



## Danube Water Integrated Management



Common borders. Common solutions.



**Under the Activity 2 of the WATER Project – Implementing of the Water Framework Directive (2000/60/EC) through a performance program for the monitoring of the conditions of the Danube Rivers**

For BG and RO - a Legislative frame of monitoring networks organization has been described.

During this activity it was analyzed the main documents regarding the surface and groundwater issues related to the European implementation strategy for the Water Framework Directive (2000/60/EC), the EU standards for quantitative and qualitative parameters of water and transposition of the EU Directives in Romanian legislation and in Bulgarian legislation. Till now in Bulgaria were implemented fourteen EU Directives concerning the water quality.

**Under the Activity 4 of the WATER Project – Harmonizing the Romanian and Bulgarian monitoring methodologies have been made and a Monitoring Guidelines was crested.**

The hydrological, chemical and biological status of surface water and quantitative and chemical groundwater monitoring networks in Romania and in Bulgaria has been described.

The Bulgarian part of the Danube River (the Lower Danube) has a length of 469,5 km between the settlements - Novo selo and Silistra, serving as border with Romania.

In compliance with the requirements of WFD an integrated water monitoring system in the Bulgarian sector of the

Danube River region has been developed consisted by 7 specific quality monitoring programs, applied to surface water and groundwater.

- 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 and groundwater;
- sections of reference program (R) applied to surface water;
- drinking water program , applied to groundwater;
- vulnerable areas program, applied to surface water and groundwater;
- programs under Danube Convention - ICPDR(TNMN), applied to surface water and groundwater;

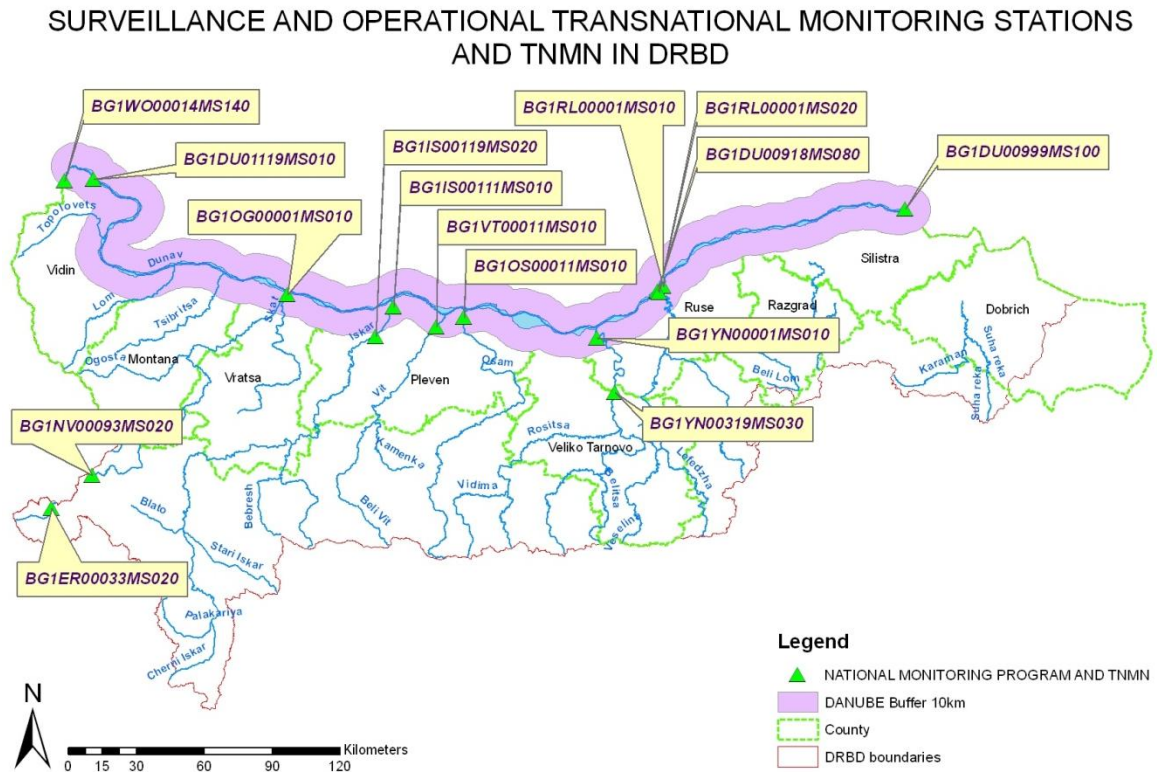
The criteria for selecting monitoring sites for surface water are described in the Monitoring Guidelines – for the Surveillance monitoring stations and for the Operational Monitoring Stations

