Flood Risk Management Plan for the Danube River Basin District

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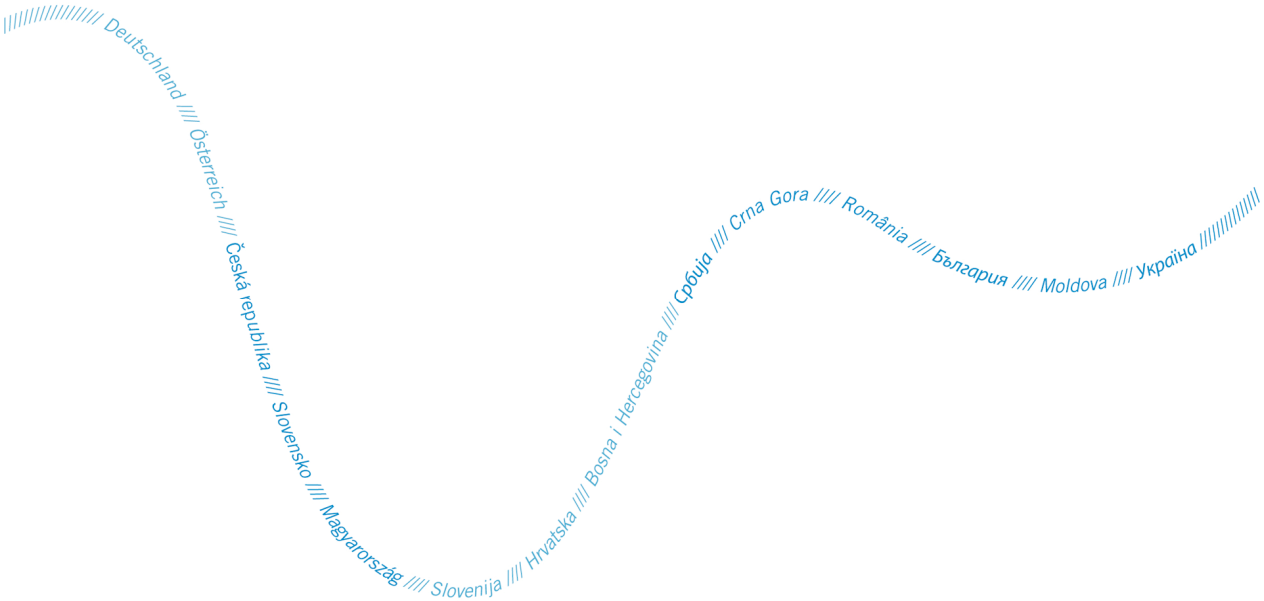

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Disclaimer

This updated draft of the Flood Risk Management Plan for the Danube River Basin District is based on information received from the ICPDR Contracting Parties by 30 April 2015.

1 Introduction

In response to the danger of flooding the ICPDR adopted the Action Programme for Sustainable Flood Prevention in the Danube River Basin at the ICPDR Ministerial Meeting on 13 December 2004.

The adoption of the FD has its impact also on the implementation of the ICPDR Action Programme both in terms of technical content and of the implementation time plan, given that the ICPDR Action Programme itself foresees incorporating the future developments of the EU flood policy.

In 2009 seventeen sub-basin flood action plans were published by the ICPDR. They were based on 45 national planning documents and covered the entire Basin. They provided the first ever comprehensive overview of actions to reduce flood risk in the Danube Basin. In drawing up the plans, measures were first elaborated at the national level in each of the ICPDR states. Joint discussions between countries sharing particular sub-basins then took place to create a harmonized plan for the entire area of each sub-basin. The finalized action plans reviewed the current situation and set targets and respective measures for reducing adverse impacts and the likelihood of floods, increasing awareness and level of preparedness and improving flood forecasting. The targets and measures were based on the regulation of land use and spatial planning; increase of retention and detention capacities; technical flood defenses; preventive actions (e.g. flood forecasting and flood warning systems); capacity building; awareness and preparedness raising and prevention and mitigation of water pollution due to floods.

At the ICPDR Ministerial Meeting in 2010 the Danube Declaration was adopted in which the Danube Ministers:

- reaffirmed conviction that flood prevention and protection are not short term tasks but permanent tasks of highest priority.
- committed themselves to make all efforts to implement the EU Floods Directive throughout the whole Danube River Basin and to develop one single international Flood Risk Management Plan or a set of flood risk management plans, based upon the ICPDR Action Programme for Sustainable Flood Protection and the sub-basin plans, coordinated at the level of the international river basin district by 2015 making full use of the existing synergies with the DRBM Plan.

Directive 2007/60/EC on the assessment and management of flood risks (EU Floods Directive, FD) entered into force on 26 November 2007. This Directive now requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. With this Directive also reinforces the rights of the public to access this information and to have a say in the planning process.

Art 7 FD requires member states to prepare flood risk management plans for all areas identified as being at potentially significant flood risk (APSFR) under article 5 or article 13.1(a), and areas covered by article 13.1(b), on the basis of the maps prepared under article 6.

The flood risk management plans (FRMP) must set out appropriate objectives for the management of flood risk within the areas covered by the plan. The objectives must focus on reducing the adverse

consequences of flooding for human health, the environment, cultural heritage and economic activity. Where appropriate, the plans should focus on reducing the likelihood of flooding and/or on using non-structural measures, including flood forecasting and raising awareness of flooding (art 7.2). The flood risk management plans shall include measures for achieving identified objectives (art 7.3).

Flood risk management plans shall include the components as detailed in the annex (Part 1) of the Directive:

- Conclusions of the preliminary flood risk assessment, as required in Chapter II in the form of a summary map of the RBD/UoM delineating the areas of potential significant flood risk (Annex part A.I.1) ;
- flood hazard maps and flood risk maps (Annex part A.I.2) ;
- description of the objectives (Annex part A.I.3);
- summary of measures and their prioritisation, including those taken under other Community acts (such as EIA, SEA, SEVESO, WFD), aiming to achieve the objectives (Annex part A.I.4),
- description of the cost-benefit methodology, when available, used in transnational context (Annex part A.I.5).
- description of how implementation progress will be monitored (Annex part A.II.1),
- Summary of public information and consultation (Annex part A.II.2),
- list of competent authorities (Annex part A.II.3);.
- description of the co-ordination process in international river basin districts/other unit of management (Annex part A.II.3)
- description of the coordination process with the WFD(Directive 2000/60/EC) (Annex part A.II.3)

The first Flood risk management plan for DRBD is produced in line with the article 8 (3) FD according to which where an international river basin district, or unit of management referred to in article 3(2)(b) FD, extends beyond the boundaries of the Community, Member States shall endeavour to produce one single international flood risk management plan or a set of flood risk management plans coordinated at the level of the international river basin district;

The Flood risk management plan for DRBD sets out appropriate objectives for the management of flood risk on the level of the international river basin district covering the whole Danube catchment. It highlights the objectives and issues relevant for the basin-wide perspective and as such it is complementary to the national flood risk management plans which provide all necessary information on measures, flood maps and other national activities in the sector of flood protection, prevention and mitigation in a more detailed way.

The transitional measures according to article 13 have been applied only in Germany and Slovakia.

2 Conclusions of the preliminary flood risk assessment

2.1 PFRA

According to FD the Member States shall, for each river basin district, or unit of management referred to in FD article 3(2)(b), or the portion of an international river basin district lying within their territory, undertake a preliminary flood risk assessment (PFRA) in accordance with paragraph 2 of FD article 4. Based on available or readily derivable information, such as records and studies on long term developments, in particular impacts of climate change on the occurrence of floods, a preliminary flood risk assessment shall be undertaken to provide an assessment of potential risks. The assessment shall include at least the following:

a) maps of the river basin district at the appropriate scale including the borders of the river basins, sub-basins and, where existing, coastal areas, showing topography and land use;

b) a description of the floods which have occurred in the past and which had significant adverse impacts on human health, the environment, cultural heritage and economic activity and for which the likelihood of similar future events is still relevant, including their flood extent and conveyance routes and an assessment of the adverse impacts they have entailed;

c) a description of the significant floods which have occurred in the past, where significant adverse consequences of similar future events might be envisaged;

and, depending on the specific needs of Member States, it shall include:

d) an assessment of the potential adverse consequences of future floods for human health, the environment, cultural heritage and economic activity, taking into account as far as possible issues such as the topography, the position of watercourses and their general hydrological and geomorphological characteristics, including floodplains as natural retention areas, the effectiveness of existing manmade flood defense infrastructures, the position of populated areas, areas of economic activity and long-term developments including impacts of climate change on the occurrence of floods.

In the case of international river basin districts, or units of management referred to in FD article 3(2)(b) which are shared with other Member States, Member States shall ensure that exchange of relevant information takes place between the competent authorities concerned.

