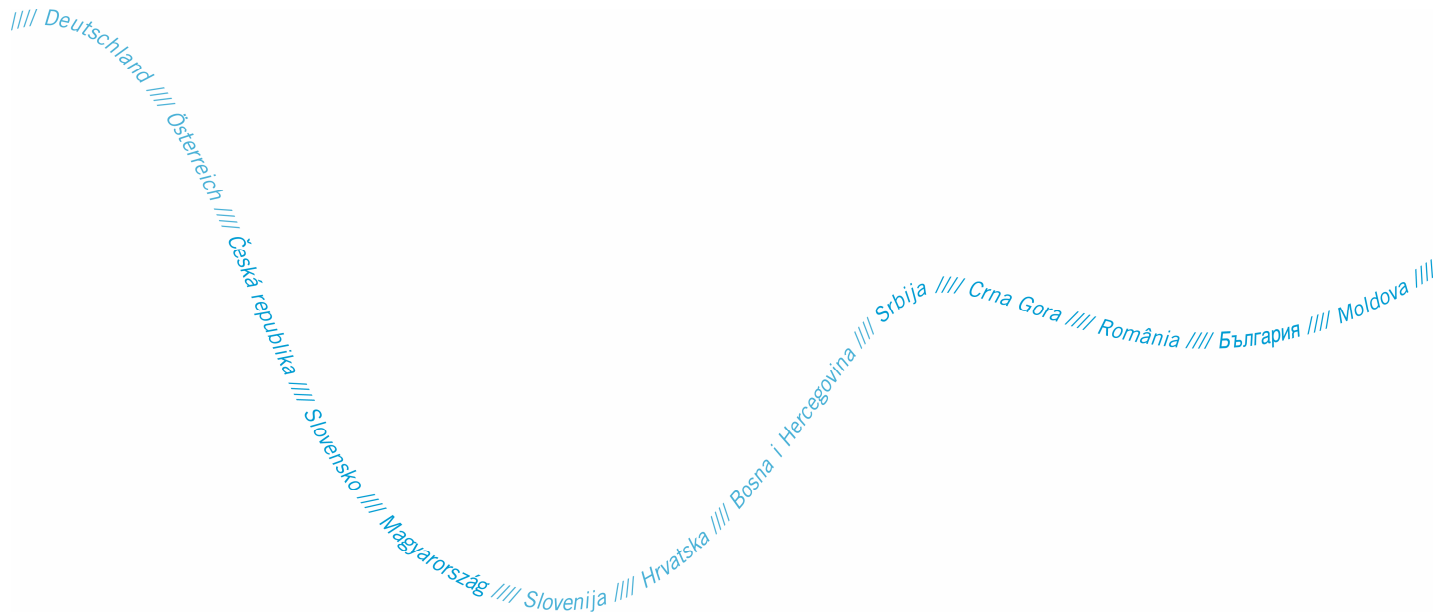


**Sub-Basin Level Flood Action Plan  
- Banat Sub-basin -**



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## **1. INTRODUCTION**

In response to the danger of flooding and in line with its Joint Action Programme, the ICPDR decided in 2000 to establish the long-term Action Programme for Sustainable Flood Prevention in the Danube River Basin. The whole process was accelerated after disastrous floods in 2002 and resulted in adoption of the Action Programme at the ICPDR Ministerial Meeting on 13 December 2004.

The overall goal of the ICPDR Action Programme is to achieve a long term and sustainable approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems. Given the area, the complexity and the internal differences in the Danube River Basin, the Action Programme represents an overall framework, which needs to be specified in further detail for sub-basins. Therefore, the targets of the ICPDR Action Programme include preparation of flood action plans for all sub-basin in the Danube catchment area.

In September 2007 a Directive of the European parliament and of the Council on the assessment and management of flood risks (EFD) was adopted by the European Council. The aim of the Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive requires Member States to first carry out a preliminary flood risk assessment by 2011 to identify areas at risk of flooding. For such areas they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015.

As the ICPDR Action Programme was designed in full coherence with EFD the flood action plans for sub-basins are an important part of implementation of the EFD and they summarize the key actions towards preparation of the flood risk management plans. Therefore, the preparation of the flood action plans for sub-basins can be considered as an interim step in implementation of EFD.

This action plan for the Banat sub-basin reviews the current situation in flood protection in Serbia and Romania and sets the targets and the respective measures aiming among others to reduction of damage risks and flood levels, increasing the awareness of flooding and to improvement of flood forecasting. The targets and measures are based on the regulation of land use and spatial planning, increase of retention and detention capacities, technical flood defences, preventive actions, capacity building, awareness & preparedness raising and prevention and mitigation of water pollution due to floods.

This Action plan is derived from Action plans prepared for Serbian and Romanian territories. It is foreseen that this planning document will be further refined as appropriate and necessary by the bilateral river commissions.

## 2. CHARACTERISATION OF CURRENT SITUATION

### 2.1. Review and assessment of current situation

#### 2.1.1. Natural conditions

Transboundary rivers in the south-eastern Banat region are the Timiș/Tamiš, Bârzava/Brzava, Rojga, Moravița/ Moravica, Caraș/Karaš and Nera. The Tamiš and Nera rivers are direct tributaries of the Danube, while the others are intersected by the DTD channel Novi Bečej – Banatska Palanka. Also, this sub-basin includes Cerna river basin, being a Romanian left direct tributary of the Danube.

Major portion of the Banat rivers' basins are mountainous and hilly regions of the Carpathian Mountains, on the RO territory, while RS territory hosts its smaller and lowland parts. Flood waves on these rivers have characteristics of torrent floods (short lag time and high peak flow), threatening riparian lowlands.

Summary of hydrological parameters for all south-eastern Banat rivers is given in Table 1. The main characteristics of each river are given in Table 2.