The determination of monitoring station and in which monitoring program /surveillance or operational/ they are included, depends on the impact assessment (risk assessment of the water body). The evaluation is done using a developed methodology and published in the Manual for the implementation of the Water Framework Directive in Bulgaria - under the Twinning project between Bulgaria and Germany. In assessing the

fulfillment of the objectives for river water using the consecutive steps of assessment:

After determination of the impact, assessment for achieving or not achieving

the environmental objectives for good water bodies' status the following locations of monitoring stations on Danube River and its larger tributaries have been selected - shown in the figure below:



**Quantitative monitoring for surface water:**

Data in the various documents in the archive have been identified for the joint Romanian-Bulgarian border on the Danube, for a number of nine gauging stations

*The gauging stations on the Danube, on joint Romanian-Bulgarian border*



## Groundwater monitoring

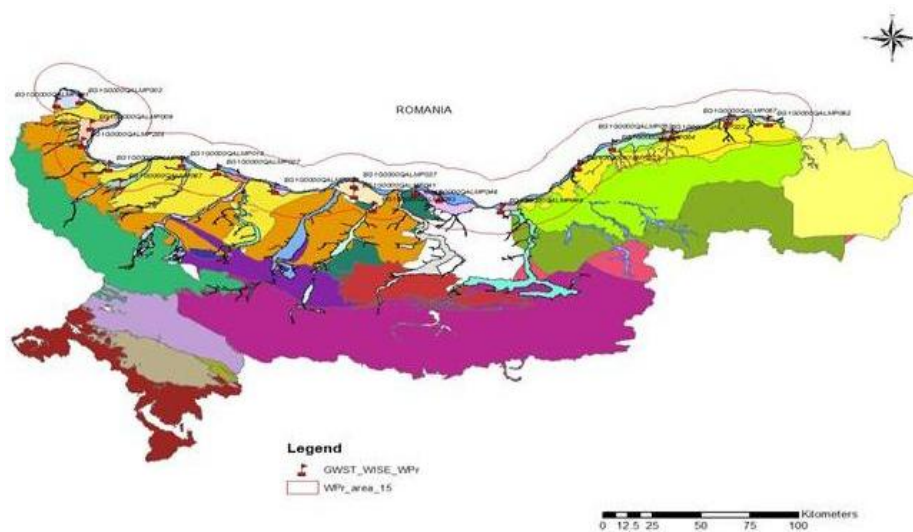
### Groundwater quality monitoring / data processing in Bulgaria

23 points belong to the chemical surveillance monitoring network of the Basin Directorate for Water Management - Danube Region within the area of the project, covering all 19 groundwater bodies have been determined. Out of those, operational monitoring is carried out in 6 points of 6 GWB; and in 21 of all sampling sites the drinking water protection areas are monitored, 12 of the

points are within the EIONET (European Environment Agency) network. Two of the points are also monitored for quantity (for flow rate).

.The locations of sampling sites, parameters and frequencies of monitoring have been determined in compliance with the requirements of WFD, Directive 2006/118/EC and CIS (Common Implementation Strategy) Guidelines and Technical reports for monitoring.

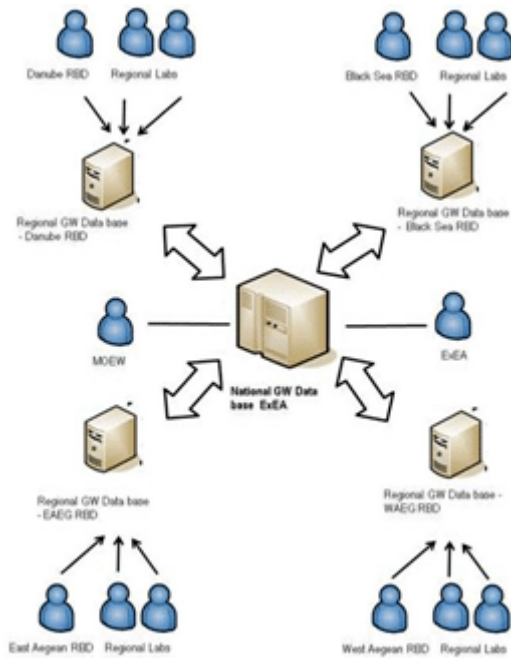
### *Chemical status groundwater monitoring points in the boundary area – Bulgaria*