On the basis of a preliminary flood risk assessment as referred to in FD article 4, Member States shall, for each river basin district, or unit of management referred to in FD article 3(2)(b), or portion of an international river basin district lying within their territory, identify those areas for which they conclude that potential significant flood risks exist or might be considered likely to occur (so called Areas of Potential Significant Flood Risk (APSFR)). The identification of areas belonging to an international river basin district, or to a unit of management referred to in FD article 3(2)(b) shared with another Member State, shall be coordinated between the Member States concerned.

The ICPDR report on preliminary flood risk assessment published in 2012 provided information on major flood events that occurred in the Danube River Basin District focusing primarily on the last decade. It summarized the methodologies and criteria used at the national level to identify and assessed floods that occurred in the past and their past adverse consequences (including whether such consequences would be ‘significant’) and whether the likelihood of such floods remained relevant. It also addressed the methodologies and criteria used to identify and assess significant floods that occurred in the past that would have significant adverse consequences were they to reoccur in the future and methodologies and criteria used to identify and assess potential future significant floods and their potential adverse consequences. In reference to the FD article 4(2)(d) a description was

provided in the report on the assessment at the national level of the potential adverse consequences of future floods for human health, the environment, cultural heritage and economic activity.

The PFRA report also provided a brief description of the methodology used at the national level for the identification of areas of potential significant flood risk as required by FD article 5 as well as the methodology agreed by the ICPDR to identify the areas of potential significant flood risk in the Danube River Basin District including those having a transboundary character. A map displaying APSFR of the basin-wide importance (level A) was included in the PFRA report and it reflected the identification of areas of potential significant flood risk as of the end of 2011.

The impacts of the climate change were addressed in a specific chapter of the report. To respond to the provisions of FD article 4(3) and article 5(2) a summary on the steps taken by the ICPDR Contracting Parties to ensure the exchange of relevant information on PFRA between competent authorities in the DRBD and the description of international coordination of APSFR that has taken place between the ICPDR Contracting Parties was provided as well.

2.2 APSFR in the Danube River Basin District

The areas of potential significant flood risk (APSFR) in the Danube RBD are shown on the map below. This map is the updated version of the APSFR map published in the PFRA report in 2011. The design and background data of the map follows the approach of the ICPDR for WFD reporting on level A (international river basin district). As for the Danube River Basin Management Plan, the river network is displayed using 4,000 km^2 catchment size as a threshold. This approach has been followed with the view of ensuring a joint flood risk management – river basin management reporting by 2015. Transboundary areas of potential significant flood risk are indicated by a specific color.

The data on APSFR were provided using the following geometry types:

Polygon: Recommended for areas >= 100km^2

Line: Recommended for river stretches >= 50km. If the APSFR is located on a reported river (>4000km^2 catchment), the same geometry should be used as reported with the river segment dataset. However, the segmentation does not need to match.

Point: Recommended for areas <100km^2 and river stretches <50km.

Transboundary APSFR was defined by the FP EG as any area (in the transboundary reach of a river) which has been assigned as transboundary APSFR by at least one country and this assignment was discussed at the bilateral level. If the transboundary character of an APSFR is regarded as not yet agreed by one country, this will be shown on the map. For a river crossing a border, the area of common interest will be assigned as transboundary APSFR. The extent of this area of common interest has to be agreed by the neighboring countries.

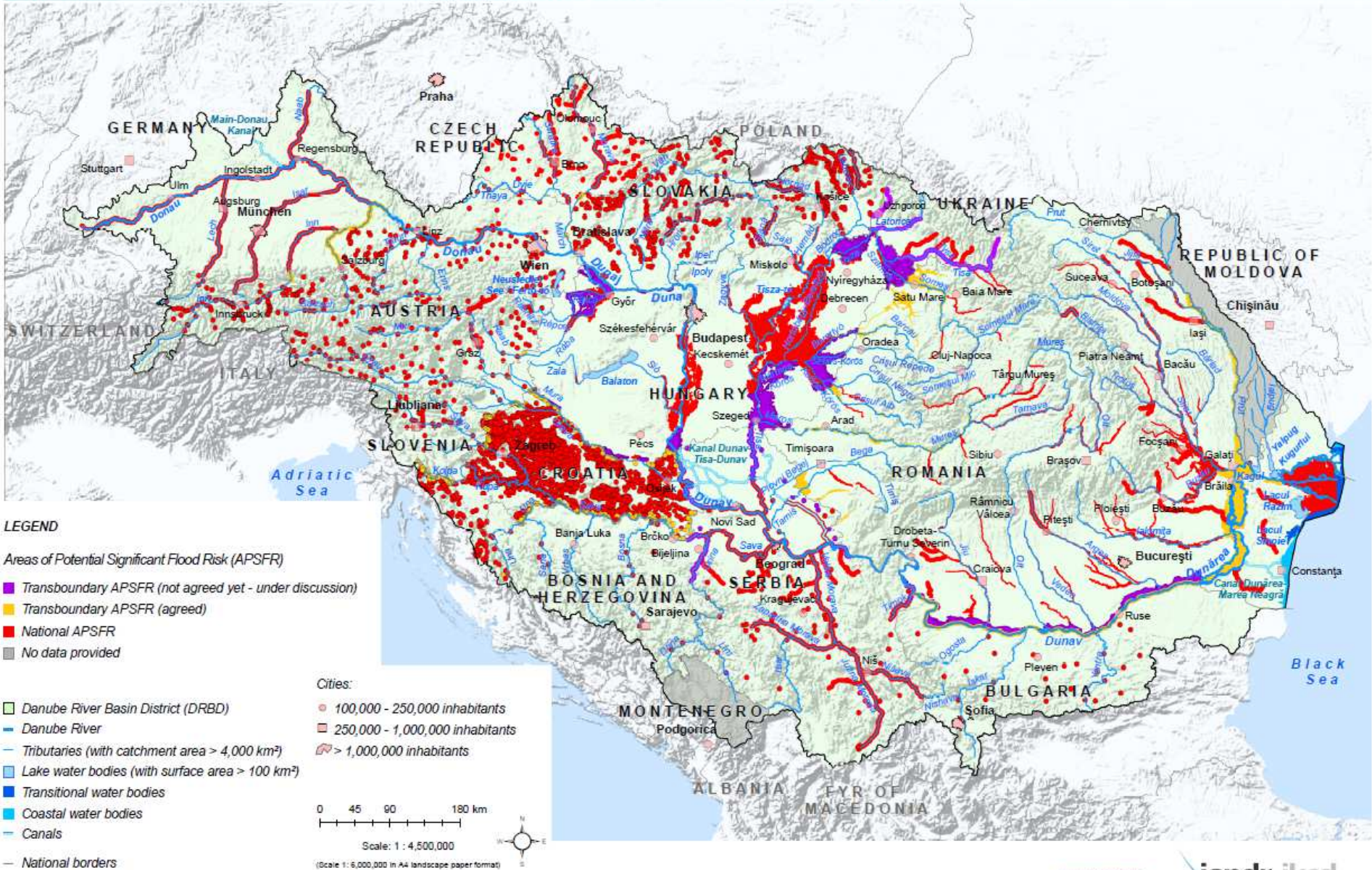
Three types of APSFR to be shown on the map were agreed:

Description in legend	Color on map	Value of attribute TRANSBOUNDARY
National APSFR	red	N (“No”)
Transboundary APSFR (agreed)	orange	Y (“Yes”)
Transboundary APSFR (not agreed yet - under discussion)	purple	U or 0 (“unknown” or “yet to be determined”)

The order of layers (top→bottom): purple→ orange→ red

The map shows the status as of 15 May 2014. The APSFR have not yet been indentified in Moldova, no information was received yet from Montenegro.

Danube River Basin District: Preliminary Flood Risk Assessment (PFRA)



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This ICPDR product is based on national APSFR information provided by Contracting Parties to the ICPDR (AT, BA, BG, CZ, DE, HR, HU, RO, RS, SK, UA). More details on the methodologies used for identification of APSFR at the national level and the definition of significance criteria are provided in the report "Preliminary Flood Risk Assessment in the Danube River Basin", chapter 5.1. National borders data was provided by the Contracting Parties to the ICPDR and CH; ESRI data was used for national borders of AL, ME, MK; Shuttle Radar Topography Mission (SRTM) from USGS Seamless Data Distribution System was used as a background layer; Data from the European Commission (Joint Research Center) was used for the outer border of the DRBD of AL, IT, ME and PL.

Vienna, November 2013

3 Flood hazard maps and flood risk maps

According to FD the Member States shall, at the level of the river basin district, or unit of management, prepare flood hazard maps and flood risk maps, at the most appropriate scale for the areas identified under article 5(1).

The preparation of flood hazard maps and flood risk maps for areas identified under article 5 which are shared with other Member States shall be subject to prior exchange of information between the Member States concerned.

Flood hazard maps shall cover the geographical areas which could be flooded according to the following scenarios:

(a) floods with a low probability, or extreme event scenarios;

(b) floods with a medium probability (likely return period ≥ 100 years);

(c) floods with a high probability, where appropriate.

For each scenario the following elements shall be shown:

(a) the flood extent;

(b) water depths or water level, as appropriate;

(c) where appropriate, the flow velocity or the relevant water flow.