Table 1: Main hydrological characteristics of the south-eastern Banat rivers

River	Gauge station	Country	River chainage	Catchment area	Average multi-annual discharge	Q <sub>1%</sub>
			km	km <sup>2</sup>	m <sup>3</sup> /s	m <sup>3</sup> /s
Timiș/Tamiš	Șag	RO	207.0	4,493	46.60	1,322
	Jaša Tomić	RS	122.7	5,334	38.00	1,292
Bârzava/Brzava	Partoș	RO	145.0	933	5.74	200
	Markovićevo	RS	18.0	1,111	6.81	192
Moravița/ Moravica	Vatin	RS	16.0	432	1.11	124
Rojga	Veliki Gaj	RS	12.0	47	0.16	38
Caraș/Karaš	Dobričevo	RS	16.8	1,366	10.50	437
Nera	Naidăș	RO	115.0	1,319	14.60	665
	Vračev Gaj	RS	7.5	1,428	16.81	670
Cerna	Topleț	RO	67.0	1,324	21.40	611

#### 2.1.2. Floodplains and flood defences

##### Romania

The main hydraulic works affecting the flow regime of the rivers are: reservoirs, deviations and water transfers from neighbouring basin into a reservoir and dykes. These types of infrastructures are in fact the most useful instruments for water management, offering possibilities in getting regulation of different volumes during the seasons and sometimes during the year, to offer flood protection or dilution in case of accidental pollution.

In order to protect goods and human lives, on Romanian territory have been realised hydraulic structures which compose the National System for Flood Defence.

##### *Reservoirs*

In the Banat hydrographical space, there are as most important 23 reservoirs from which 9 are permanent and 14 temporary. The maximum volume gathered by these is 405.1 mil.m<sup>3</sup>, from which 194.4 mil.m<sup>3</sup> in permanent and 210.7 mil.m<sup>3</sup> in polders. The permanent reservoirs have a global utile volume 136.5 mil.m<sup>3</sup> and an attenuation volume of 48.5 mil.m<sup>3</sup>. The attenuation volume of the polders is 202.3 mil.m<sup>3</sup>.

The main reservoirs with complex purposes are:

- **Gozna, Văliug, Secu and Timiș Trei Ape** for water supply for Reșița city and for electric power;
- **Valea lui Iovan**, on Cerna River for industrial water supply for Turceni and Ișalnița thermo-electric powerplant.

The polders of the Banat hydrographic space **Cenei, Hitiaș, Pădureni, Gad, Cadar-Duboz, Gherteniș, Vărădia, Lișava, Moravița – Clopodia**, are designated to comply with the border conditions regarding the maximum discharges, respectively those which may cross the border within the limits of the values imposed by the Romanian-Serbian agreements in action.

#### ***Derivations and intakes***

In the Banat hydrographical space, there have been retained as most important 11 derivations of total length of 106.6 km and with an installed discharge of 455.9 m<sup>3</sup>/s. From the water uses view point, 4 have main energetic purpose, 2 the supply with potable and industrial water, 3 ensure the water supply and the production of electric power, 1 is a derivation for high waters and 1 has complex purposes. These are:

- **Semenic** derivation, Caraș-Severin county, which contributes to the supplementation of the supply with water of the Reșița municipality and to the production of electric power, making the derivation of the water from Timiș River in Bârzava River through the intermediary of the pumping station which draws off water from Timiș Trei Ape, the discharge being at Crăinicele HPP;
- **Nera-Bârzava** derivation, Caraș-Severin county, which contributes to the supplementation of the supply with water of the Reșița municipality and to the production of electric power, making the derivation of the waters from Nera River in Bârzava River through Crăinicele HPP;
- **Secu-Reșița** intake, Caraș-Severin county, for the supply with water of Reșița municipality from Secu reservoir;
- **Gozna and Safra** intakes, Caraș-Severin county, with energetic role which draws off water from Guzna reservoir, respectively through the catchments of some tributaries of Bârzava river and bring it to Crăinicele HPP;
- **Brezova and Grebla** intakes, Caraș-Severin county, with energetic role which bring waters between Crăinicele and Brezova HPP, respectively between Brezova HPP (and Văliug reservoir) to Grebla HPP;
- **Nera-Oravița** derivation, Caraș-Severin county, which draws off water from Nera River downstream from Sasca Montană locality for the supply with water of Oravița town, situated on Oravița brook, tributary of Caraș River;
- **Ruieni** intake, Caraș-Severin county, with energetic role which draws off water from Poiana Mărului reservoir and brings it to Ruieni HPP;
- **Timiș - Bega** derivation (**Coștei-Chizățu** canal), Timiș county, which starts from Timiș River, from the Hydraulic Knot Coștei and has the role to supply with water the uses along Bega canal, in Timișoara area and downstream, having as water source the Timiș River;
- **Bega - Timiș** derivation (**Topolovăț-Hitiaș** canal), Timiș county, which starts from the Topolovăț hydraulic Knot on Bega River and brings the water toward Timiș River to the Hitiaș hydraulic Knot. It has the main role in the derivation of high waters toward Timiș River for the protection against floods of the Timișoara municipality and with role to limit the maximum admitted flows on Bega River at the border with Serbia.

#### ***Dikes and river regulations***

In the Banat hydrographic space there exist 82 regulations of river beds of a total length of 1040 km and 141 dikes with a total length of 1067 km. These works protect against floods: 19 towns, 46 industrial units, 64,000 houses and residences, a surface of 43,000 ha, roads, bridges, railways and other objectives.

From the Regulation and dike works of the Banat hydrographic space, there have been retained as most important 11 works with a total of 972.7 km regulations of river beds and 1068.4 km dikes.

These works protect both localities and important agricultural areas. The protected objectives are industrial units, bridges, roads, railways and others. The main hydro-works against floods are on Timiș River. From the main works:

- Regulations and dikes on Timiș River, Caraș-Severin county ( $L_{reg}=273.0$  km,  $L_{dike}=471.9$  km);
- Regulations and dikes on Bârzava River, Timiș county and Caraș-Severin ( $L_{reg} = 23.0$  km,  $L_{dike} = 4.5$  km);
- Regulations and dikes on Moravița River, Timiș county ( $L_{reg} = 47.8$  km,  $L_{dike} = 50.0$  km);
- Regulations and dikes on Caraș River, Caraș-Severin county ( $L_{reg} = 48.2$  km,  $L_{dike} = 89.3$  km).