The chemical status of Groundwater is evaluated based on information has been stored in Groundwater (GW) monitoring data – Database in the Executive Environment Agency (EAE ExEA). The National

ORACLE database is situated in the Executive Environment Agency - on ORACLE server. The 4 regional databases – for 4 River Basin Directorates are on 4 MySQL servers.

***Right Figure: Groundwater data flows from the 15 Regional Laboratories to the 4 River Basin Directorates – to the National Groundwater data base***

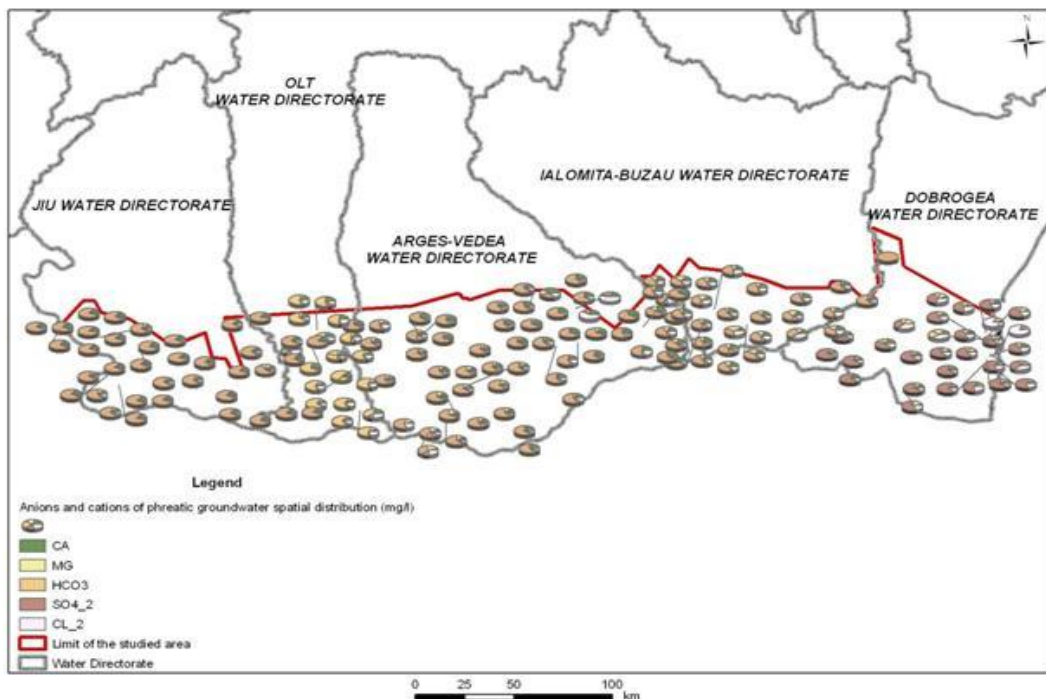


In accordance with Article 4(2), Directive 2006/118/EC, a groundwater body shall be considered to be of good condition status according to the Annex V to Directive 2000/60/EC and on the basis of the assessment required in paragraph 3 of Annex III, when the concentrations of pollutants are not exceeding the groundwater quality standards or threshold values, had been established in cause of significant environmental risk, taking into account, where appropriate, the extent of the pollution in the body of groundwater which is affected;

