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"NETWORK OF DANUBE WATERWAY ADMINISTRATIONS"

South-East European Transnational Cooperation Programme

STATUS QUO REPORT ON HYDROGRAPHICAL ACTIVITIES

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1 LIST OF ABBREVIATIONS

TRACECA	Transport Corridor Europe-Caucasus-Asia
GDP	Gross Domestic Product
NIMH	National Institute of Meteorology and Hydrology
IPCC	
DGPS	

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4 SCOPE OF DOCUMENT

This document is prepared in within Activity 3.1 of the project – Improve methods, processes and procedures for hydrographical and hydrological activities. According to the Description of works all the project partners have to prepare status quo report on the hydrographical activities including information about the water river network, watershed divide, watershed area, landscape, surveying activities, equipment for measurements, etc.

This report will contribute for the elaboration of a final report for all the countries from the WPL, based on which best practices cases will be identified and know how exchanged.

5 ASSIGNED REGION OF INTEREST

5.1. Geographical position and area

Bulgaria is situated in the Eastern part of the Balkan Peninsula and takes 22% of its territory. Its area is 110 843 km², 110 510 km² of which is land and 333 km² water. The natural boundary with Romania is the Danube River which is navigable for cargo, commercial and passenger vessels along the entire boundary stretch. The eastern boundary is the Black Sea with a coastline of 378 km and two main bays – the Varna and Bourgas Bays. The southern boundary is with Greece and Turkey and the Western – with the Republic of Macedonia and Serbia. The total state boundary length is 2245 km as 1181 of them are land, 686 are river kilometers (mainly along the Danube River) and 378 are sea kilometers.

Figure 1 Location of Bulgaria

5.2. Economical position

Bulgaria has unique transport location. As a part of Eastern Europe Bulgaria is a transport crossroad and a transit territory between Western Europe, the Near and the Middle East and the Mediterranean. The roads from the former Soviet republics to Southern Europe and Africa are crossing here. Five Pan-European transport corridors pass through the territory of Bulgaria, as determined at the Common European conferences of the transport ministers in Crete (1994) and Helsinki (1997), namely: Pan-European Transport Corridor IV, Pan-European Transport Corridor VII, Pan-European Transport Corridor VIII, Pan-European transport corridor IX and Pan-European transport corridor X.

Figure 2 Transport corridors passing through Ruse

The main transport directions crossing the country are doubled with railroads. The access of Bulgaria to the Black sea connects the country with all other Black sea countries. This gives great opportunities for developing the transport and the loading and discharging activities in the big ports of Bourgas and Varna. The East European countries are connected to the inland waterways of West Europe through the Danube River. The meaning of the river has significantly increased after the completion of the navigation channel Rhine – Mein – Danube. Combined river – land and river – sea transportation of goods is performed along the river.

The crossroad location of Bulgaria is very important for its development as a world tourist destination. There are great opportunities for development of both the transit and the active recreational international tourism. These are facilitated by the significant number of natural and cultural and historical sights.

Currently the Bulgarian foreign trade has European orientation. Bulgaria gets a good advantage from: being a member of the World Trade Organization /since the autumn of 1996/, being associated to the European Union, being a member of the Black sea economical zone for cooperation and the economical organizations within the UN.

Bulgaria stands alone among the EU’s eastern members as the only one yet to show an improvement in GDP performance. Unlike its fellow east-central European countries, Bulgaria saw its year-on-year decline in real GDP worsen to -5.8% in the third quarter of 2009.