### **Serbia**

The flood protection in the south-eastern Banat region is provided by the Danube-Tisa-Danube Hydro-system (HS DTD) channel network, and levees. Namely, most of the rivers in this region (all except the Nera) are incorporated into the HS DTD, which provided more favourable flood defence conditions for the Banat rivers. A single flexible system, comprised of intersected watercourses and main canals, allows mutual redistribution of the flow depending on the rate of discharge in each river and coincident water levels of the recipients – the Danube and the Tisa. Levees along the Tamiš, Brzava and Moravica rivers enable protection from  $Q_{5\%}$  at RO border, while further downstream the safety level is increased due to favourable influence of the DTD channel. The alignment of flood protection structures along all south-east Banat watercourses (RS and RO part) is presented at Figure 1.

The RS part of the Tamiš River has two distinct parts. The upstream part (between the Tomaševac weir and RO border) has both-side levees (on 350 to 900 m distance), while 50% of floodplain is covered with forests. The downstream part of the river (between the Tomaševac weir and the mouth to the Danube), within the Lower Tamiš Hydro-system, has been fully modified after the construction of the Tomaševac, Opovo, Čenta and Pančevo weirs. Levees are built only along the most downstream reach of the river, and they protect the Pančevački rit area of Belgrade on the right bank<sup>1</sup> and Pančevo city on the left bank. These levees were built between 1929 and 1935.

The Tomaševac weir controls water levels within the HS DTD, together with other weirs (Botos and Novi Bečej weirs at the Novi Bečej – Banatska Palanka Channel and Stajićevo weir at the Begej Channel, near its mouth to the Tisa).

High waters are evacuated usually through the Tamiš channel, over the Tomaševac, Opovo and Pančevo gates, to the confluence with the Danube near Pančevo. However, since HS DTD offers a flexibility in flood management, if the conditions on the Danube are not favourable, another possible flood routes can be used: towards the Danube over the Čenta weir (confluence with the Danube at km 1,206) or towards the Tisa through the Novi Bečej – Banatska Palanka Channel (with two alternative mouths: over the Stajićevo weir on the Begej River or over the Novi Bečej weir).

The Brzava and Moravica rivers were once tributaries of the Tamiš River. Within the training works (1963-1968), these rivers were diverted towards the DTD Novi Bečej – Banatska Palanka Channel. The Brzava River course was shortened by 15 km and maximum water level at the mouth is lowered by 1.5 m. Both bank levees (20 km along the left and 16.3 km

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<sup>1</sup> The Pančevački rit is an area encircled by the Danube, Tamiš and Karašac and protected by 88.8 km of continuous levees along these rivers.

along the right bank) were erected in 1983 along the entire RS section. There are both bank levees along the Moravica River: from the mouth to 15.3 km at the right and to 15.85 km at the left bank. By diverting the Moravica flow from the Tamiš towards the DTD Novi Bečej – Banatska Palanka Channel, maximum water level at the mouth was reduced for over 3 m. Also, there are both side levees along the Rojga River in RS (tributary of the Moravica River), with a total length of 25.02 km.

Along the Nera River, only local protection structures were built (protection of the Kusić settlement and 5.5 km long right-bank levee near the mouth to the Danube). The problem of flood protection is still unresolved.

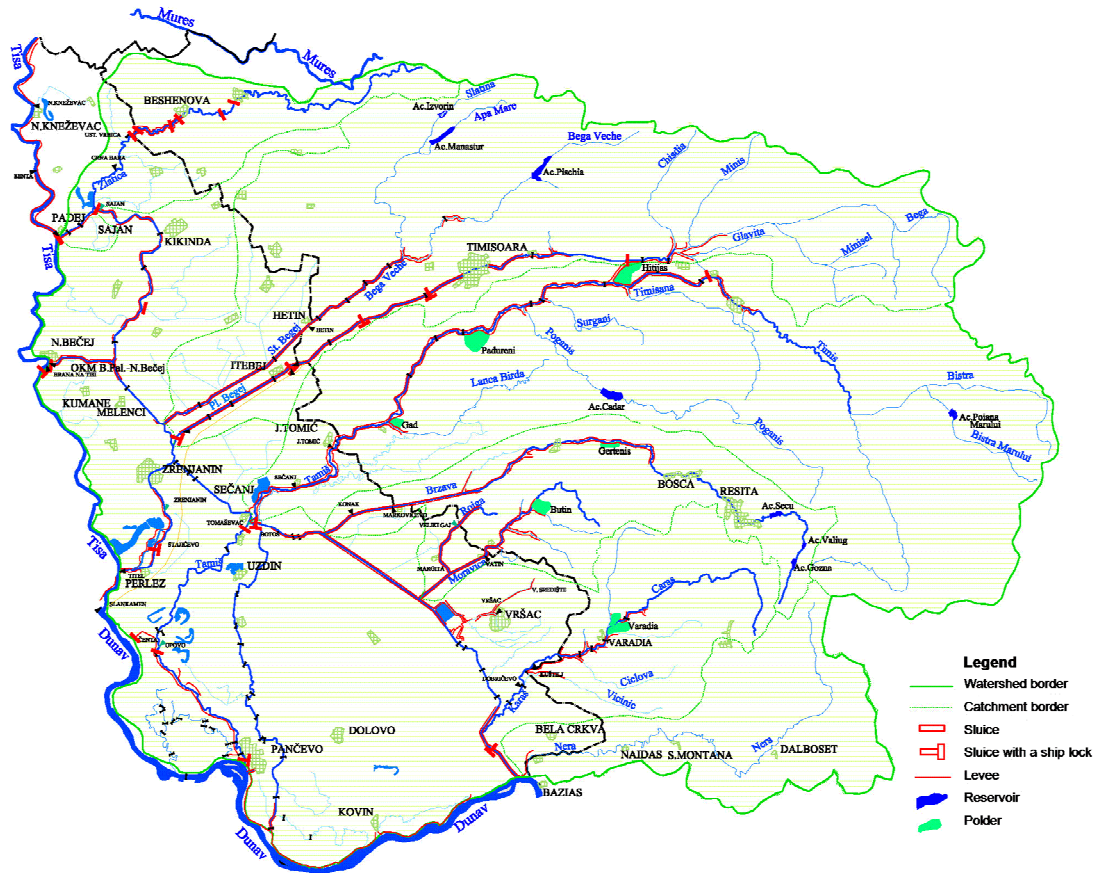


Figure 1: Flood protection lines along the south-east Banat rivers (Source: RS-RO commission)

### 2.1.3. Institutional and legal framework

An intergovernmental Joint RS-RO Commission was established in 1956, in order to carry on the implementation of the intergovernmental *Agreement Between the Federal People's Republic of Yugoslavia and the People's Republic of Romania on Hydraulic Engineering Issues Relating to Hydraulic Systems and National Border or Cross-border Watercourses*, signed in Bucharest in 1955.