### Groundwater quality monitoring / data processing in Romania

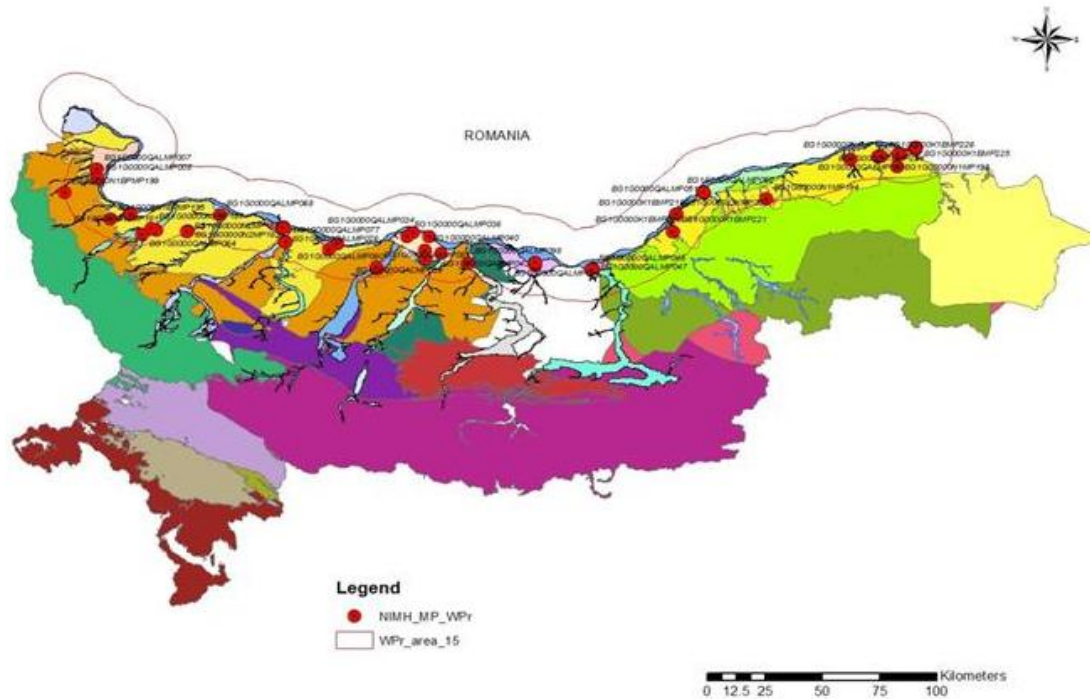
Characterization of groundwater quality in natural conditions shall be based on general indicators covering natural regime and on some specific indicators – determined by the types of existing pollution in the area (industrial sites, human agglomerations, agricultural sources of pollution (pollution 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 which are monitored both the possible occurrence of pollution underground aquifers and their dynamic evolution. A map with the main quality parameters is presented in the next map.



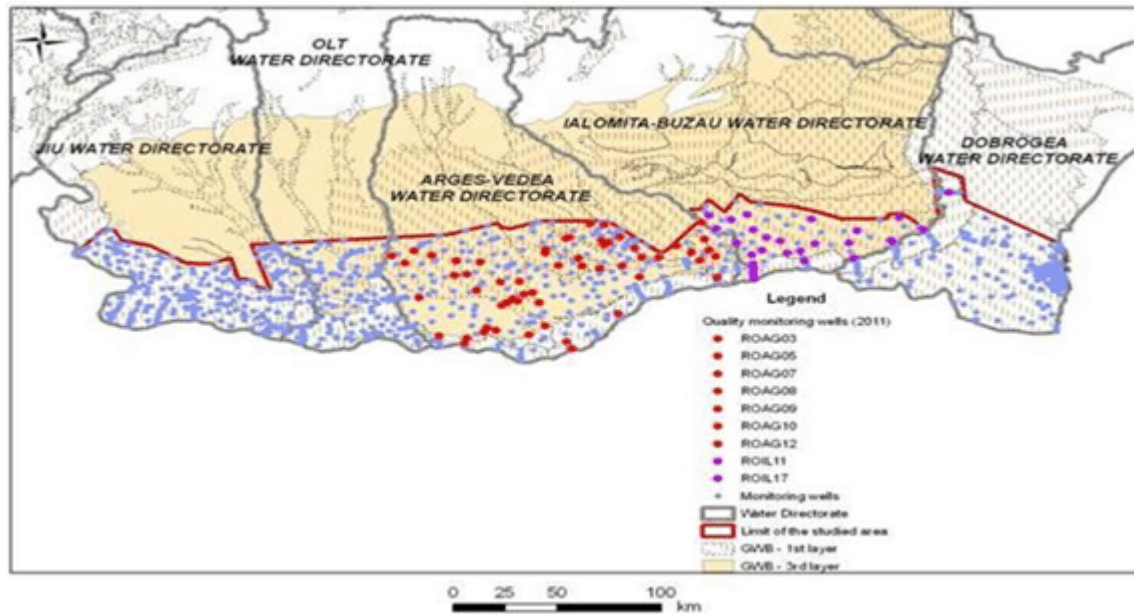
## Groundwater Quantity monitoring points in Bulgaria

