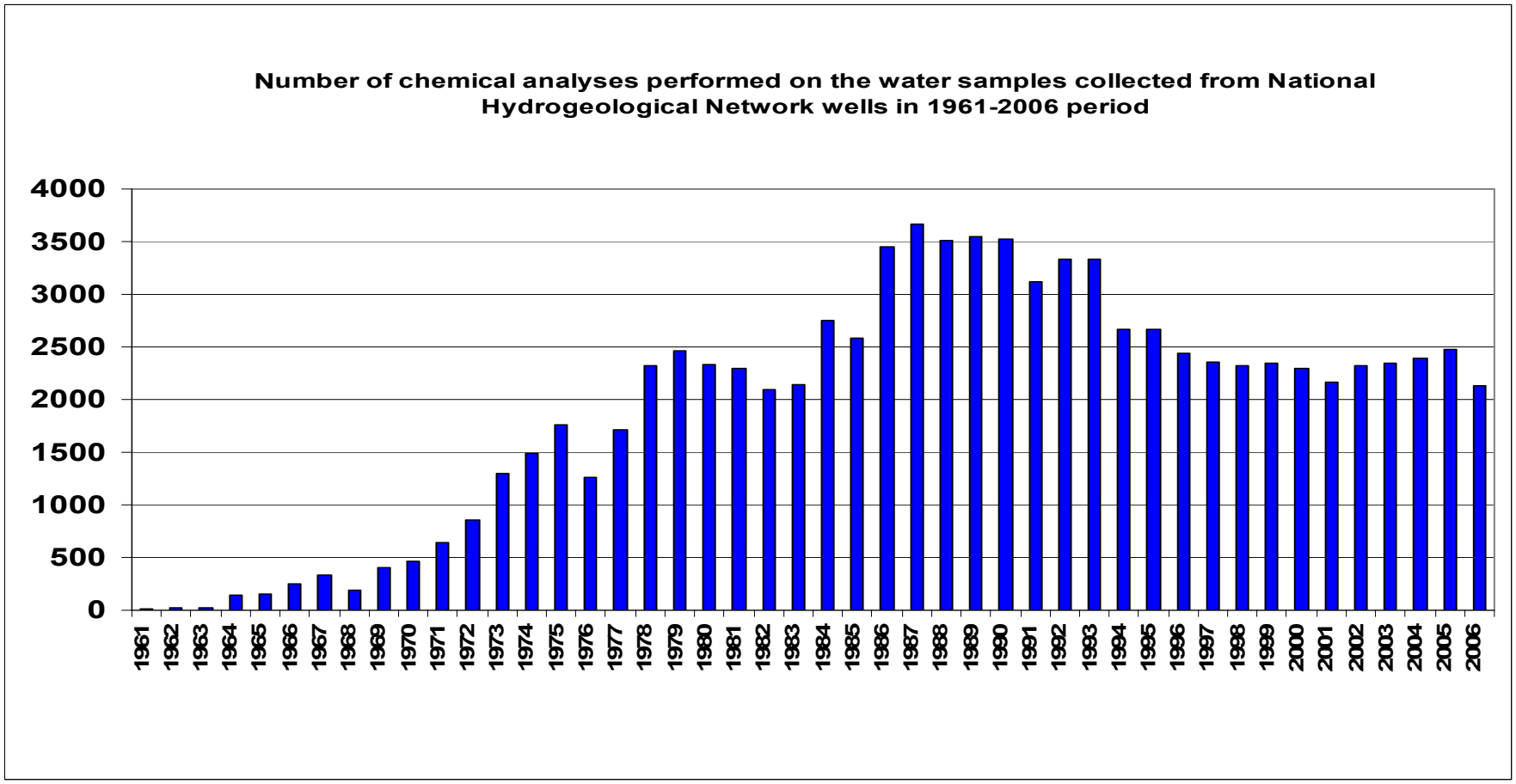
- hydrogeological stations types:
  - *Ist order* (aim: surveying of connection between groundwaters and surface waters): transversal alignments of wells (2 – 15) on the main surface water courses, situated at the distance of 15 – 20 km between them (located in floodplains and terraces)
  - *IInd order* (aim: surveying of groundwaters regime in connection with climatic factors): isolated wells (1 – 2) located in interfluvial areas of plains, with a density of 1 well/ 20 km^2 - 1 well/ 50 km^2
- achievement period: 1960 – 1972
- total number of achieved wells – ca. 5.500, out of which in observation:
  - for levels and temperatures – ca. 4.000
  - for water quality – ca. 1.200
- measurements programme:
  - levels and temperatures - at each 3 days
  - samplings and analyses – twice/ year (at minimum and maximum levels)
  - analysed indicators – 22 (general and of pollution – NO_3, NO_2, NH_4 etc.)