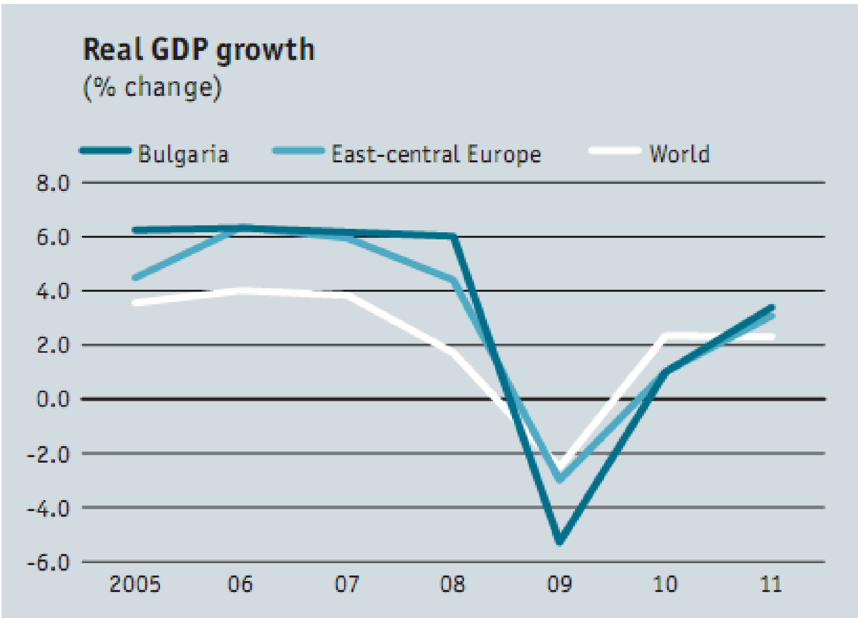

Figure 3 Real GDP growth 2005 – 2010

5.3. Water river network – main basins and sub basins

The Bulgarian stretch of the Danube, which is part of the Lower Danube, is along the right bank of the river starting from the outfall of the Timok river and reaching the city of Silistra downstream the Danube with total length of 471 km. The catchment area of the river increases with 105 000 km² 43 000 km² from which are in the Bulgarian sector (the Predbalkan Mountains, the north slopes of the Balkan Mountines and a part of the Rila Mountain).