The monitoring programme for the quantitative status in the project area includes 54 points for 19 groundwater bodies – shown in the figure below:



**Monitoring for Groundwater quantitative status in Romania** The network and the monitoring program of the quantitative status of groundwater bodies have been designed to provide data for assessment of the changes in the natural recharge of groundwater and the water balance; The interaction between groundwater and surface waters in the

larger rivers; Elaboration of the initially adopted conceptual models of the groundwater bodies; The direction of the flow and the rates of the groundwater flows crossing the state boundary to the territory of the Republic of Romania, for the identification of the cross-border groundwater bodies.



**Under the Activity 15 Detailed of the WATER project detailed analysis of the underground water in the RO-BG border area has been done.**

Among others a study environmental isotope in groundwater and surface water has been done.

Regarding the **study related to the environmental isotope field campaign**, PP3 has done a good documentation concerning the use of radioactive isotopes for groundwater, as well as the laboratories which may analyze the samples and accomplish the interpretation and correlation of the results.

Environmental isotopes planned to be used are: Tritium ( $^3\text{H}$ ); Deuterium ( $^2\text{H}$ , D) and Oxygen-18 ( $^{18}\text{O}$ ). The analyses have been done during the project for all

types of water (phreatic or deep groundwater and surface waters) in representative points established by the project team (PP3, PP9 and PP12).

Since in many areas of the world relevant long-term data on water resources are missing the isotope methods in combination with mathematical modelling can answer questions about groundwater origin, chemical reactions, fluxes, ages and mixing processes occurring in aquifers and caused naturally or by man. So, the isotope methods are part of modern hydrology and contribute to the possibility of getting a detailed insight into the water cycle and permit identification and quantification of groundwater and surface water components.

**For BG territory two sampling groundwater campaigns for isotopes study (23, 24 and 25<sup>th</sup> of July 2013 and 16, 17 and 18<sup>th</sup> of October 2013) were carried out** – from Vidin to Ruse – and have been sampled 6 groundwater sampling sites and 6 river water sampling sites situated in 6 Groundwater bodies:

- Groundwater Body BG1G0000QAL010 Porous water in Quaternary - Brashlyanska lowland – sampling groundwater Slivo pole, Shaft well - Pumping Station and
- Groundwater Body BG1G0000QAL002 Porous water in Quaternary - Vidinska lowland - sampling groundwater Vidin, Shaft well – Pumping Station and Danube river
- Groundwater Body BG1G0000QPL023 Porous water in Quaternary between rivers Lom and Iskar - sampling groundwater Borehole Kozloduy and Danube
- Groundwater Body BG1G0000QPL026 Porous water in Quaternary between rivers Osam and Yantra - sampling groundwater Tsarevets, Shaft well and tributary of Danube

- Groundwater Body BG1G00000N2034 Porous water in Neogene of Lomsko-Plevenska Depression (instead of the GWB BG1G00000N2035) - sampling groundwater Lom, Borehole and Danube
- Groundwater Body BG1G000N1BP036 Karst water in Lomsko-Plevenska Depression - sampling groundwater Mizia, Borehole and Ogosta River, which is tributary to Danube.