GROUNDWATER MONITORING IN ROMANIA (6)

Wells number of the National Hydrogeologic Network with observations
concerning shallow waters levels in 1962-2006 period

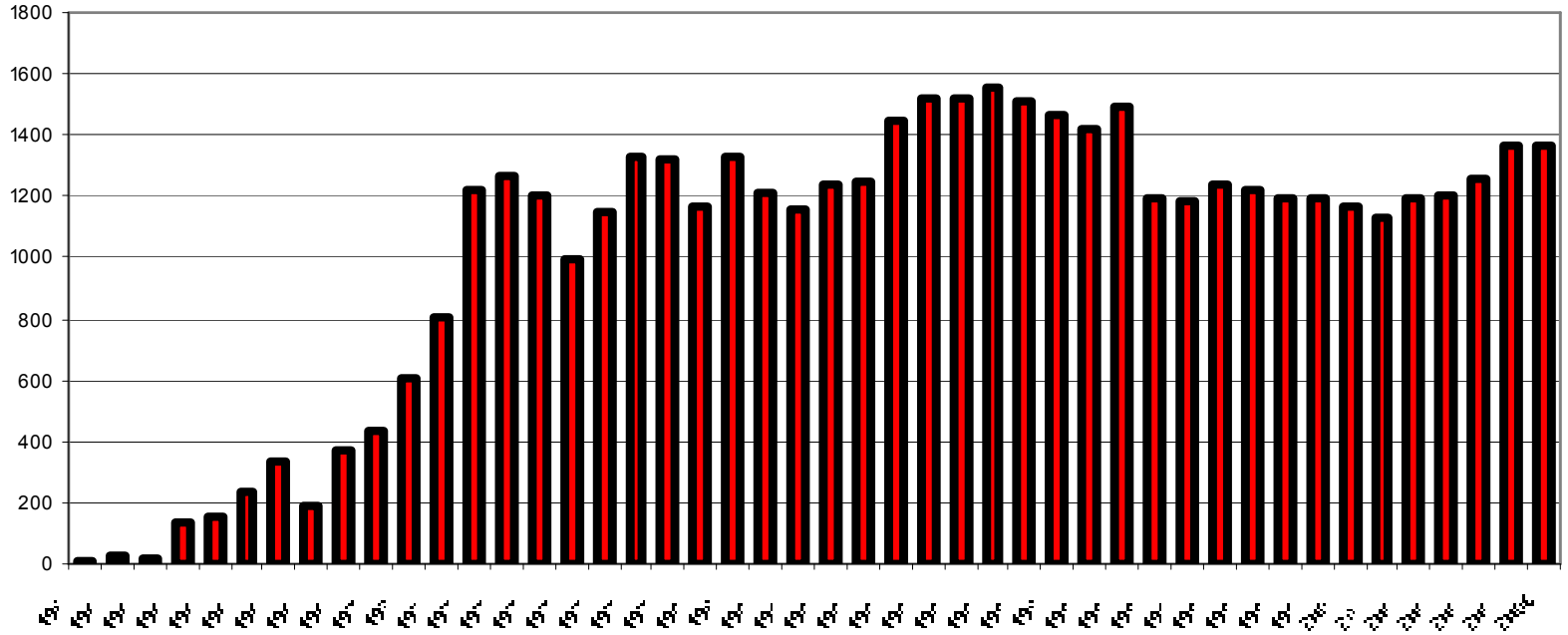


GROUNDWATER MONITORING IN ROMANIA (7)