Flood risk maps shall show the potential adverse consequences associated with flood scenarios referred to above and expressed in terms of the following:

(a) the indicative number of inhabitants potentially affected;

(b) type of economic activity of the area potentially affected;

(c) installations as referred to in Annex I to Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control which might cause accidental pollution in case of flooding and potentially affected protected areas identified in Annex IV(1)(i), (iii) and (v) to Directive 2000/60/EC;

(d) other information which the Member State considers useful such as the indication of areas where floods with a high content of transported sediments and debris floods can occur and information on other significant sources of pollution

The ICPDR report on Flood Hazard and Flood Risk Maps of the Danube River Basin District published in 2014 provided an overview of methods used at the national level for preparation of flood hazard maps in the DRBD Countries focusing on the approaches to identify, assess or calculate the flooding extent and flooding probabilities or return periods. A summary was also provided of methods (including criteria) used to prepare flood risk maps in the DRBD Countries. The links to flood hazard and risk maps available electronically in the ICPDR Contracting Parties as well as to other relevant documents were given in a separate chapter. The key item of the report was presentation of flood hazard and flood risk maps for the Danube River Basin District including a detailed description of the applied criteria.

The report presented the first ever set of flood hazard and flood risk maps for the entire Danube catchment demonstrating to the public and stakeholders the results of cooperation of the Danube countries towards minimizing the risks from flooding. All maps are shown in the **ANNEX 1**.

3.1 Flood hazard map

MAP 1 Hazard and flooding scenarios

The agreed format is as follows: A3 map of flood hazard and flooding scenarios, showing the DRBD and rivers with catchment areas >4000km^2, lakes >100km^2, transitional and coastal waters. The large flood hazard areas are reported and displayed as polygons, while smaller areas are reported as lines or points (the same criteria as used for the APSFR map[1]). The map shows the flood hazard area polygons using zero outline thickness.

The ICPDR agreed that two scenarios (flood hazard areas with medium and low probabilities) are relevant for the level of the international river basin district. Red color is used on the map for the low probability floods (extreme events) and orange color for the medium probability floods. Medium probability scenario is shown on top of the low probability scenario, so in some cases it can overlay the low probability scenario. If no information is available, the whole country's area is displayed with a grey overlay.

The national definitions of floods with medium and low probability are as follows:

Country	Medium probability	Low probability
DE	HQ100	HQ1000 / 1,5 x HQ100
AT	HQ100	HQ300
CZ	HQ100	HQ500
SK	HQ100	HQ1000/extremely dangerous flood
HU	HQ100	HQ1000
HR	HQ100	HQ1000 with no flood protection facility, protected systems considering dike failure
SI	HQ100	HQ500
RS	HQ100	HQ1000
BA	HQ100	HQ500
BG	HQ100	HQ1000
RO	HQ100	HQ1000
UA	HQ10-20	HQ100-200
MD	HQ10-20	HQ100

Some countries announced problems with the agreed catchment threshold as the most significant inundation areas are not located on the major rivers and will therefore not qualify for the level A map.

[1] Areas >=100km² as polygons, areas < 100km² and river stretches >= 50 river-km as lines, and areas < 100km² and river stretches < 50 river-km as points

The ICPDR discussed the issue of the application of the catchment size threshold and agreed that the level A map has to show all inundated areas placed on the river network with catchments >4000km^2 and can also show the significant inundation areas in the smaller catchments if a country decides for such option. In such a case, an explanation has to be provided on the map - that the areas which are not placed on the displayed river network, are on the rivers with catchments <4000km^2, and are being considered to be of a major importance at the national level.

3.2 Flood risk maps

MAP 2 Risk and population

The agreed format is as follows: A4 map on Risk and population is prepared using white background and showing country borders, the DRBD, the Danube River and country capitals. The number of affected population in each country is shown by a bar chart with 3 bars per each country (one bar for each scenario). 2D bars are used, data for high probability scenario are shown on the left side of the graph and the number of affected population is indicated in the bars in thousands for each scenario. If the number is less than thousand then the label "<1000" is displayed. If no data were provided by country then the label "NO DATA" is displayed instead. Red color is used for low probability floods, orange for medium probability floods and yellow for high probability floods. Percentage of the affected population is shown in a separate table. An explanation is provided that data are given for the part of the country belonging to the Danube River Basin District.

No tributaries are displayed on maps 2-4 and 5b.

MAP 3 Risk and economic activity

The agreed format is as follows: Three A4 maps are presented (one for each scenario) using white background and showing country borders, the DRBD, the Danube and country capitals. Each map shows a 2D pie chart for each country displaying the share of inundated area by class of economic activity. If no data were provided by country then the label "NO DATA" is displayed instead. The size of the affected total area in thousand km² is shown below each pie chart. Corine LC colors are used in the chart. An explanation is provided that data are given for the part of the country belonging to the Danube River Basin District.

ICPDR agreed on the following aggregation of Corine Land Cover classes to be used for reporting of economic activities:

- Agriculture: 2.1.1 - 2.4.4 (all agricultural areas)
- Industry: 1.2.1 (industrial and commercial units)
- Infrastructure: 1.2.2 - 1.2.4, 1.3.1 - 1.3.2 (road and rail networks, sea ports, airports, mineral extraction sites, dumps)
- Urban areas: 1.1.1, 1.1.2, 1.4.1, 1.4.2 (urban fabric, green urban areas, sport and leisure facilities)
- Others: all other classes

MAP 4 Risk and installations with the potential to cause pollution

ICPDR agreed that this map should have the same layout as the Map 2. The charts show the number of IPPC and Seveso installations in each country.

MAP 5 WFD protected areas

ICPDR agreed on two maps: One is based on the available Danube RBMP map of areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant NATURA 2000 sites designated under Directive 92/43/EEC and Directive 79/409/EEC. The other map of affected areas designated for the abstraction of water intended for human consumption under WFD Article 7 and of the affected bodies of water designated as recreational waters, including areas designated as bathing waters under Directive 76/160/EEC follows the layout of the other risk maps as indicated above.

MAP 5a

This is an A3 map, showing protected areas (based on DRBMP Map 9) superposed by the flood hazard areas (for low probability floods scenario). Only the overlapping flood hazard areas are displayed (in red). The different types of protected areas (Bird, Habitat and other protected areas) are not distinguished.

MAP 5b

This is an A4 map with the same layout as the map 2. The number of affected protected areas in each country is shown by a bar chart - with 3 bars per each country (one bar for each scenario). The total numbers of affected areas designated for the abstraction of water intended for human consumption under WFD Article 7, and of the affected bodies of water designated as recreational waters, including areas designated as bathing waters under Directive 76/160/EEC, is indicated in the bars.

The ICPDR agreed that the >4000km^2 catchment threshold has to be applied also for all risk maps, to keep the consistence between the hazard and risk maps.

4 Objectives

Article 7(2) FD stipulates that Member States shall establish appropriate objectives for the management of flood risks for the areas identified under article 5(1) and the areas covered by article 13(1)(b), focusing on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity, and, if considered appropriate, on non-structural initiatives and/or on the reduction of the likelihood of flooding.

The ICPDR agreed upon the following objectives of the Flood risk management plan for the Danube River Basin District:

- Avoidance of new risks
- Reduction of existing risks
- Strengthening resilience
- Raising awareness
- Solidarity principle

These objectives focus on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity and address all aspects of flood risk management focusing on prevention, protection, preparedness, including flood forecasts and early warning systems and taking into account the characteristics of the DRBD.

4.1 Avoidance of new risks

Physical planning as well as urban, rural and industrial development and construction should take into account the requirements of flood prevention. All activities concerning physical planning, agriculture, forestry management, energy, transport, urban development, etc., shall be planned and carried out without having any impacts on increasing of the risk of flooding. Special focus must be put on activities planned in upstream parts of flood risk areas that might have negative downstream effects. Not to increase the risk potential, the extension of development land into areas affected by flood risk must be avoided.

4.2 Reduction of existing risks

The purpose of FD is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods. All FD implementation steps in the Danube River Basin District: PFRA, development of flood maps and of flood risk management plan have been accomplished following this principle.

4.3 Strengthening resilience

To improve its resilience against flooding the society has to have an adequate emergency response during and immediately after flooding to limit adverse effects and it shall recover to regain a standard of living comparable to the pre-flooding status.