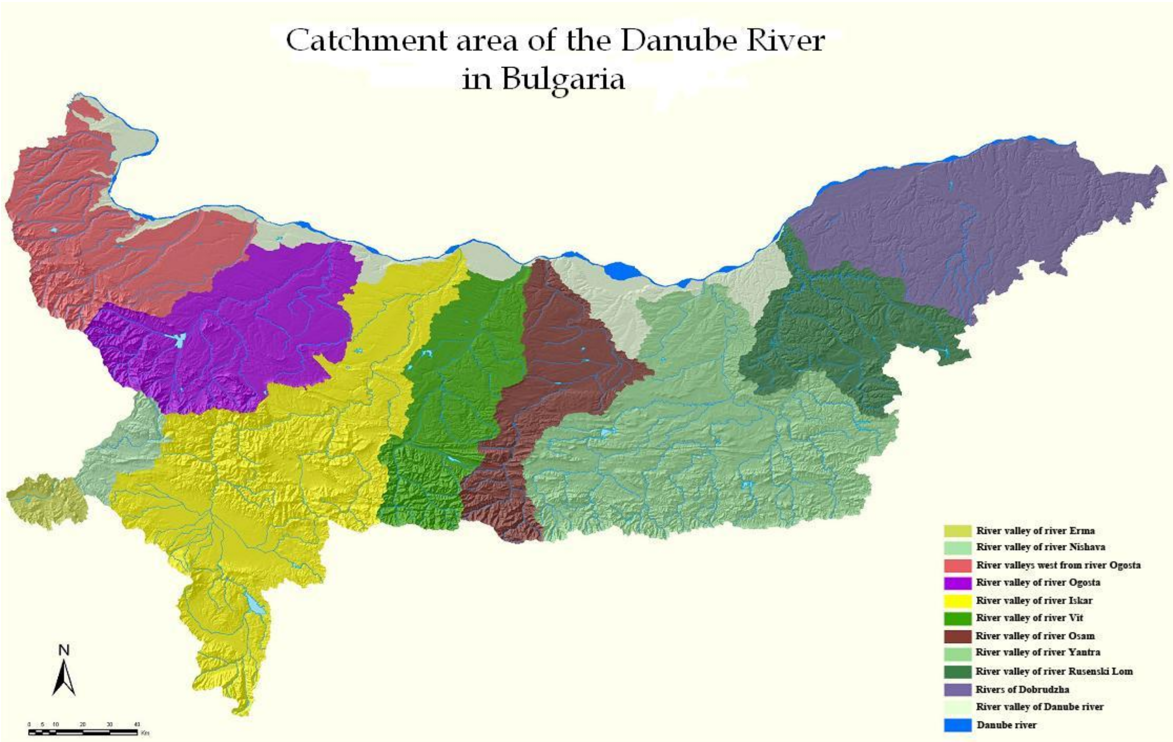

Figure 4 - Catchment area of the Danube in Bulgaria

The catchment area of the Danube in the Bulgarian section of the river has the following boundaries: from north – Romania, from east – The Black sea region, from west – Serbia, and from south – East and West Aegean sea basin regions.

It includes the rivers Erma, Nishava, Ogosta and west from Ogosta, Iskar, Vit, Osam, Yantra, Rusenski Lom and the rivers of Dobrudzha.

River	Length of the river network /main river plus all trubutries / km.	Length of the river network main river plus main trubutries / km.	Length of the main river km
West rivers	3594.388	1086.484	
Ogosta	2880.603	747.155	142.473
Iskar	7358.285	1318.481	350.705
Vit	2454.087	509.098	167.999
Osam	2036.285	357.569	204.457
Yantra	6426.084	1291.984	222.49
Rusenski lom and the rivers of Dobrudzha	2175.456	874.543	244.528
Total	26925.188	6185.314	1332.652

Table 1 Length of the Bulgarian Danube tributaries

Iskar River is the longest river entirely running in Bulgaria. Its length is 368 km, and the catchment area together with its tributaries - 8647 km^2. Its location has the following coordinates: between 42° 05’ and 43° 45’ north longitude and 22° 50’ and 24° 30’ east latitude. The river network density is 1,1 km/km^2. It had 25 tributaries with total length over 15 km

Vit River is 189 км long. Its catchment area is 3220 km^2 with average river network density about 0,5 km/km^2 . The river has 10 tributaries with total length of 10 km. Its location has the following coordinates: between 42°45' and 43°40' north longitude and 24° 10' and 24° 45' east latitude.

Ogosta river and the rivers west from Ogosta (Topolovets, Woinishka, Vidbol, Archar, Skomlia, Lom, Tsibritsa, Ogosta and Skat) have a total area of 8 022 km^2. The total annual discharge if these river is 1 254.10^{6}m^3. Ogosta River is the biggest one among them with about 40 tributaries.

Osam River is 314 km long. Its catchment area is 2824 km^2 and has just few tributaries. Its river network density is 0,4 km/km^2, and at some places to 0,15 km/km^2 .

Its location has the following coordinates: between 42° 35' and 43° 13'north longitude and 24° 30' and 25° 20' east latitude.

Yantra River is the river that has biggest area of catchment area after Iskar (7869 km^2). It is 285 km long and has 30 tributaries with total length about 10 km. The river network density varies as for the river itself it is 0.7 km/km^2 and for the tributaries – from 0.3 km/km^2 to 1.5 $km/km^{2.}$ Its location has the following coordinates: between 42° 40' and 43°40’ north longitude and 24° 45' and 26° 30' east latitude.

6 CLIMATOLOGICALLY CONDITIONS

6.1. Network

The Bulgarian section of the Danube River stretches from the Timok River estuary to the town of Silistra and is included in the northern climatic area of the Danube plain which itself is a part of the moderate continental sub region of the European continental climatic region. The main climate forming factors for the Danube region are the geographical location of the Bulgarian riverside (which is approximately along the 44th parallel), the low above sea level height, the Balkan mountain to the south and the Carpathian mountain to the north.

The hydrometeorological stations of EAEMDR in Novo selo, Lom, Oriahovo, Svishtov, Ruse and Silistra continuously perform the entire complex of meteorological observations. NIMH also has a number of specialized synoptic and meteorological stations.