Following extensive construction of hydraulic structures (reservoirs, retention basins, levees, the HS DTD, etc.), *Common Flood Defence Rules for the Yugoslav/Romanian Border or Cross-border Watercourses and Hydraulic Systems* were developed and adopted in 1971. These Rules, as amended from time to time, are still in effect today.

The Flood Defence Rules include two parts:



- Part 1 contains general provisions, measures, and activities which are to be undertaken before, during, and after flood and ice defence situations; and,
- Part 2 contains specific actions to be undertaken during the implementation of flood defence, for every watercourse and every hydraulic system.

The Flood Defence Rules accurately define the watercourses and hydraulic systems of joint interest, and include major characteristics of appurtenant structures. The Rules also define the obligations of competent authorities to:

- maintain the river channels and flood defences in good working order, provide the means required to undertake action, and develop identified technical documentation and plans in order to prepare for successful flood defence in joint-interest sectors;
- hold a mandatory joint meeting of RS and RO specialists, every year before the autumn rainy season, in order to assess the status of flood defence structures and to review flood defence documentation;
- in the course of flood and ice defence, provide specified hydro-meteorological data, exchange such data at specified times for each stage of defence, and organize the monitoring of phenomena and action teams tasked with eliminating potential dangers from overflowing water or failure of the lines of defence. In the event of a critical situation in a joint-interest sector, both Parties are required to provide all possible mutual assistance in material, equipment and manpower, including simplified national border crossing procedures;
- in the event of overflow or levee breach, to provisionally seal levees and contain the flood water, based on a joint plan, and to immediately notify the other Party of the exact time, place and extent of breach, as well as of the measures which have been undertaken to contain and evacuate the water from the flooded area;
- exchange specified information about water levels, ice conditions, time and place of ice formation, measures undertaken to break up ice formations, and the effectiveness of the measures undertaken; and,
- notify each other of the cessation of defence and prepare defence reports for the Joint Committee to review during its next session.

Part 2 of the Flood Defence Rules includes basic indicators for each watercourse and hydraulic system relating to discharge, operating modes of training structures, specified restrictions which apply to the operation of pumping stations, other conditions required for the unhindered conveyance of flood water and ice, and defined second lines of defence in the event of levee breach within the RS and RO territories.

### **Romania**

Issued or updated important regulations are as follows:

- The National Strategy for Flood Risk Management on short term (Governmental Decision 1854 from 2005), which establish prevention and protection measures for flood effects mitigation for each of involved structures from central to local level;
- National Plan for Prevention and Flood Protection at Hydrographic Basin level (Governmental Decision 1309 from 2005);
- The Water Law 107 from 1996 modified and completed according tot the National Strategy;
- Emergency Order regarding safety operation of the reservoirs for fishery, recreation or local importance, establishing operating conditions;
- Regulations for management of emergency situations generated by flooding, dangerous meteorological phenomena and accidents at hydraulic structures adopted in May 2005.

Based on these regulations, taking into account the 2005 and 2006 floods, new flood protection plans at basin, county and local level have been approved in 2006. These plans

comprise maps with level curves that bordered flooded zones by watercourses overflow and versant run-off corresponding to the maximum known discharges. In 2009 all flood protection plans will be updated.

The main actors involved in flood protection actions are: Ministry of Environment, Apele Române (Romanian Waters) National Administration, National Institute for Hydrology and Water Management, General Inspectorate for Emergency Situations and National Administration for Meteorology.

### **Serbia**

Protection against harmful water effects is regulated by the “Water Law” (Official Gazette of the Republic of Serbia, 46/91). The Law arranges proceedings and measures for flood and ice protection, as well as protection from torrents and erosion.

The participants involved in flood defence are:

- Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia – Republic Directorate for Water;
- Public Water Management Company “Vode Vojvodine” – Novi Sad;
- Public Water Management Company “Beogradvode” – Belgrade;
- Local water management companies;
- Republic Hydrometeorological Service of Serbia.

Responsibilities of participants are determined in the General Flood Defence Plan and the Annual Plan for Flood Defence. These plans are prepared only for watercourses with the existing flood protection structures. For other areas endangered by floods, local community appoints flood protection measures and proceedings. Also companies whose properties are endangered prepare special flood protection plans.

The flood and ice control actions are organized and carried on in three phases, depending on the hazard degree: preparation, regular and emergency defence. Phases of defence are defined in the Annual Plan for Flood Defence, in relation to the river stage on the adjacent gauging station.

#### **2.1.4. Recent awareness of flooding**

Floods are frequent in the south-east Banat, especially in the unprotected valleys of the Karaš and the Nera. Also, cross border flooding with devastating social and economic impacts, and political and administrative implications, occurred on the Tamiš River several times. In the year 1966 there was disastrous flooding after a breach of the Romanian left-bank levee upstream of the border. Forty years later, major flood waves occurred in April of 2000 and April of 2005.

In spring 2000 a breach of the left-side levee in Romania, 3.4 km upstream of the border, caused flooding at the Serbian territory, similar to the 1966 flood event. A state of emergency on the territory of the Sečanj municipality was proclaimed, and emergency levees around three settlements were made. At RS side about 9,500 ha of agricultural land were flooded (17,500 ha within both countries), as well as oil field facilities. The evacuation of flood water towards the Brzava River involved artificial breaches on a road, railroad and levees, and lasted 32 days. Although flooding of settlements was prevented (cost of emergency flood defence measures was about 500,000 €), the flood damage was about 5 million € (apart from damages to traffic, flood protection and other structures).