4.4 Raising awareness

Preparedness is a result of awareness and is based on the necessary information to make the individual recognise his possibilities of action. It is the personal responsibility of anyone who lives and works by or on the river, and broader in the potentially flooded area, to adapt his use of the water and all activities to flood risks. So, everyone must know the risk and take it into account appropriately when acting. Problems associated with floods are often not sufficiently recognised and acknowledged. The authorities should ensure that the information concerning flood prevention and protection plans is transparent and easily accessible to the public. The information provided to the effected communities should also include communication of opportunities how they can adapt e.g. their land use practises to natural circumstances on floodplains. All measures linked to public information and awareness raising are most effective when they involve participation at all levels. Public participation in decision-making is a cornerstone of successful implementation of integrated and comprehensive action plans, both to improve the quality and the implementation of the decisions, and to give the public the opportunity to express its concerns and to enable authorities to take due account of such concerns

4.5 Solidarity principle

The solidarity principle is very important in the context of flood risk management. In the light of it countries should be encouraged to seek a fair sharing of responsibilities, when measures are jointly decided for the common benefit, as regards flood risk management along water courses. FD stipulates that in the interests of solidarity, flood risk management plans established in one Member State shall not include measures which, by their extent and impact, significantly increase flood risks upstream or downstream of other countries in the same river basin or sub-basin, unless these measures have been coordinated and an agreed solution has been found among the Member States concerned in the framework of article 8 FD.

5 Measures

Flood risk management plans shall include measures for achieving the objectives established for the management of flood risks for the areas identified under article 5(1) FD and the areas covered by article 13(1)(b) FD, focusing on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity, and, if considered appropriate, on non-structural initiatives and/or on the reduction of the likelihood of flooding.

The measures described in this plan address all phases of the flood risk management cycle and focus particularly on prevention (i.e. preventing damage caused by floods by avoiding construction of houses and industries in present and future flood-prone areas or by adapting future developments to the risk of flooding), protection (by taking measures to reduce the likelihood of floods and/or the impact of floods in a specific location such as restoring flood plains and wetlands) and preparedness (e.g. providing instructions to the public on what to do in the event of flooding).

The FP EG agreed that only the strategic level measures reflecting the activities on the level of an international river basin district shall be presented in the Flood risk management plan for DRBD. This category includes measures with transboundary effect and measures applicable in more countries of the basin such as awareness rising, warning systems or ice protection measures. Therefore this plan contains a general list of measures providing thus a basin-wide overview of types of actions to be taken by countries to address the flood risks. The detailed description of all planned measures is presented in the national flood risk management plans to enable progress monitoring.

The measures presented in this plan are the planned measures and their implementation subjects to technical and financial conditions at the national level.

To better demonstrate the key actions of a basin-wide importance the measures presented in this chapter are combined with the examples of best practices.

5.1 Prioritization

Presenting only the strategic level measures in this plan can be considered as a basic prioritization criterion which was applied for the level of the international Danube River Basin District. Selecting the measures for this plan the priority was given to measures with downstream effect such as natural water retention, warning systems, reduction of risk from contaminated sites in floodplain areas or exchange of information. The top priority was given to Natural Water Retention Measures (water retention and giving more space to rivers) but the importance of the structural measures was also recognized.

The overview of all measures reported by the Contracting Parties and selected as relevant for the level of the international Danube River Basin District are presented in the **ANNEX 2**.

5.2 EU Strategy for the Danube Region

The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011. The Strategy was jointly developed by the Commission, together with the Danube Region countries and stakeholders, in order to address common challenges together. The Strategy seeks to create synergies and coordination between existing policies and initiatives taking place across the Danube Region. The Priority Area 5 of the EUSDR deals with managing environmental risks including flood risk management.

The synergy between ICPDR and EUSDR activities on flood protection, prevention and mitigation is an inevitable prerequisite for an efficient implementation of the FD in the Danube River Basin. ICPDR has a clear mandate for coordinating flood risk management on Danube River Basin District (level A) based on DRPC and the EU Floods Directive. This includes establishment of a basin-wide flood risk management plan in coordination with national plans and sub-basin plans. EUSDR supports the measures foreseen for the flood risk management plan and provides mechanism for developing related projects on flood risk management, especially flood mitigation.

These projects shall i.a.:

- Reflect the objectives and priorities set in this plan for the management of flood risks;
- Have a transboundary character;
- Help to implement the needs listed i.a.in the Annex 2.

5.3 Types of measures

5.3.1 Measures to avoid new risks

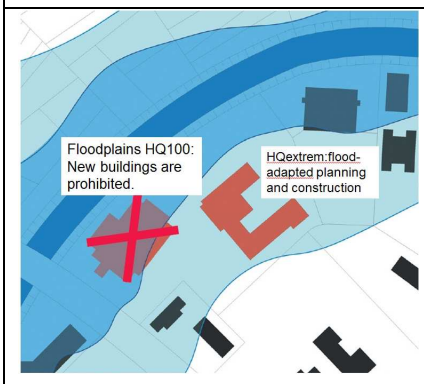
Inappropriate physical planning as well as urban, rural and industrial development and construction in the areas of potential significant flood risk will lead to future damages, losses and casualties. All such activities shall be planned and carried out without having any impacts on increasing of the risk of flooding.

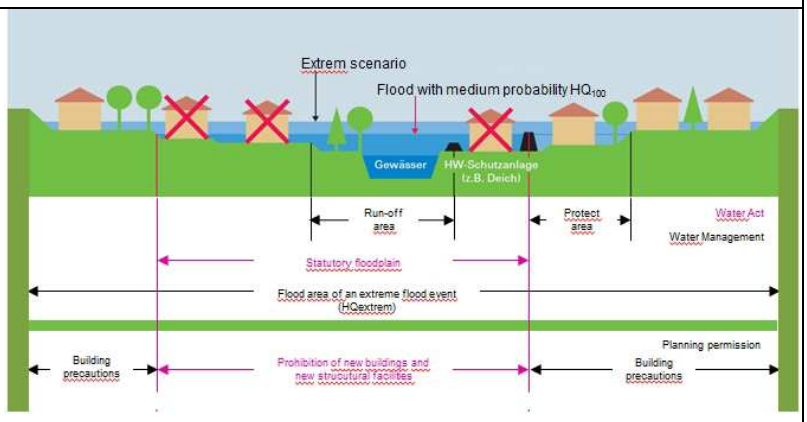
	GERMANY	**Status:** Implemented
	Baden-Württemberg	
Project:	**Declaration of statutory floodplains**	

The most effective and most cost-efficient method to avoid new flood risks is keeping the flood areas, which can be seen in the flood hazard maps, free of new buildings. Therefore in Germany the land-use in designated floodplains which are potentially flooded with a return period of one hundred years (HQ_{100}) is restricted. The restrictions contain amongst others the prohibition of new building zones and new structural facilities.

The federal states in Germany are responsible for the designation of the floodplains. In Baden-Württemberg the designated floodplains are statutory, so that no further administrative procedures at local level are necessary for the definition of the floodplains or the implementation of the restrictions. This has amongst others the advantage that it is possible to react more quickly to potential changes of the flood areas, based for example on impacts of climate change, changes in hydrology or construction of flood protection systems. For this purpose, the flood hazard map shall be reviewed, if necessary updated and republished. Both for new planning and for existing plans the most current flood areas must be correctly included and noted in the planning and approval of urban land use plans.

In the flood areas of an extreme flood event (HQ_{extrem}) there are no such strict restrictions, but usages potentially endangered by floods shall be avoided or planned and implemented in an adapted form.



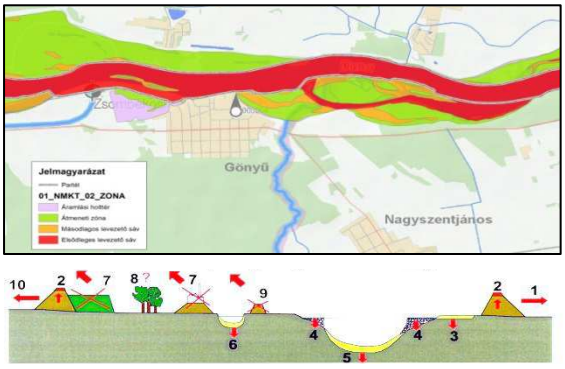


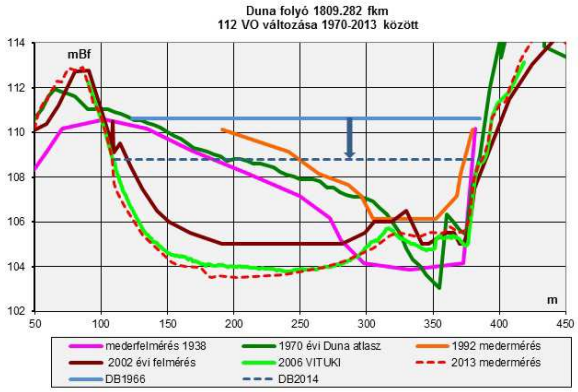
	HUNGARY	**Status:** Under consultation
	Target area: all rivers with design/regulatory flood levels (app. 2800 km + floodplains)	
Activity:	**Floodplain Management Plans**	

In Hungary the flood protection has remarkable history and the defence system is highly developed. Events like the Tisza floods and the Danube floods in between 2000- 2013 called attention to the limited capacity of the reservoirs and narrow development possibilities of the structures. Parallel, the continuous field observations, enhanced measuring techniques and numerical investigations prove the unfavourable processes in the floodplains which obstructs the flood conveyance, such as intensive expansion of vegetation in the flow routes because of depression of the low water regime, uplift of the embanked floodplains, morphologic changes in the rivers and the consequences of budget-limited maintenance.