*Pictures from field trips and isotope sampling in Bulgaria*

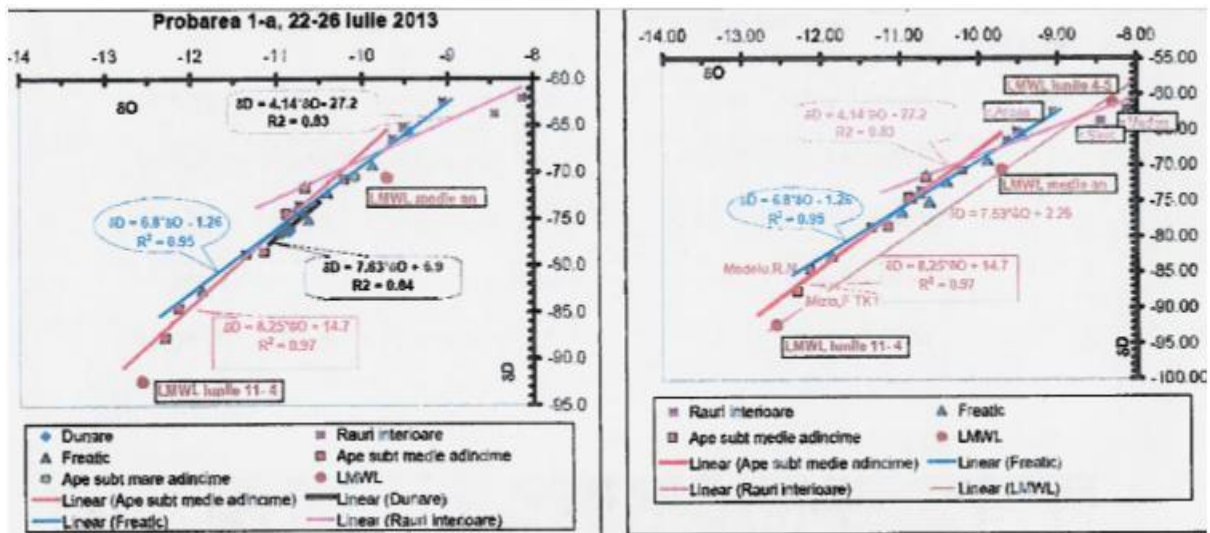


*Some laboratory results for isotope contents in groundwater and surface water:*

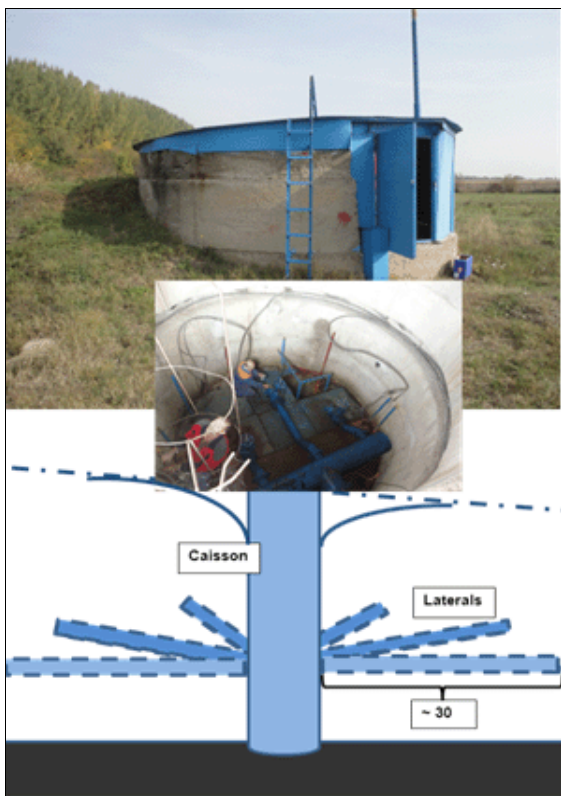
Lab-No.	Sample, no & label	Sampling date	$\delta^{18}\text{O}$ ‰	$\delta^2\text{H}$ ‰	D-excess	Tritium, TU
250398	1 Rou Vieru, P13	prob 1-a	-10.09	-70.6	10.12	$2.7 \pm 0.76$
250399	2 Rou Balanoaia, P2		-10.21	-70.7	10.98	$6.4 \pm 0.66$

250408	11 Bulg. Slivo Pole		-10.87	-74.5	12.46	$11.4 \pm 1.10$
250409	12 Bulg. Danube Slivo Pole		-10.87	-76.1	10.86	$16.2 \pm 1.10$
250410	13 Bulg. Tsaverets F		-10.76	-73.8	12.28	$5.0 \pm 0.92$
250411	14 Bulg. R. Bara Tsaverets		-10.74	-73.5	12.42	$4.9 \pm 1.10$





One example – groundwater and Danube river water sampling – next to the village Slivo pole - Bulgaria



Below: Surface water sampling from Danube river near to the village Slivo pole into the right bank of the Danube River



Left side: Groundwater sampling from Ranney collector well near to the village Slivo pole into the right bank of the Danube River.



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