In mid-April of 2005, a major flood wave occurred again, due to snowmelt and simultaneous rainfall in the RO portion of the basin. The RO side warned of repeated heavy rainfall and forecasted extremely high stages, similar to the disastrous 2000 flood event. Huge quantity of precipitation has been recorded, even 3 times more than average monthly value.

In 18 April 2005 dikes in Bârzava and Timiș basins (RO side) were overtopped, producing breaches and many localities in Romania were flooded (Gătaia, Berecuța, Sângeorge, Mănăstire, Denta, Cruceni, Rudna partially, Foeni, Otelec, Sânmartinul Sârbesc partially).

In April 2005, Timiș river united with Bega through Topolovăț derivation, passed the highflood with the biggest volume ever recorded on these watercourses. At Șag station the volume was 669 mil. m<sup>3</sup>, in comparison with other two events those from 2000 and 1966 was 3 and respectively 5 times bigger. Due to this volume on Timiș River the dikes have been broken in Crai Nou zone and 320 mil. m<sup>3</sup> water were overtopped, resulting in the “Banat Sea”.

About 30,000 ha of land and a number of villages in both countries have been flooded. On RS side of the border several villages were flooded for 48 days, and about 2,000 people were displaced. Long new-built emergency levees prevented further spreading of flood on RS territory. The total damage in RS was about 14 million €. In RO only damages on hydraulic structures were about 11 million €.

After such experience it was concluded that flood defence structures at RO and RS territories do not provide the required safety level and that they should be reconstructed to provide safety from Q<sub>1%</sub> flood.

### 3. TARGET SETTINGS

#### 3.1. Romania

The National Action Plan for flood protection on medium-term (2009-2012) launched and comprises new hydraulic structures in frequently affected zones, higher safety degree of existing works and finalization of ongoing ones.

The National Action Plan foresees 1850 km river regulation 976 km of dikes, 810 km riverbank consolidation, identification of new zones as wetlands and DESWAT and WATMAN Projects finalisation.

The prioritisation criteria for promoting investments for flood protection have been made following:

- Inclusion of the proposed works in the Strategy of Ministry of Environment;
- Actual safety degree of the flood protection structures;
- Amplitude of avoided damages as result of the projects;
- The elaboration status of technical and economic documents;
- Financing possibility
- Occupied field status.

Flood Action Plan for the short term strategy implementation started in 2005 by integrated actions for 5years (2010):

- development of the hydrological information system and modernization of the early warning system – DESWAT Project
- rehabilitation of the old flood defence hydraulic infrastructure and building new ones in areas of high risk,
- Flood hazard mapping and flood management plans. The first pilot basin was Siret. Nowadays, interdisciplinary studies in eight river basins are under implementation (Siret, Mureș, Crișuri, Banat, Jiu, Olt, Someș-Tisa, Ialomița-Buzău) and will be finalized during 2009, beginning of 2010.

The National Plan will be finished in the frame of the River Basin Management Plans – Flood management Section first draft, till December 2009 and is planned to be adopted till mid 2010.

In the mean time, during 2009 will be finalized mid and long term National Strategy for Flood Risk management, which will take into account the need for Flood Directive implementation.

### **3.1.1. Regulation on land use and spatial planning**

The existing local urban plans for development should contain maps with actually flooded areas, based on historic and studies data.

These maps are from the Local Flood Protection Plans and are updated every 4 years.

### **3.1.2. Reactivation of former, or creation of new, retention and detention capacities**

The polders are designated to comply with the border conditions regarding the maximum discharges, respectively those which may cross the border within the limits of the values imposed by the Romanian-Serbian agreements. In RO side of the Banat sub-basin are 7 main polders having an important role in flood protection and cutting the peak-flow in the area. The polders are the following:

- Hitiaş on Timiș river ( $V=20 \text{ mil. m}^3$ )
- Cadar Duboz on Pogăniș river ( $V= 42.2 \text{ mil.m}^3$ )
- Gad on Lanca Birda river ( $V= 20.5 \text{ mil.m}^3$ )
- Gherteniș on Bârzava river ( $V= 7.7 \text{ mil.m}^3$ )
- Vărădia on Caraș river ( $V= 7.47 \text{ mil.m}^3$ )
- Lișava on Lișava river ( $V= 9.45 \text{ mil.m}^3$ )
- Pădureni ( $V= 35 \text{ mil. m}^3$ ).

### **3.1.3. Structural flood defences**

The structural flood defences are realized in order to make an effective protection for populated areas, to avoid human and material losses.

The Action Plan (2009-2012) at national level foresees 1850 km river regulation 976 km of dikes, 810 km riverbank consolidation. For all investments works are realized feasibility studies.

### **3.1.4. Non-structural measures (preventive actions, capacity building of professionals, raising awareness and preparedness of general public)**

#### **3.1.4.1. Preventive actions**

These actions are concentrated towards prevention/mitigation of potential damages generated by floods through:

- a) avoiding houses, social and cultural or/and economic objectives constructions in potentially flooded area;
- b) realisation of structural and non-structural measures for protection;
- c) geographical delimitation of natural flood risk zones and noting these in the general urban planning studies;
- d) modern forecast, warning and alarming systems implementation in case of floods;
- e) existing infrastructure for flood protection and riverbed maintenance;

- f) effective communication and people education regarding flood risk and the action ways in emergency situations.

A good system for people warning and preparation could save many lives. For this reason, in the last years was and are in development three projects: SIMIN (National Meteorological Integrated System), DESWAT (Destructive Water) and WATMAN (Water Management).

SIMIN integrates the provided data from existent systems in Romania with a high technology in meteorological radars field, stations with surface hydrologic sensors, data processing systems and forecast decision based on satellite transmission. System was released in September 2003.