The evolution of the flood management leads towards the sustainable floodplain management. The aim is to keep the characteristic peak levels on the design/regulatory flood level (MÁSZ - Q1% flood level) or lower them with comprehensive tools. The Hungarian Government made a decision at the end of 2013 to elaborate flood management plans for all rivers or river stretches that possess with MÁSZ. The legal force adopted in June, 2014. The documentations were carried until the end of the same year. The first step was to define of conveyance zones: primary, secondary, transition, still (legislative changes and official land use limitations). For that 2 dimensional numerical modeling had been carried out on detailed complex terrain raster. The division between the categories generally based on unit discharge. The banks of the rivers have also been redrawn and with the zonal distribution they will legally affect the users in the floodplain. During the process the morphological history was investigated, but the documentation considers the existing landuse, the regional and national development strategies, forestry, housing nearby the river, WFD and FD aspects, nature protected sites, national border region specialties, navigation and the geometric parameters of the floodplain. The development chapters contain the measures to be taken to enhance the flood transport.

The public consultation of the plans starts in the middle of 2015 and after the harmonization they will be finalized.





The preventive measures focus on avoiding the location of new or additional receptors in flood prone areas. They are essential for the land use planning policies or regulation.

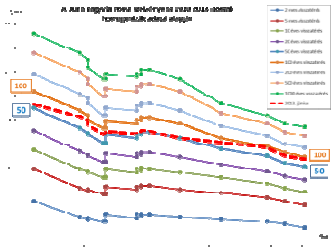
General preparedness is being enhanced through measures that establish or enhance flood event institutional emergency response planning.

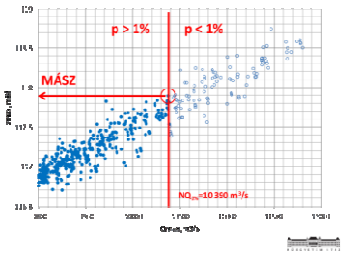
The other measures to establish or enhance preparedness for flood events to reduce adverse consequences include e.g., insurance, financial precautions, new regulation of the financial circumstances, communication of flood risk, permanent monitoring and inspection of erosion control and flood protection structures.

	HUNGARY	**Status:** Closed, legally adopted
	Target area: app. 2800 km rivers with legally defined design flood level	
Activity:	**Recalculation of the design/regulatory flood levels**	

The observed water surface of the June/2013 Danube flood rose above the highest ever recorded flood levels in 90% of the Hungarian river section. Enormous defence work was carried out to avoid overtopping or failing of the dike system, furthermore the former "high ground" areas needed remarkable local elevation on hundreds of kilometres to protect the settlements. The event highlighted the necessity of an update of the 100 year flood levels, so called "MÁSZ" - regulatory (ice-free) flood level, which is the threshold limit of the state responsibility of general protection and the main parameter of the embankment design. On the basis of highly scientific method – carried out by the Budapest Technical University Department of Hydraulic and Water Resources Engineering – the values had been recalculated for all the app. 2800 km main river sections in 2013-2014 and the new longitudinal profiles were legally adopted on 01/01/2015.

The process started with detailed statistical elaboration of the observed hydrological data for 100-130 year at main gauges on the rivers. The analyses resulted in definition of the Q1% discharge value at the measuring points. After discretization of the peak discharge artificially (Monte-Carlo) 14000 years of synthetic inflow were simulated with a time-series model, taking into cross-correlation of tributaries. Maximum flow and water level modelled with HEC-RAS for all 14000 years, along the whole river system. MÁSZ is equal to the maximum level of those simulated floods that locally don't exceed HQ1%. Between gauge stations: interpolation following the hydrodynamic z_{max} profiles was used. The new MÁSZ is based on statistically determined discharge value and represents the actual conditions of the riverbed with numerical modelling. The actualization is obligatory in every 6 years or after a remarkable event.





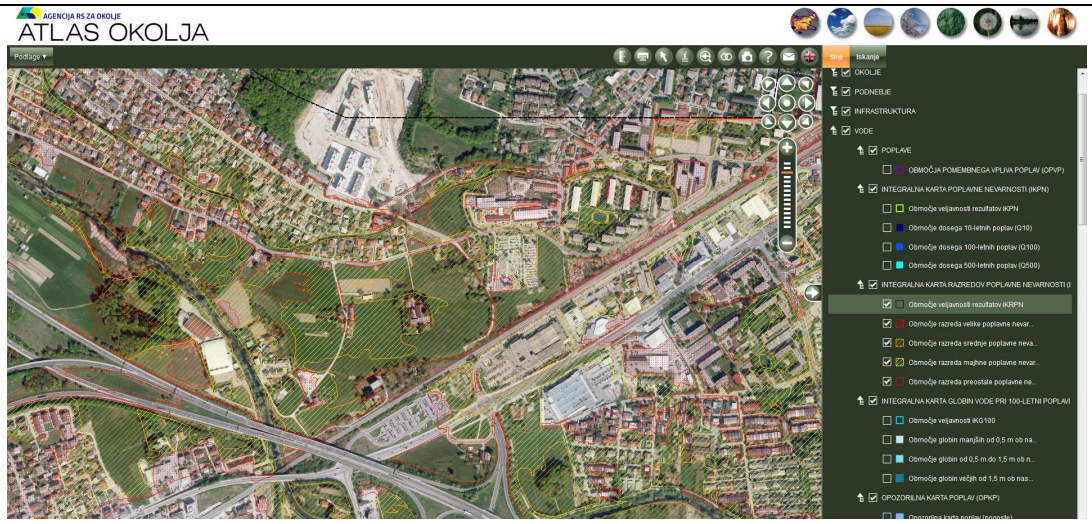
Szelvény	fkm	2013. évi HQ	
Duna-Dévény	1879,3	10640	60
Duna-Medve	1866,3	10150	80
Duna, Mosoni-Duna fölött	1754,8	9975	80
Duna, Mosoni-Duna alatt	1754,8	9774	80
Duna-Komárom	1768,3	9410	80
Duna, Vág fölött	1765,8	9404	80
Duna, Vág alatt	1765,8	9554	60
Duna-Ipza	1764,8	9550	60
Duna, Garam fölött	1716,8	9510	70
Duna, Garam alatt	1716,8	9610	60
Duna, Ipoly fölött	1708,2	9600	60
Duna, Ipoly alatt	1708,2	9650	60
Duna-Nagymaros	1659,6	9530	60
Duna-Budapest	1646,5	9250	50
Duna-Dunaújváros	1560,6	9070	70
Duna-Dombori	1506,8	8840	90
Duna-Baja	1479,7	8600	80
Duna-Mohács	1446,9	8360	80

	SLOVENIA	**Status:** Implemented
	Floodplains in Slovenia	
Project:	**Preventing increase of damage potential of floodplains through conditions and limitations for constructions and activities**	

Besides protecting the floodplains without significant damage potential and with important effect on flood extent, an important element of a preventive flood risk management is limiting the introduction of additional damage potential on flood areas. Since 2008 Slovenia is achieving this goal through legal restrictions for public or private investments by conditioning and limiting different types of constructions and activities on flood risk areas. Also the Decree on conditions and limitations for constructions and activities on flood risk areas (Official Gazette of the RS, no. 89/08) presumes that in case of changed hydrological conditions the compensatory measure must be provided to keep the retention capacity and not to worsen the hydraulic situation downstream. This legal measure has been applied on local, municipal and national level of planning and therefore the spatial data needed are continuously provided by hydrologic and hydraulic studies which are made by investors according to the Rules on methodology to define flood risk areas and erosion areas connected to floods and classification of plots into risk classes (Official Gazette of the RS, št. 60/07). The state, municipalities and private investors are obliged to map the flood hazard classes in the process of preparation of spatial planning documents or projects for obtaining water and building permits for the area of interest being located on a floodplain.

Based on studies decisions are being made whether or under what conditions the planned construction or activity is allowed. In the period 2008-2015 over 300 hydrologic - hydraulic studies modelling water depth and speed were made and certified for more than 1000 km2 of valid result areas. Data from studies are collected in the form of polygon data layers and published in the Environmental atlas for extents Q10, Q100 and Q500, four hazard classes and three water depth classes for Q100 (gis.arso.gov.si/atlasokolja/profile.aspx?id=Atlas_Okolja_AXL@Arso).

Preparation and publication of flood hazard maps made according to the methodological rules represents also a non-structural measure raising awareness of flood hazard in the area.



5.3.2 Measures reducing the existing risks

The EU Floods Directive requires Member States to take adequate and coordinated measures to reduce the risk of adverse consequences, especially for human health and life, the environment, cultural heritage, economic activity and infrastructure associated with floods. It is essential that the measures to reduce these risks are, as far as possible, coordinated throughout a river basin to ensure their effectiveness.