GROUNDWATER MONITORING IN ROMANIA (8)

Number of wells from National Hydrogeological Network in which was performed the chemical analyses from 1961-2006 period



GROUNDWATER MONITORING IN ROMANIA (9)

Monitoring activity in Romania according to European Monitoring Guide beginning since 2006

MONITORING PROGRAMMES

Since 2006 it was begun a new monitoring programme according to the Water Framework Directive 2000/60/EC and Guide 15 - Monitoring guide. In Romania a national guide was achieved for the monitoring of the groundwaters and was presented in the frame of Working Group of the European Comission, General Environmental Direction.

The monitoring programmes are:

- ***Surveillance programme (S) ;***
- ***Operational programme (O);***
- ***Programme for potability (P)***
- ***Programme for the vulnerable zones (VZ)***
- ***Programme for international agreements (IC).***

GROUNDWATER MONITORING IN ROMANIA (10)

Groundwater monitoring examples (1)

A. The Buzău-Ialomita inner river basin

The Buzau-Ialomita river basin covers a surface of 23,874 km^2 and comprises territory of the South-East part of Romania. It is surrounded by the Siret and Prut river basins (Northward), the Olt basin (North-Westward), the Arges basin (South-Westward), Danube basin (Southward), the Danube river being the border between Romania and Bulgaria on a length of 75 km, and by the Dobrogea-Litoral basin (Eastward).

In the Buzau-Ialomita Water Direction the monitoring programme is aplied for the 18 groundwater bodies which were delineated in Romania according to the Water Framework Directive 2000/60/EC.

GROUNDWATER MONITORING IN ROMANIA (11)

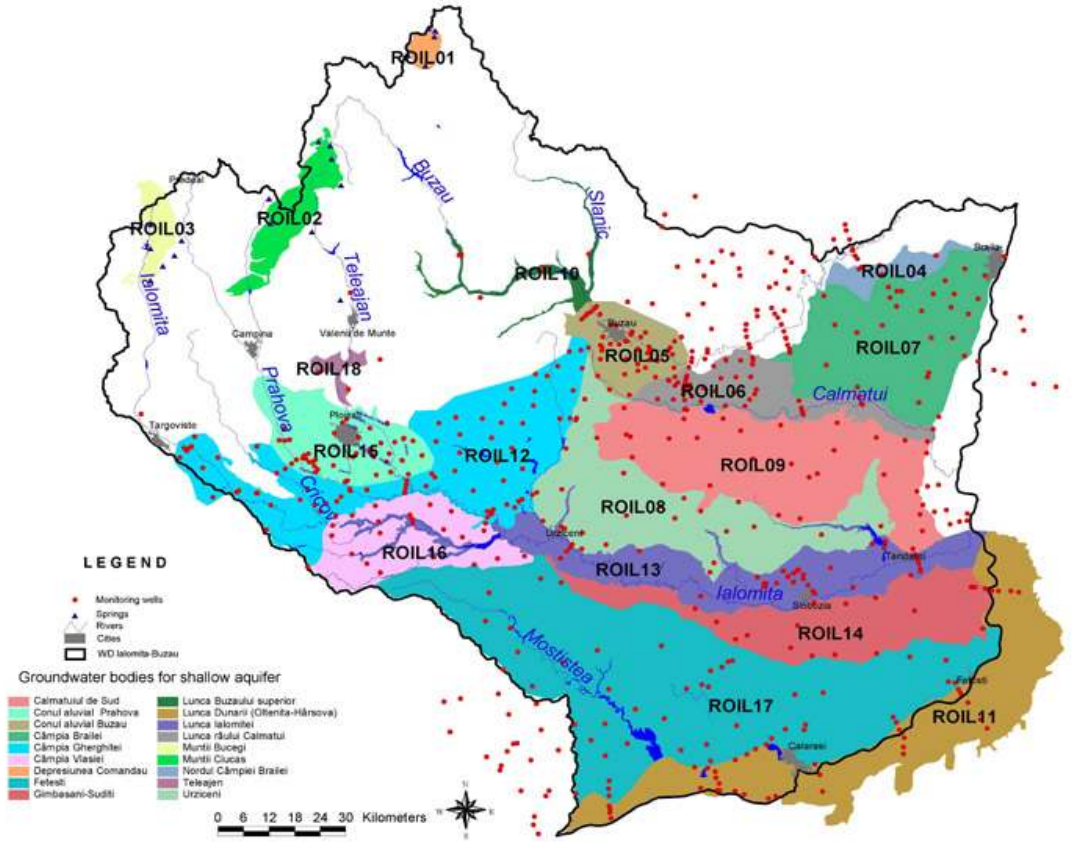
Location of the Buzau-Ialomita and Dobrogea-Litoral Water Directions