Figure 5 Locations of synoptic and climatologically weather stations in the Bulgarian Danube Region

6.2. Temperature

This region is situated within the temperate continental climatic area and is typical with its cold winter and hot summer. Most stations have registered absolute minimum air temperatures in January, except the one in Ruse (in December) and the absolute maximum air temperatures have been registered in July.

Station	Absolute minimum	Average per year	Absolute maximum
Novo selo	-23.8	11.2	41.2
Lom	-20.6	11.7	40.3
Oriahovo	-20.4	12.2	41.0
Svishtov	-20.4	12.2	43.0
Ruse	-19.3	12.2	44.0
Silistra	-22.0	11.9	39.9

Table 2 Air temperatures, °C (1961-2001)

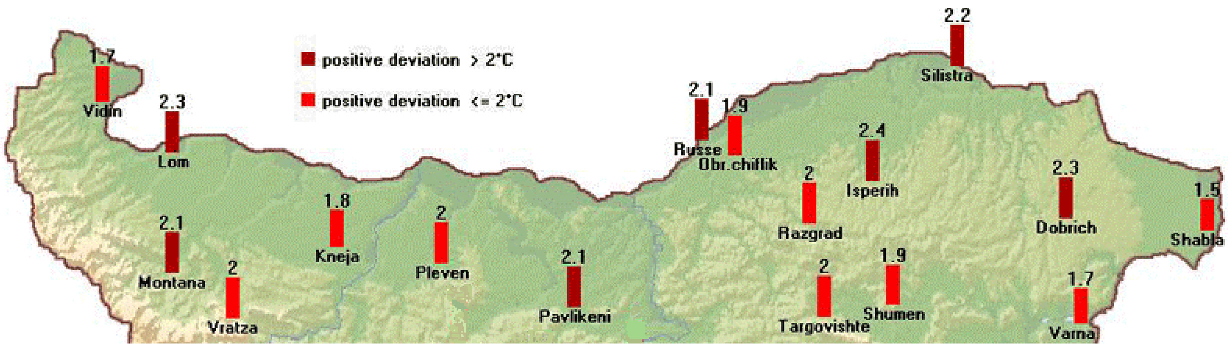

Figure 6 Air temperature deviation (ºC) from the mean annual values for the period 1961-1990 2007

6.3. Precipitation

The rainfalls regime along the Danube River is also distinctively continental. Their maximum is registered in June and their minimum – in February.

Station	Average rain quantities per year, l/m^2
Novo selo	528
Lom	579
Oriahovo	555
Svishtov	543
Rousse	614
Silistra	547

Table 3 Average rain quantities per year

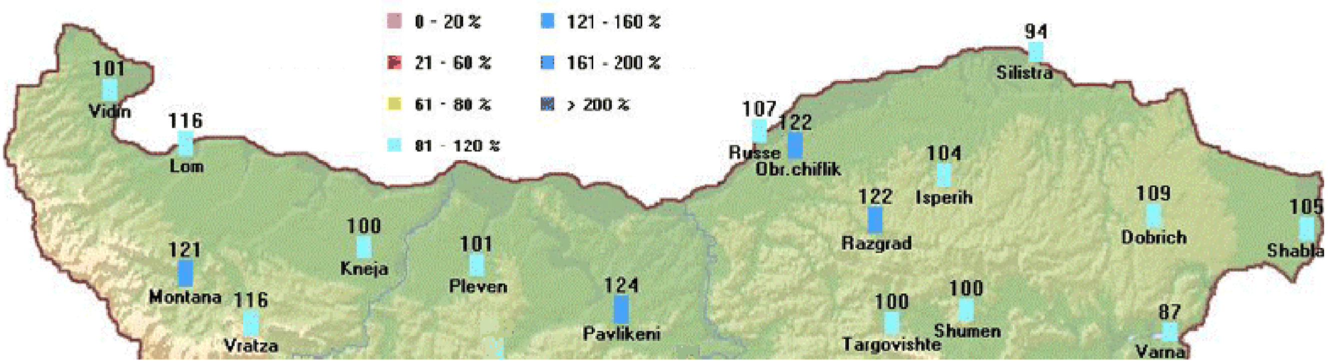

Figure 7 Precipitations in % from the mean annual sums for the period 1961-1990 2007