	AUSTRIA	**Status:** Implemented
	Upper-Austrian Machland	
Project:	**Flood plain by-out and relocation as part of an integrated Flood Management**	

The first studywas carried out after the Danube flood 1991 defining zones with non-protectable objects. The buy-out phase started in 1993. The objects in zone I (33) were between the Danube and the HQ-30 flood protection dyke and objects in zone II (221) were between the HQ-30 flood protection dyke and the HQ-100 flood protection dyke. Basis for the amount of the funding was the estimated current value of the object and the estimated damage costs. Legal basis for buy-out was the Federal law for funding of hydraulic constructions. The key conditions were: voluntary participation, 5-year financing scale, new buildings had to be outside the HQ-100 flood area, the zone I/II area was prohibited for new buildings and former building area was rededicated to grassland. The lessons learned are

- : Flood plain by out should start immediately after the incidence
- Excellent team work between state, federal state and municipality are essential
- The more often floods occur the better the this solution works
- Objectives and targets of the measure must be clear and fully transparent
- The population has to be partner and communication is the key

The preventive measures aim to remove receptors from flood prone areas, or to relocate receptors to areas of lower probability of flooding and / or of lower hazard. This includes removing structures illegally built on flood-prone areas and relocation of most endangered population based on the information from risk maps.

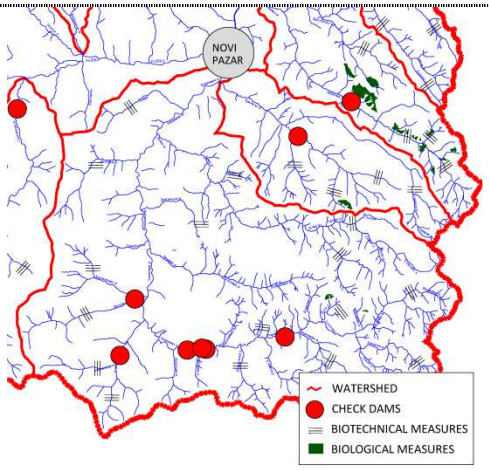
In case the removal/reallocation is not possible the measures are taken to adapt receptors to reduce the adverse consequences in the event of a flood actions on buildings or public networks. Such measures include flood adapted planning, construction and renovation especially in the urban areas, physical protection of buildings, flood proof storage of water-hazardous substances or reassessment and modification of vulnerable infrastructure (esp. road and railroad crossings on rivers).

Other prevention measures include modelling and assessment of flood risk and flood vulnerability to ensure the most reliable information for planners as well as for public. Compilation and regular update of hazard zone plans provides a good basis for land-use and urban planning. Regular upgrade of flood defence plans leads to minimization of risk of flooding. Use of good agricultural practice principle by e.g., proper selection and rotation of plants increases water retention. Technical and safety supervision of water structures including the update/preparation of technical documentation for the existing flood protection structures increases the flood protection safety. Establishing efficient bilateral cooperation with all neighbouring countries, including common actions on transboundary rivers during flood and ice defence is essential not only for flood prevention but also for implementing the solidarity principle.

	**SERBIA**	**Status:** Implemented
	South-western Serbia (the area of Novi Pazar city)	
Project:	**Erosion and torrent control measures**	

A number of torrents endanger the area of the Novi Pazar city, inducing damages on houses and infrastructure after every rain episode. The designed system for erosion and torrent control includes construction of 13 check dams, and afforestation of degraded areas on about 300ha.

Construction of 8 check dams and implementation of bio-technical and (at the areas shaded in blue) was finished in 2013 and in early spring of 2014. The total investment was only 400,000 €. The system of dams had a major role in May 2014, when it prevented disaster caused by extreme rainfalls.



The protection measures rely on natural water retention, enhancement of infiltration, in-channel works, restoration of active and former floodplains and on the reforestation of banks. These measures restore natural systems to help slow flow and store water. They include natural water retention in the catchment, in wetlands and in settlement areas, restoration of active and former floodplains and sedimentation areas. Revitalization of rivers in general leads to enhanced water retention. Important are also the erosion protection measures in the whole river catchment areas (e.g., erosion control trenches, terraces at hill slopes), the measures supportive to rainfall infiltration e.g., by reduction of soil sealing, by improvement of infiltration properties of forest soils or by interruption of trajectories of concentrated runoff (including those on the forest roads) and the technical forestry measures to influence interception and transpiration of forest vegetation. Sustaining the existing forests and afforesting new areas, especially in hilly and mountain areas prone to erosion is an efficient way to maximize water retention at the precipitation areas.

	CROATIA	**Status:** Implemented
	Lonjsko Polje Nature Park	
Project:	**Central Posavina – Wading toward Integrated Basin Management**	

The Central Sava Basin is an area which combines natural values with the function of storage of floodwaters of the river. 23, 706 ha of the Nature Park are used as natural water retention area. This project developed and improved an integrated management approach in Lonjsko Polje Nature Park. It has been accomplished by applying non-structural flood protection methods which take advantage of the natural functions of wetlands to supplement or replace the existing flood control infrastructures.

More information: http://life.pp-lonjsko-polje.hr/english/index_en.html

Because the water retention brings multiple benefits not only to reducing flood risks but also reduce the water scarcity and to achieve the environmental objectives of the EU Water Framework Directive more detailed info about this issue is provided in chapter 6.

	AUSTRIA	**Status:** Implemented
Project:	**WETwin project: Floodplain restoration achieves multiple objectives**	

In Austria, as an Alpine country with limited area available for permanent settlement the protection and restoration of retention areas and floodplains is generally a complex task. Nevertheless, numerous projects and activities had been implemented along various rivers in Austria especially during the past two decades. Even along the largest river in Austria, the Danube, which is bounded by various interventions several floodplains have been protected and restored. Besides multiple projects with the main purpose to flood risk reduction (e.g. by resettlement and restoration of retention areas) several meanders and side-arms that historically have been cut off from the main channel have been re-connected. The re-connected side-arms are important for flood risk reduction, biodiversity, water status (hydromorphological conditions), drinking water and recreation. The process of floodplain protection and restoration is steered by the Austrian principle that “nature oriented” measures have to be implemented and funded with priority if the direct benefits are comparable to those of structural measures.

One example is the Lobau wetland within the city limits of Vienna. In the Lobau, a trade-off analysis was performed to select the management options that best address various management objectives, including the need to safeguard or improve the ecosystem condition of aquatic and terrestrial habitats, drinking water production, recreational use, flood risk reduction, agriculture and fisheries. Six management options representing a gradient from complete isolation to full reconnection with the Danube River channel have been assessed for the above mentioned sectors . The best-compromise solution identified by the analysis was a partial reconnection of the wetland with the Danube main channel.

Sources: http://wisa.bmlfuw.gv.at/ ; www.bmlfuw.gv.at ; http://www.wetwin.eu/downloads/Wetwin_09.pdf ;.

Water flow regulation measures involve physical interventions to regulate flows aiming to increase the capacity of the river channel to be able to cope with elevated flows during flood events. They are based on construction, modification or removal of water retaining structures and on regulation of the hydrological regime. The aim of water flow regulation is raising of storage volume, increasing of discharge capacity and, hence, increase of safety.

Key flow regulation activities include planning, construction/reconstruction, operation, and maintenance of flood retention systems . – Construction, maintenance, repair or reconstruction of water structures such as dams and reservoirs, dry or semi-dry reservoirs, polders and bypass canals are the measures which provide more space for the water and reduce flood peak discharge. The possibilities of new flood retention capacities are explored in the whole river catchment area focussing also on small rivers. Green infrastructure measures (relocation of dikes and designation of natural retention areas where applicable) are in emergencies supported by the use of mobile protecting constructions.

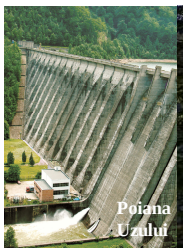
Supportive activities are the optimisation of operational rules and service regulations for water retaining structures.

	**SLOVAKIA**	**Status:** Implemented
	Vah River downstream of the Nosice dam	
Project:	**Revitalisation weir**	
The channel of the Vah River downstream of Nosice hydro power plant was strongly affected by vegetation as a result of high hydropeaking factor and caused a potential flow obstruction under high water conditions. To ensure adequate flow capacity of the channel it was revitalized and a new weir was constructed with the view of covering by water the whole river channel profile via a backwater effect. This approach enabled an increased water throughput during flood events and respecting the requirements of EU WFD.		
 		

The channel and floodplain works cover the construction, modification or removal of structures, the alteration of channels and dykes and also sediment dynamics management. The structural measures (dikes, dams, flood protection walls, dunes, beach ridges or mobile flood defences) are complementary to the green infrastructure measures increasing safety in case that flood water retention cannot cope with the water volumes. They require regular maintenance and proper restoration in case they were damaged by previous floods. To lower the water level the possibilities of removal of transversal structures in the rivers are explored and the discharge capacity of bridges, culverts and inundation structures is being increased. The channels of water courses are maintained (removal of deposits, maintenance of vegetation) to ensure the adequate flow capacity.