GROUNDWATER MONITORING IN ROMANIA (12)

In 2006, 469 wells were observed in Buzau-Ialomita Water Direction for all groundwater bodies and present the following characteristics:
- for piezometric level measurement - 191 wells of the Ist order, 214 wells of the IInd order, 38 wells for the monitoring of the lakes and 19 wells for the monitoring of the catchments;
- for chemical parameters, 460 analyses from 253 point of sampling were performed;
- 8 wells were used for the pollutants monitoring;
- temperature of water was measured in 69 wells;
- in 9 wells pumping tests were carried out;
- in 62 wells works were undertaken.
The frequency of monitoring was established taking into account the monitoring programme.
As far as the shallow aquifers are concerned, in 2007 piezometric levels measurement will be carried out in 519 wells and 20 springs (in the mountain area for the monitoring the 4 groundwater bodies which develop in this area)

GROUNDWATER MONITORING IN ROMANIA (13)

Map with the monitoring wells in the Ialomita-Buzau Water Direction



GROUNDWATER MONITORING IN ROMANIA (14)

Groundwater monitoring examples (2)

B. South Dobrogea

The programme monitoring of transboundary Sarmatian and Upper Jurassic-Lower Cretaceous aquifers was made in the frame of EU/PHARE project between Romania and Bulgaria with one year duration and ending in the November 2007.

Programme comprises two types of monitoring networks (as required by WFD, surveillance and operational networks for groundwater quality, and network of monitoring points for groundwater quantity).

Number of points, frequency of monitoring and list of parameters and constituents are specified for both Romania and Bulgaria.