The DESWAT project has in its first stage as objective, the modernisation of informational hydrological system, beginning with data acquisition through 600 automatic stations placed on rivers, 250 automatic gauging stations and 64 automatic quality stations, continuing with transmission support which will comprise the actual classic radio system, the GSM and satellite systems.

The programme package for hydrological forecast will be modernised, enlarged and will include semi-automatic procedures for elaboration of warnings, forecasts and information products for various decision makers, media and population.

WATMAN is a project through that the National Strategy for water management in case of disaster will be applied. It will integrate the output data from SIMIN and DESWAT, finally being carrying-out the Information-Decisional Integrated System. Those two projects, through modernised hydrologic and meteorological information systems will provide data and forecast in real-time, which represents input data for WATMAN infrastructure, optimising the integrated water management system.

#### **3.1.4.2. Financial insurance for flood risk**

In 1 January 2010, a law referring to the obligatory insurance for houses against natural disasters such earthquakes, landslides and flooding will come into force.

#### **3.1.4.3. Raising awareness and preparedness of general public**

- Improvement reaction capacity, response and intervention;
- Information and awareness of the population regarding floods and its effects;
- Eco-centres setting-up in frequently affected zones;
- Public meeting presenting the local flood protection plans and the warning procedures based on colours code;
- Exercises for flood simulation at basin and county level with the participation of population.

#### **3.1.4.4. Capacity building of professionals**

It was planned an intensive programme for raising personnel capacity from the water management units of Romanian Waters responsible with flood defences maintenance and with means and equipments for interventions in case of flooding.

It is developing the training action of new elected mayors and public local administration.

#### **3.1.4.5. Prevention and mitigation of water pollution due to floods**

A characteristic is represented by the pollution with heavy metals, where there are important mining perimeters with rocks which reach the surface and which are washed by the

precipitation. Another significant pressure is represented by the suspended solid loads caused by coal mining activities.

The Law 466 (regarding dam safety) covers the safety problems of dams and dikes of the mining waste deposits.

Now, according to the EU Directive 1999/31/CE and Governmental Decision 349 from 2005 the major part of the mining ponds with high risk stopped the activity.

The actual legislation foresees the continuity monitoring of the closed ponds.

### **3.2. Serbia**

Implementing criteria from the Water Management Master Plan of the Republic of Serbia, and taking into account the actual flood protection conditions and problems (especially the size of flood prone areas and possible damages) the long term flood protection strategy in the south-eastern Banat rivers sub-basins in Serbia will comprise of:

- The existing layout of flood protection structures on the Tamiš, Brzava, Moravica and Rojga rivers remains the same, while the following is planned:
  - Reconstruction of the flood protection structures to decrease flood hazard;
  - Regular maintenance of the flood protection structures, according to criteria, standards and norms;
- New flood protection scheme on the Karaš and Nera rivers;
- Gradual and broad implementation of non-structural flood protection measures (as upgrade of the flood forecasting and warning procedures; introduction of flood maps into spatial plans, etc.);
- International cooperation in flood management with Romania.

#### **3.2.1. Regulation on land use and spatial planning**

Target 1. Spatial plans of municipalities contain flood hazard maps (both for potentially and actually flooded areas) and flood risk maps.

Target 2. Limitations related to land use in flood prone areas are defined.

#### **3.2.2. Reactivation of former, or creation of new, retention and detention capacities**

Target 1. Natural retention capacities along the Middle Tamiš are preserved (between the Tomaševac weir and the Lower Tamiš System).

Target 2. Creation of new detention capacity on the Karaš River (planned within the new flood protection scheme).

#### **3.2.3. Structural flood defences**

Target 1. Provide adequate flood protection safety. The adequate criterion for the protection of the riparian land will be defined considering the size of the potentially endangered areas, number of inhabitants and infrastructure value.

Target 2. Provide permanent preparedness of the flood defence system.

**3.2.4. Non-structural measures (preventive actions, capacity building of professionals, raising awareness and preparedness of general public)**

The non-structural measures (encompassing institutional, preventive, corrective and other measures) should be given an appropriate role in flood control and mitigation. Main activities should be tied to:

- Preventive and operative tasks (setting up or improving the data base on natural events and protection system characteristics, modification of the existing plans for flood coping practices, adoption of reservoir operational rules, development/improvement of flood forecast and warning system);
- Regulative and institutional measures (zoning of floodplains, floodplain management policy, construction standards etc.);
- Managerial and technical education, as well as public awareness building.

All these tasks will be tied together within the Flood risk management plan for the Banat sub-basin.

- Target 1. Reduce flood risk
- Target 2. Introduce principles of EU Floods directive
- Target 3. Build capacity of professionals and institutions responsible for flood management
- Target 4. Upgrade flood monitoring, forecast and warning
- Target 5. Introduce regulations for emergency situations response (natural disasters)
- Target 6. Prepare Flood risk management plan
- Target 7. Improve awareness of stakeholders on floods
- Target 8. Update/build scientific base for flood management
- Target 9. Improve international cooperation in flood management

#### 4. MEASURES TO ACHIEVE TARGETS

Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment	
<b>4.1. Regulation on land use and spatial planning</b>							
RS	<b>Target 1: Spatial plans of municipalities contain flood hazard maps and flood risk maps</b>	Defining water estate	Administrative	MAFWM-RDW, PWMC VV		Continuous	
		Introduction of flood maps into spatial plans of municipalities	Administrative	MESP			
	<b>Target 2: Limitations related to land use in flood prone areas are defined</b>	Preparation of instructions for limitations on land use	Administrative	MAFWM-RDW, MESP			
		Land use limitations applied	Administrative	LRSG			
RO	<b>Target 1: Local and regional developing plans contain flood hazard maps</b>	Including the results of the study "Identification and delimitation of the natural hazards (earthquakes, landslides and floods). Hazards maps at county level" into local and regional developing plans	Administrative	Public Administration	120	2009	
	<b>Target 2: Urban Development Plans contain flood maps</b>	Including the maps from Local Flood Protection Plan (Contingency Plans) into the Urban Development Plans	Administrative	Public Administration	20/year	Continuous	This actions include flood risk evaluation (flooded areas maps and estimation of damages)
<b>4.2. Reactivation of former, or creation of new, retention and detention capacities</b>							
RS	<b>Target 1: Natural retention capacities along the Middle Tamiš are preserved</b>		Administrative/ Technical	PWMC VV		Continuous	
	<b>Target 2: Creation of new detention capacity on the Karaš River</b>	Design and construction	Technical	PWMC VV		Started	Presently in the phase of Preliminary design.
<b>4.3. Structural flood defences</b>							
RS	<b>Target 1: Provide protection for the adopted design flood along the south-eastern Banat rivers</b>	Reconstruction of levees along the Tamiš upstream of HSDTD	Technical	PWMC VV	5,000	Started	
		Reconstruction of levees along downstream section of the Tamiš	Technical	PWMCies		Started	PWMC BV (right bank), PWMC VV (left bank). Presently in the phase of Preliminary design.