	ROMANIA	**Status:** ongoing
	All 11 Water Basin Administrations	
Project:	**Risk mitigation in case of natural calamities and preparation for emergency situations C-Component – Risk reduction in case of floods and landslides**	

The project aim is to rehabilitate through adequate works of eight existing improvements on interior rivers (Tarna Mare, Tarnava Mica, Cibin, Bega, Slanic, Prut, Valsan and for Babadag locality), three on the Danube (on Borcea arm), to increase the safety degree of seven large dams (Berdu, Varsolt, Maneciu, Lesu, Poiana Uzului, Valea de Pesti, Siriu) and five small dams (Sanmihaiu Roman, Pucioasa, Catamarasti, Taria and Buftea)

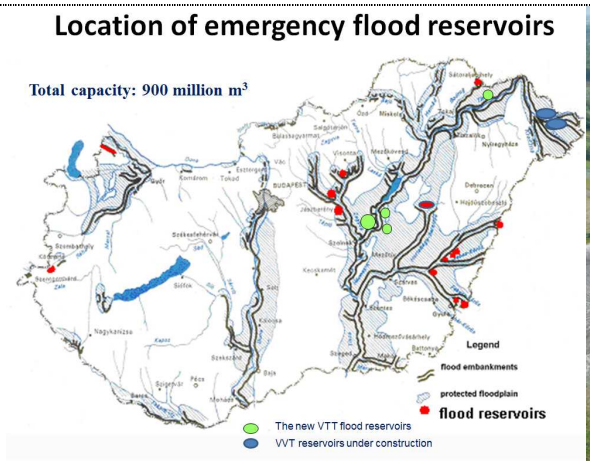


	HUNGARY	**Status:** Ongoing
	Tisza River	
Project:	**New VÁSÁRHELYI Plan (VTT)**	

VTT is expected to raise the level of flood safety along the Tisza in harmony with the overall flood control improvements in Hungary by focusing on two problems, increasing the conveying capacity of the flood bed and the use of emergency reservoirs. The studies on increasing the conveying capacity of the flood bed have succeeded in identifying the potential and necessary measures needed to lower the flood peaks to the necessary extent. In the program of implementation the following key measures have been envisaged: removing the obstacles from, and keeping clear of, the flood conveying channel, proposal on retaining, relocation or complete demolition of summer dykes, solving the problems associated with parallel bars, river training works, realignment of the main defences (where unavoidable).

Improvement of the conveying capacity of the flood bed has been envisaged in combination with the environmental revitalisation thereof. The study on the emergency storage scheme in the Tisza Valley (flood plain revitalisation by means of controlled diversion) has revealed no obstacle to establishing the reservoirs at the proposed sites. Eleven potential reservoirs studied were found viable – with some restrictions – in the VTT. The sites were ranked by sections. The reservoirs Cigánd-Tiszakarád, Nagykunság, Hany-Tiszasűly, Tiszaroff has already in operation, the reservoirs Szamos-Kraszna, and Bereg are under construction. These reservoirs have a total capacity of 537 mil m^3 + 186 mil m^3.

In the event of the thousand-year flood the impact of the six emergency reservoirs identified would extend to the full length of the Hungarian Tisza section. The local and cumulated effect would lower the peak stage by the set target of 60 cm. The final plan with 11 reservoirs will be to reduce by 1,0 m the thousand-year flood, with a capacity of 1 500 mil m^3.



Development of concepts, plans, projects, strategies on catchment scale to improve the water and sediment balance is an important tool to implement sediment management measures to maintain river conveyance capacity.

Surface water management covers measures involving physical interventions to reduce surface water flooding especially in an urban environment. To achieve this the infiltration structures to catch the rainfall water have to be constructed, properly maintained (kept clear) and, if necessary, repaired. Use of green roofs and rain gardens contributes positively to increasing the water retention in urban areas. To avoid pollution problems the flood protection measures on sewerage systems will be taken including construction of retention storages on sewerage system.

5.3.3 Strengthening resilience

Resilience is the ability to cope and respond before, during and after a flood event occurs. The society affected by floods shall recover to regain a standard of living comparable to the pre-flooding status.

The sound resilience concept requires having clear management objectives for preparedness oriented activities as well as for recovery and review. Ensuring sufficient preparedness includes measures to establish or enhance flood forecasting or warning systems, measures to establish or enhance flood event institutional emergency response planning (contingency planning) and measures to establish or enhance the public awareness or preparedness for flood events.

	ROMANIA	**Status:** Ongoing
	All 11 Water Basin Administration	
Project:	**WATMAN – Information System for Integrated Water Management**	

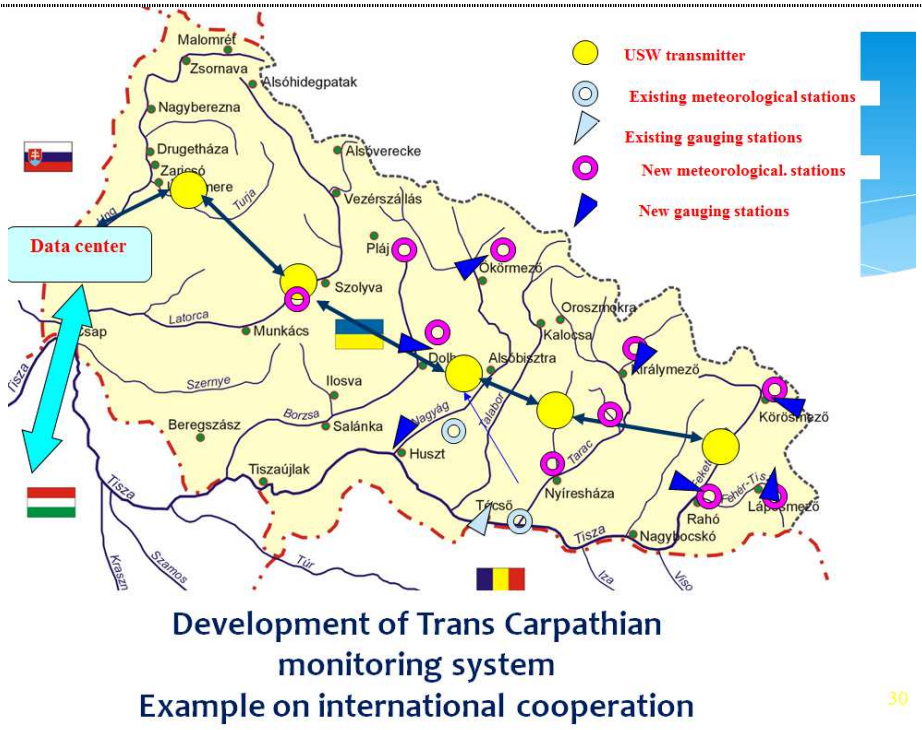
The general objective of WATMAN project is to contribute to a sustainable flood management in most vulnerable areas by implementing structural and non-structural measures according to the European legislation. The project helps achieving the objective of the National Strategy of Water Management, to reduce the consequences of natural disasters affecting the population by implementing preventive measures in the most vulnerable areas and by implementing an up-to-date highly specialized integrated decision support system for the National Water Authority. The first project phase aims at increasing safety degree of hydraulic engineering structures, which includes 89 major dams monitored in an automatic system for structure safety parameters, 125 stations for measuring solid and liquid precipitations, 31 gauging stations along tributaries, 41 automated stations for measuring users discharges (population and industry), 36 automated stations for measuring discharges on diversions. Aim is also to increase the response capacity of Romanian Waters in case of natural disasters, which includes setting-up 23 Rapid Response Centers, 15 Coordination Centers and 51 Automatic Sensors Stations for water quality monitoring throughout the country.

The Phase II of WATMAN project will integrate the data and information supplied by the two information systems in use in Romania, SIMIN and DESWAT, in the operation of an Integrated Information Decision Support System for an efficient and sound management of the water resources at the national level. The system of warning/alarming the population will be upgraded.

The measures to enhance flood forecasting and warning systems are ongoing or planned in all Danube countries. These include research and development projects and best practice projects, revision and completion of forecast profiles and flood announcement limits, construction of local warning and notification systems, creation of expert systems to analyze measured data, building new monitoring systems based on radar and precipitation stations, introducing new forecasting models based on automated precipitation and gauging stations as well as use of radars and satellite imagery. Emphasis is given to making the measured data available to relevant services in real time, improving the alarm

systems and systems for issuing timely warning to population at risk, especially on river basins without structural flood protection and upgrading the international exchange of meteorological and hydrological data.

	HUNGARY & UKRAINE	**Status:** Implemented
	Upper Tisza River	
Project:	**Trans-Carpathian Flood Monitoring System**	
This monitoring system was established in cooperation with Ukraine and Hungary. The main goal was increasing lead time for emergency operation. The data exchange between the two countries is direct and in real time.		