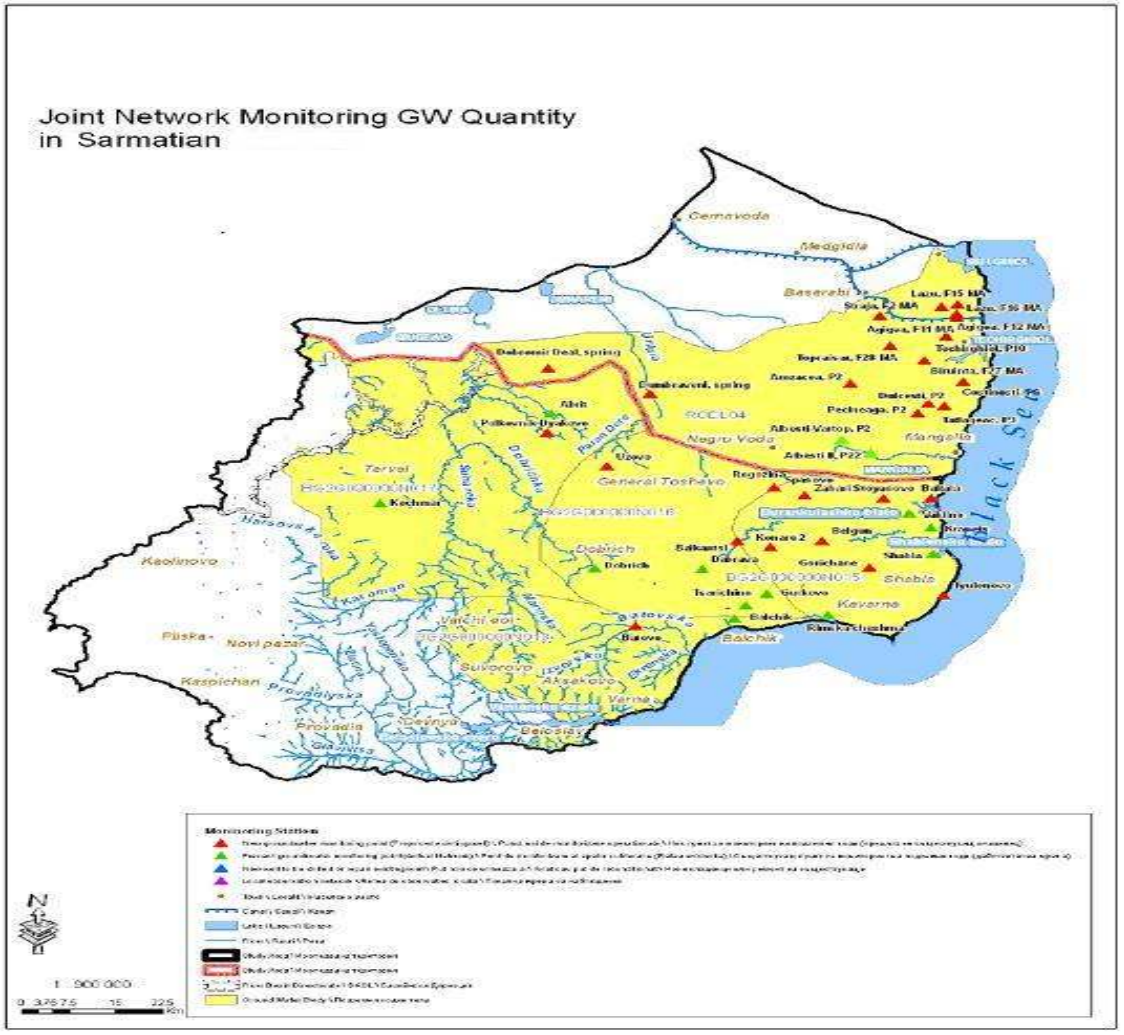
GROUNDWATER MONITORING IN ROMANIA (15)

Summary of Proposed Groundwater Monitoring Programme

Monitoring Network	Subnet	Number of monitoring points		
		BG	RO	Total
Qualitative				
Surveillance	Upper aquifer (N1s)	12 (14)[2]	10	22 (24)
	Lower aquifer (J3-K1)	10 (14)[1]	16	26 (30)
Operational	Upper aquifer (N1s)	10 [3]	6 [4]	16
	Lower aquifer (J3-K1)	0	8 [5]	8
GW Dependent Ecosystems	Upper aquifer (N1s) + coastal lakes	6 (to be specified for Durankulak Lake)	3 quantity 1 quality	10
Quantitative	Upper aquifer (N1s)	23	14	37
	Lower aquifer (J3-K1)	27	15	42
Total		88 (94)	73	161 (167)

GROUNDWATER MONITORING IN ROMANIA (16)

Groundwater quantity network in the Sarmatian aquifer



Conclusions

The groundwater monitoring in Romania is made both through the monitoring wells from the National Hydrogeological Network and through the local networks which can be public or private.

The Buzau-Ialomita and Dobrogea-Litoral Water Directions are two from the eleven Water Directions on the Romanian territory and are situated in the south-eastern part of the Romania.

The monitoring programmes from 2006 were applied for groundwater bodies atributed for the management to the Buzau-Ialomita inner river basin.

The analysis of the monitoring wells carried out in 2006 for the 18 groundwater bodies has indicated, locally, over-takings of the maximum allowable concentrations for: ammonium, nitrates, nitrites, and for chlorides.

The results of the local monitoring from 250 monitoring wells, in the Ploiesti area which is polluted with the oil products, indicate the most significant decrease in total hydrocarbons concentrations from 2003 to 2006.

As regards the monitoring of the two transboundary groundwater bodies in South Dobrogea, the monitoring network was established by Romania and Bulgaria, and the recommended parameters are according to the Water Framework Directive and European Monitoring Guide stipulations.

THANKS FOR YOUR ATTENTION !