6.4. Long-time variations climatological elements

Climatic models are used to produce long-term forecasts of the climate elements' changes. The numerical climatic surveys are performed using two types of physical-mathematical models with different resolution. It is the most important feature as far as the experiment precision and details depend on it. The step decrease is accompanied by the necessity of significant increase of the calculation resources and that is why these models are divided to global and regional ones.

The global models have low resolution of approximately 300 km and are directly coordinated by the IPCC. They cover the entire Earth. Regional models with high resolution of approximately 10 km are used for a more detailed definition of changes for a certain region.

After these models have been applied for the Bulgarian Danube riverside, the following changes of air temperatures and rainfalls for the period between 2020 and 2050 came as a result compared to the period between 1960 and 1990 (which is considered as a climatic standard):

- increase of the average year air temperature: from 2.0 to 2.4°C;
- decrease of the average year sum of rain quantities with 5 – 10%.

For the period between 2050 and 2100 according to the 1960 – 1990 period the changes are as follows:

- increase of the average year air temperature with 3.8 - 4.0°C;
- decrease of the average year sum of rain quantities with 5 – 10%.

The analysis of the linear regression for the mean annual temperatures for the station at Ruse for the period 1961 – 2008 shows that the trend is to increase. The mean annual temperature for the period increased with 0,8 ºC

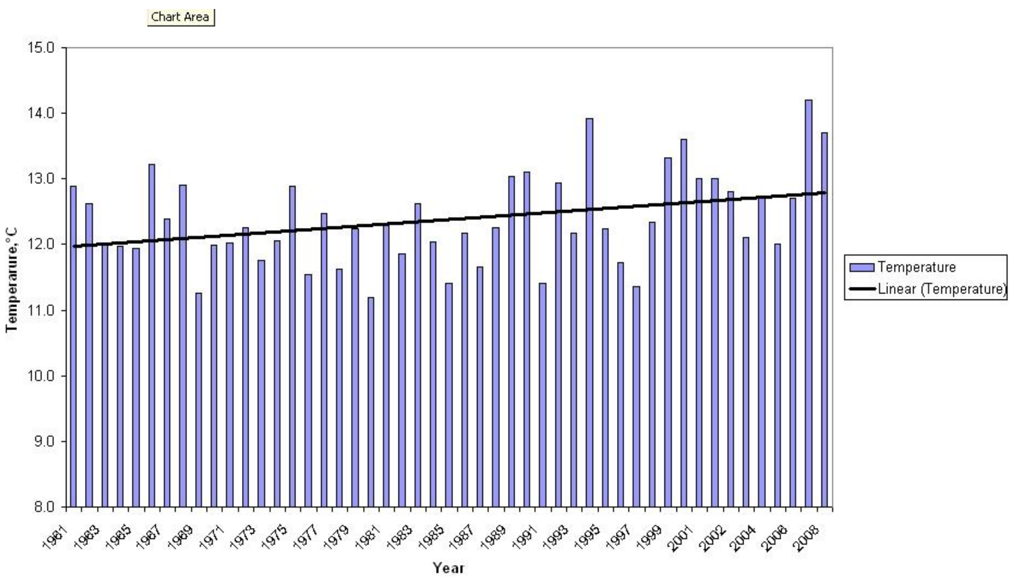

Figure 8 Mean air temperature at Ruse 1961 – 2008

The analysis of the linear regression for the annual precipitation quantities for the station at Ruse for the period 1961 – 2008 shows that the trend is to decrease. The the annual precipitation quantities for the period decreased with 16l/m².