Targets		Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		Reconstruction of the Brzava River channel	Technical	PWMC VV	2,500	Started	Presently in the phase of Detailed design.
		New levees along several sections of the Karaš River	Technical	PWMC VV	10,000	Started	Presently in the phase of Preliminary design.
		Construction of a diversion channel Karaš-DTD Channel	Technical	PWMC VV		Started	Presently in the phase of Preliminary design.
		Regulation of the Karaš channel (km 22-RO border)	Technical	PWMC VV		Started	Presently in the phase of Preliminary design.
		New flood protection scheme along the Nera river	Technical	PWMC VV		Started	Presently in the phase of Pre-feasibility study.
	<b>Target 2: Provide permanent preparedness of the flood defence system</b>	Maintenance of flood protection structures	Technical	MAFWM-RDW, PWMCies, LRSG, OTHER		Continuous	According to specific standards and norms.
		Maintenance of weirs on Tamiš	Technical	MAFWM-RDW, PWMCies, OTHER		Continuous	According to specific standards and norms.
		Purchase and repair of machinery, tools, materials, equipment and communications	Technical	MAFWM-RDW, PWMCies, OTHER		Continuous	According to specific standards and norms.
		Rehabilitation of weak points at levees	Technical	PWMCies		Continuous	
	<b>RO</b>	<b>Target 1: Provide flood protection in Banat sub-basin</b>	Increase of safety degree for Tăria dam for Bozovici water supply, Caraș-Severin county	Technical	RW	2.201	2010
Bârzava river and tributaries control in Bocșa town, Caraș-Severin county			Technical	RW	3.3	2009	National Budget & External funds
Bârzava River regulation and riverbed consolidation on Gătaia-border sector, Timiș county			Technical	RW	2.6	2010	National Budget & External funds
Bistra river control on Oțelu Roșu-Bucova sector, Caraș-Severin county			Technical	RW	2.2	2009	National Budget & External funds
Bârzava river and tributaries control in Reșița town, Caraș-Severin county			Technical	RW	4.3	2009	National Budget & External funds

Targets		Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		Timiș riverbank consolidation and reshaping on Lugoj-border sector, Timiș county	Technical	RW	67.4	2010	National Budget & External funds
		Bistra river regulation and embankment on Oțelu Roșu-Iaz sector, Caraș-Severin county	Technical	RW	8.5	2009	National Budget & External funds
		Consolidation and reshaping of Bega-Timiș canal on Topolovăț-Timiș river confluence, Timiș county	Technical	RW	3.5	2009	National Budget & External funds
		224 objectives (polders, riverbank Regulations, dams) at national level	Technical	RW	2000	2013	9 dams, 4 polders, 211 Regulations works
<b>4.4. Non-structural measures (preventive actions, capacity building of professionals, raising awareness and preparedness of general public)</b>							
RS	<b>Target 1: Reduce flood risk</b>	Implementation of operative flood defence measures	Technical/Organizational	PWMCies, LRSG		Continuous	
	<b>Target 2: Introduce principles of EU Floods directive</b>	Preparation and adoption of new Water Law	Legal/Administrative	Republic of Serbia, MAFWM-RDW		2010	
		Preparation of bylaws according to new Water Law	Legal/Administrative	MAFWM-RDW		2011	
	<b>Target 3: Build capacity of professionals and institutions responsible for flood management</b>	Regular upgrade of General and Annual Flood Defence Plans for the Republic of Serbia	Administrative	MAFWM-RDW		Continuous	State level – increased efficiency of operative flood defence.
		Preparation and regular upgrade of General and Annual Flood Defence Plans for municipalities	Administrative	LRSG		Continuous	Municipality level – increased efficiency of operative flood defence.
		Characterisation of current situation	Technical	MAFWM-RDW, PWMCies		2010	
		Update/preparation of technical documentation for all existing flood protection structures (incl. data on water estate)	Technical	PWMCies			Finished partially.
	Update/preparation of flood defence manual	Technical	MAFWM-RDW		2010		

Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
	Preparation of bylaw for establishment and management of cadastre of water structures	Administrative	MAFWM-RDW		2010	
	Preparation of cadastre of flood protection structures	Technical	PWMCies, LRSG		Continuous	
<b>Target 4: Upgrade flood monitoring, forecast and warning</b>	Improvement of the system of automated weather and gauging stations	Technical/ Organizational	RHMSS, MAFWM-RDW		Continuous	Measured data available to relevant services in real time.
	Improvement of the system of hydrological and weather forecasting	Technical/ Organizational	RHMSS, MAFWM-RDW		Continuous	Introduction of the latest technologies in forecasting. Forecasts available to relevant services through WMISS and by other IT.
	Improvement of alarm systems and systems for issuing timely warning to population at risk	Technical/ Organizational	RHMSS, MAFWM-RDW		Continuous	
<b>Target 5: Introduce regulations for emergency situations response (natural disasters)</b>	Preparation of strategic, tactical and operative disaster management plans for catastrophic flood	Technical/ Organizational	MAFWM-RDW, PWMCies, MI, LRSG			- Criteria for declaration of an emergency; - Information routes; - Methods of public warning; - Evacuation routes; - Preparedness of public services.
	Training exercises	Public participation	PWMCies, LRSG, MI		Continuous	- Organizing operations of the police and fire fighting forces as during floods; - Organizing evacuation of population; - Organizing life (medical services and emergency recovery).
<b>Target 6: Prepare Flood risk management plan for the south-eastern Banat sub-basin in</b>	Preliminary flood risk assessment	Scientific	MAFWM-RDW		2010	Activities started. Required harmonization with RO.

Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment	
<b>Serbia</b>	Preparation of methodology for flood risk mapping	Scientific/ Technical	MAFWM-RDW		2010	The following results/conclusions will be used: - Common position on flood risk mapping (ICPDR); - Floodrisk project; - Tamnava project (Swedish Rescue Service and MAFWM-RDW).	
	Adoption of bylaw on methodology for flood risk mapping	Administrative	MAFWM-RDW		2011		
	Preparation of flood hazard maps	Scientific/ Technical	MAFWM-RDW, PWMCies		2013		
	Preparation of flood risk maps	Scientific/ Technical	MAFWM-RDW, PWMCies		2013		
	Preparation of draft Flood risk management plan	Technical / Organizational	MAFWM-RDW, PWMCies		2014	Support: Tamnava project (Swedish Rescue Service and MAFWM-RDW).	
	Public information and consultation on draft Flood risk management plan	Public participation	MAFWM-RDW, PWMCies		2014-2015	Flood risk management plan and Flood risk maps should be discussed in public. The results, benefits and consequences of preparation of the flood risk maps as a legal act should be presented to a broad public.	
	Bring into force Flood risk management plan	Administrative	MAFWM-RDW		2015		
	<b>Target 7: Improve awareness of stakeholders on floods</b>	Introduction of flood insurance	Administrative				
		Introduction of water management issues into schools	Public participation			Continuous	From elementary school to university.
		Preparation of flood leaflet, film, TV broadcasts etc.	Public participation				
<b>Target 8: Update/build scientific</b>	Preparation of studies and design	Scientific	All		Continuous		

Targets		Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
	<b>base for flood management</b>	Common RS-RO study on possible impacts on a current flood protection level	Scientific	Bilateral commission			
	<b>Target 9: Improve international cooperation in flood management</b>	Bring into force new bilateral agreement with RO	Legal	Republic of Serbia		2010	
		Update Common Flood Defence Rules	Administrative	Bilateral commission			
		The south-eastern Banat sub-basin wide on-line flood related meteorological and hydrological data exchange	Administrative	Republic of Serbia, RHMSS bilateral commission		2010	Improvement and formal agreement.
		The south-eastern Banat sub-basin wide on line operative flood defence information exchange	Administrative	Republic of Serbia + bilateral commission		2010	Improvement and formal agreement.
<b>RO</b>	<b>Target 1: Implementation of preventive measures</b>	Update the Water Law	Administrative	ME			
		Update the Flood Protection Plans at basin, county and local level	Administrative	RW		Every 4 years	
		Update the Plan for warning-alarming for downstream localities in case of accidents at dams	Administrative	RW		Every 10 years	
		DANUBE FLOODRISK flood risk reduction: risk assessment, risk mapping, involvement of stakeholders, risk reduction by adequate spatial planning.	Administrative Public	RW	6.38	2012	
		DESWAT – Carrying of a hydrologic information-decisional system for the management of emergency situations (61 automatic stations in Banat hydrographic space)	Technical	RW	45	2010	
		Information System for Integrated Water Management (WATMAN)	Technical	RW	138.4	2013	
		Contributions to the development of the flood risk management strategy	Technical	Romanian Waters	1.7	2009	

Targets		Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		FLIWAS – Warning Informatic system in case of floods	Technical	RW	0.15	2009	
		WIMS – Investment supporting the information system and database for water management (PHARE project) at national level	Technical	RW	2.4	2009	
		High-flood forecasting and flood management in Romania – feasibility study - the analysis for implementing of the decision support system	Administrative/ Technical	RW	0.1	2009	
	<b>Target 2: Raise awareness and preparedness of general public</b>	Exercises for general public preparedness for flood simulation	Public participation	RW, GIEO	0.50	Continuous	
		Flood Protection leaflets	Public participation	ME	0.01	Continuous	
		Setting-up New Eco-centres	Administrative	ME	0.02	Continuous	
	<b>Target 3: Prevention and mitigation of water pollution due to floods</b>	Monitoring the closed ponds and waste deposits	Administrative, Technical	MIN	5.00	2012	USTDA estimation of the minimum needed equipment for monitoring and communication

## Annex 1

### List of competent authorities responsible for preparation and implementation of the Action Plans

Country	Name of institution	Abbreviation	Address
RS	Ministry of Agriculture, Forestry and Water Management – Republic Directorate for Water	MAFWM-RDW	Bulevar umetnosti 2a 11070 Novi Beograd
	Ministry of Environment and Spatial Planning	MESP	Nemanjina 11 11000 Beograd
	Public Water Management Company “Vode Vojvodine”	PWMC VV	Bulevar Mihajla Pupina 25 21000 Novi Sad
	Public Water Management Company “Beogradvode”	PWMC BV	Svetozara Ćorovica 15 11000 Beograd
	Republic Hydrometeorological Service of Serbia	RHMSS	Kneza Višeslava bb 11000 Beograd
	Ministry of the Interior	MI	Bulevar Mihajla Pupina 2 11070 Novi Beograd
	Local and regional self-government units	LRSB	
	Other water and land users	OTHER	
RO	Ministry of Environment	ME	12 Libertatii Blv. Sector 5 Bucuresti
	Ministry of Transportation and Infrastructure	MT	38 Dinicu Golescu Blv. Sector 1 010873 Bucuresti
	Romanian Waters National Administration	RW	6. Edgar Quinet St. Sector 1 010018 Bucuresti
	National Institute of Hydrology and Water Management	NIHWM	97 Bucuresti-Ploiesti Av. Sector 1 Bucuresti
	General Inspectorate for Emergency Situations	GIES	46 Banu Dumitrache St. Sector 2 Bucuresti
	Ministry of Economy	MIN	152 Calea Victoriei St. Sector 1 010096 Bucuresti