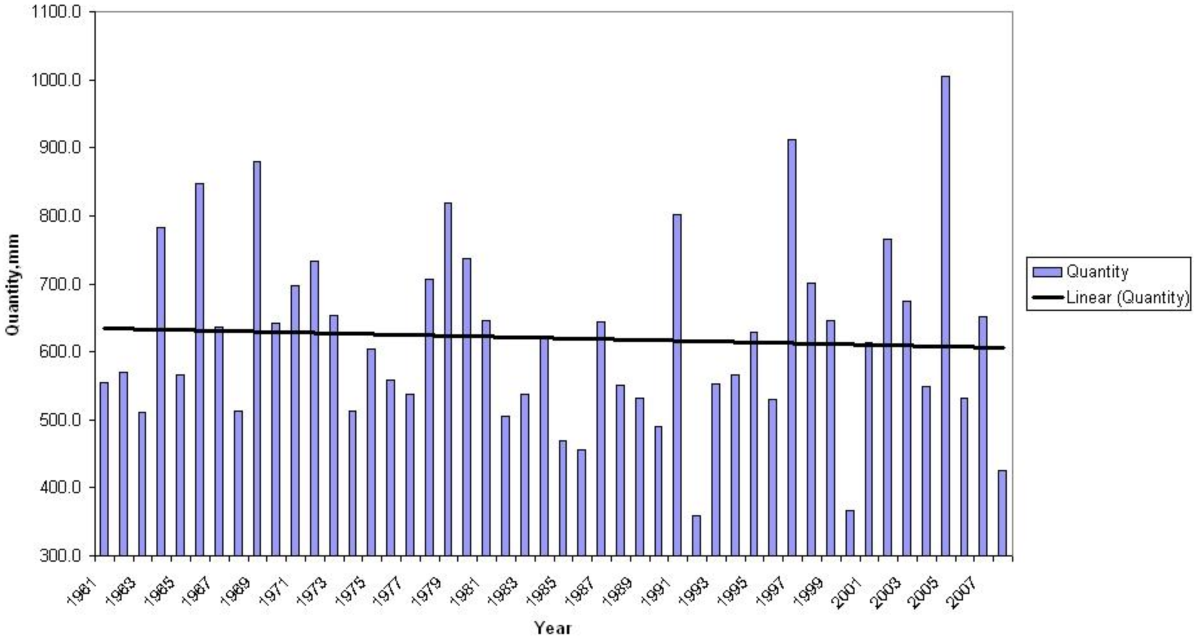

Figure 9 Annual precipitation quantities at Ruse 1961 – 2008

7 MAIN BASINS DESCRIPTION

7.1. Orographic, geomorphic and morphometric conditions

The low Bulgarian riverside has a number of dykes built on it. The dykes are at a lower level compared to the Romanian ones. It is necessary to perform an expert dykes' evaluation of the as the Bulgarian dykes are built before the Romanian ones.

7.2. Hydrogeological conditions

The river in this section is typical lowland river, it becomes shallower and broader and has a big seasonal difference of water levels – more than 9 m. Steep sediment walls, in some places up to 150 m, characterise the Bulgarian river bank.

The width of the riverbed in the Bulgarian section varies from 600m to 720m and is subject to constant changes. The influence of the local meteorological conditions, the existing soil types through which river passes, the riverbed configuration, the increase and decrease of the water and hard flow, the different river flow velocity influenced by the water formations, the hydrotechnical facilities and other natural forces and human factors define the active hydromorphological processes of the river in this section. As a result of their activity the riverbed constantly changes its geometrical and hydrological parameters (situation of the midstream, direction and velocity of the flow, structure of the flow, terrain shapes in the riverbed, etc.).

7.3. Prevailing soil condition

The soil cover of most of the Danube plain has formed on a loess base with steppe and forest steppe vegetation. Black earth soils are mainly developed compared to the less developed grey forest soils. The carbonate and typical black earth soils are located in the loess plateaus near the Danube River. South of the black earth soils' area the dark grey and grey forest soils are developed and mainly located in the Western part and to the East of the River Kamchia valley. Alluvial soils are developed on the low terraces of the big rivers and the lowlands along the Danube River.

7.4. Vegetation

The specific climatic and soil conditions have determined the transition from broad-leafed forest vegetation to the West to more dry-resistant grass vegetation to the East. The natural vegetation is located in limited areas /which are not suitable for agriculture/. Today the natural vegetation is preserved on the Danube islands and the riverside lowlands where the level of sub-surface waters is high which makes them not suitable for agriculture. The forests include mainly moisture tolerant species – willow and poplar. The most frequent tree species are some oak sub-species, elms, hornbeams, lime-trees, hazel bushes and etc. The most frequent steppe grass species are the iris and etc.

7.5. Sensitivity of basins to creation the flood extreme

During unusually high water levels there are islands, river terraces and population areas in danger of flooding. These are Vidin, a part of Lom, Nikopol, a part of the Ruse industrial area and the Silistra peer.

8 HYDROGRAPHICAL MEASUREMENTS

8.1. River bed measurements

The river bed measurements of the Bulgarian section of the river are performed by an expert team in the Hydrotechnical and Projects Department within the Executive Agency for Exploration and Maintenance of the Danube River.

Every year detailed hydrographical surveys of the critical sections are performed during the low water periods. If necessary, these sections are measured twice a year. Complete topographical and hydrographical surveys of the entire Bulgarian-Romanian section of the Danube River are performed every ten years not including the cases when it is needed. The last complete surveys were performed in the period 2004 – 2005. In order to monitor the hydrotechnical facilities (in the area of Ruse – Giurgiu Bridge) surveys are performed twice a year – during high and low water levels.

8.2. Types of used equipments for measurements, etc

The surveying is done with the measurement positioning DGPS Novatell with positioning accuracy ±0.30 m and a single-beam echo sounder Marimatech with measurement accuracy ±0.01 m. Combining of the measurements is immediately done with the HydroNavigation module of the software product Trimble HidroPRO 1.0, which is installed on a laptop.The data is acquired and digitally stored in MS Excel and *.TXT formats. They are also entered in the data base server of the Agency. The information gathered for every site is stored in a special register as well.

8.3. Processing of data

The follow-up processing of data is done at the office using the HidroEdit module (Trimble HidroPRO 1.0), through which the gross measurement errors are removed and the necessary corrections regarding water temperatures and others are entered in the data.

The numerical terrain model is elaborated with the software packages AutoDesk Land Desktop 3.0 and Pythagoras. The terrain is displayed by levels and/or depths and the respective lines (horizontal and isolines) related to zero elevation of the closest gauge station on the Bulgarian riverbank and taking into account the incline of the water surface.

The so called Danube polygon is formed along the entire Bulgarian riverbank. The polygonal points are within the Bulgarian national coordinate and height systems. They are included in the National triangulation network. Currently EAEMDR is initiating a project related to the update of the supporting network for topo-hydrographic measurements for applying the GPS technology. The DGPS technology helps the survey needs by allowing the determination of additional supporting points for the referent station at locations which are suitable for the survey.

9 LEGISLATIVE MEASURES

The Bulgarian law includes a number of measures regarding the management, monitoring and preservation of the country's waters. As a member-state of the EU, Bulgaria has harmonized with the European legislation its national regulations in this respect.

Our country together with other countries is an active participant in the elaboration and cooperation of policies, programs, and strategies for management and preservation of the cross border waters.

On a national level the usage of waters and water sites is strictly regulated by the Law for waters. In relation to that a special permissions regime has been foreseen. The water management is performed at both national and basin level.

Regarding the measurements the Law for measurements has a number of regulations connected that regulate the ways and means for measurement performing as well as their control and supervision. The purpose is to provide traceability, accuracy and reliability of measurements, to guarantee their quality, the environment safety and the safety and health of people.

In relation to that there is a rich sub-law normative base. One main example of that is Regulation №5 for water monitoring dd. 23rd April, 2007.

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