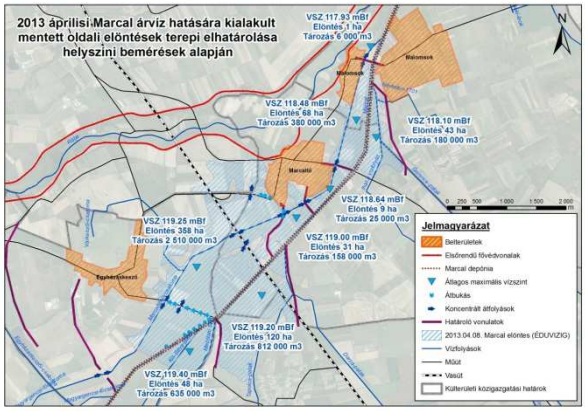


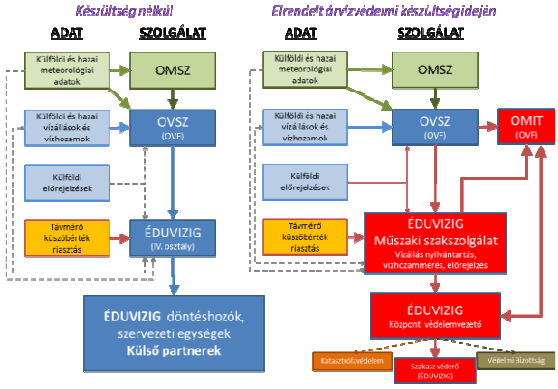
Preparation and update of emergency and crisis plans at local/regional/country level is an essential prerequisite to an efficient flood resilience. Of equal importance is training and professional support of flood and crisis authorities; improvement of cooperation between different sectors, institutions and professionals involved in flood management; and pre-assignment of technical devices and materials for rescue activities during floods.

Individual and societal recovery activities focus on clean-up and restoration activities (buildings, infrastructure, etc); health and mental health supporting actions, including managing stress; disaster financial assistance (grants, tax), including disaster legal assistance and disaster unemployment assistance. The measures adopted by the Danube countries include assistance with post-flood repair, restoration activities, aftercare planning and elimination of environmental damage. Support is provided to activities of humanitarian organizations and volunteers during and after floods.

	HUNGARY	**Status:** Closed
	Target area: settlements on high grounds or on open flooplains, exposed to hazard of fluvial floods, excess water or flash floods, incorporating extreme local precipitation consequences as well (drainage system malfunctions)	
Project:	**Municipality defence plans for water-related damages**	

After the 2013 highest-ever-recorded (LNV) flood in the Danube it became evident that most of the settlements along directly at the Danube banks are subject of the flood hazard maps. These populated places was known formerly as the housing and industry placed on high-grounds which settles above the design flood levels and possibly not be inundated. Full reconsideration was needed due to the new calculations that had been carried out accompanying the measured discharge and water levels in June, 2013. At the end of 2013 the Hungarian Government decided to assign the task of creating municipality defence plans for water-related damages, to the regionally responsible Water Directorate for those settlements that are located on open floodplains. This duty was covered and financed by the local municipality before the decision but the quality and content was very diverse. In 2014 from state budget ~160 plans were carried out coherently based on the manual defined by the Hungarian Engineering Chamber. The documentation deals with the hydrological circumstances of the settlements, main characteristics of the rivers and creeks or ground water table around them. It defines the operative tasks in case of different levels of alert for the municipality organisations and the most important legislative information is given to the mayors. Furthermore with annexes the official documentation guidelines and preparatory activities, development possibilities are reflected as well. The full plan contains textual and map information.





	ROMANIA, UKRAINE & MOLDOVA	**Status:** Ongoing
	Siret and Prut Water Basin Administration	
Project:	**EAST AVERT**	

EAST AVERT is a project for strengthening flood prevention and protection in the Siret and Prut river basins through the implementation of a modern monitoring system with automatic stations. The project will be implemented by partners from Romania, Ukraine and Moldova and aims to reduce the vulnerability of communities in border areas by modernizing the Stanca-Costesti dam on the Prut river, by improving the warning system through installing monitoring systems in the Siret and Prut river basins and by increasing the responsiveness of the population.

In case of pollution caused by a flood event the evaluation and repair of damages as well as clean-up and restoration activities (mould removal, ensuring well-water safety and securing hazardous materials containers) are to be carried out.

	**SERBIA**	**Status:** Implemented
Project:	**International aid during May 2014 Flood**	

In reaction to the severe flooding and ensuing landslides, on 15 May the Government of Serbia declared a state of emergency for its entire territory. At the same time, in order to maximize the effectiveness of the response to the emergency, a request for assistance was sent to the international community, notably to the Governments of the European Union (EU) Member States, EU Candidate Countries in the region, the Russian Federation, the European Commission (EC) and the United Nations (UN). In response the European Commission activated immediately the EU Civil Protection Mechanism to call on Member States resources and staff.

The government established a "Floods Emergency Headquarters" within the Sector for Emergency Situations in the Ministry of Interior, together with crisis centres in each of the flood-affected municipalities/districts/cities. They worked in close cooperation with the EU Civil Protection (EUCP) and the UN Disaster Assessment and Coordination (UNDAC) teams, both of which were co-located in the HQ office.

Assistance to Serbia in protection and rescue actions has been provided by rescue teams from 13 countries: Slovenia, Bulgaria, Denmark, Czech Republic, Germany, Romania, Austria, France, Hungary, Russia, Belarus, Macedonia and Montenegro, which also provided rescue equipment. Helicopters from Russia, Slovenia, Switzerland, Germany, Macedonia, Hungary, Belarus, and EULEX were engaged for the rescue, survey and delivery of food and other necessities. Croatia has sent police unit with a team of divers to the area of the most vulnerable city of Obrenovac.

5.3.3.1 Flood information service in the Danube River Basin

Activities associated with protection against floods are governed by the respective legislation of each Danube state (the Water act, the Act on Crisis Management, the Act on Integrated Rescue System etc.). Flood protection authorities and Crisis authorities are bodies of the State and/or municipal administration fully responsible in pertinent areas for organization of the flood monitoring services. These authorities' co-ordinate and control the activities of other participants involved in the flood protection. The individual states of emergency depend on the water levels or discharges, which are defined for every section of the river according to the local/national flood risk management plans. The state of alert generally occurs when the water level rises above the river channel. The states of danger, state of emergency and severe situation are proclaimed at the behest of the competent river basin authority with reference to the hydrological forecast.

The major tasks of the meteorological services of the Danube states in the area of flood forecasting include monitoring and forecasting of the weather situation, and advisory and warnings on dangerous weather events such as heavy precipitation, storms, hail etc. Quantitative precipitation forecast belongs to the most important activities of the meteorological services and it is provided through the use of numerical weather modelling by the top European Meteorological Services (France, Germany, UK). This information is supplemented by data from the meteorological satellites and maps of rain intensities provided by national meteorological radars.

The hydrological services monitor the current situation on the rivers in the Danube river basin by gauging stations which provide regular hydrological information that is supplemented with the data from the River Basin Authorities. Hydrological data include those on flow regulation in reservoirs which influence the flood transit.

National forecasting methodologies were improved by developing and introducing hydrological models into the forecasting service. The hydrological forecasting system is connected to the meteorological forecasting system. Rainfall-runoff and routing models are calibrated for all main river basins and river reaches in the DRB. Data on observed precipitation and quantitative precipitation forecast enter to the models and this allows to extent the lead time up to 48 hours. In winter period the snow melting model is used within the systems.

The flood forecasting services regularly provide hydrological forecasts to the River Basin Authorities and other stakeholders and publish them on web-sites. In case of flood they inform the flood protection authorities and other participants involved in the flood protection about flood danger and flood evolution. Warning messages are disseminated as soon as the extreme meteorological or hydrological conditions have been forecasted, and during floods they are accompanied by information on the flood evolution and its further prediction.

More information can be found in the ICPDR report on assessment of flood monitoring and forecasting in the Danube River Basin from 2009.

5.3.3.2 The European Flood Awareness System (EFAS) for the Danube river basin

After the Danube and Elbe floods in 2002 the European Commission initiated the development of a European Flood Awareness System (EFAS) to increase the preparedness for floods in Europe. EFAS was developed in close collaboration with the ICPDR and the national hydro-meteorological services sharing the Danube river basin amongst others. The aim of EFAS is to gain time for preparedness measures before major flood events strike, particularly for large trans-national river basins such as the Danube, both on country as well as European level. This is achieved by providing complementary, added value information to the national hydrological services and by keeping the European Response

and Coordination Centre[2] informed about ongoing floods and about the possibility of upcoming floods across Europe. Since 2012 EFAS is running fully operational as part of the Copernicus Emergency Management Service[3].

EFAS provides the national authorities with the likelihood of flooding to occur in the upcoming 10 days. The information is always shown at the river basin and European level. Flood forecast information can be accessed by the EFAS partners either through a password protected web site (www.efas.eu) or through web services. The flood warning information is always sent to the affected national authority and to all downstream located authorities. In this manner also the downstream located authorities are aware of an upcoming flood situation that may affect them at a later stage. Furthermore, through collaboration at the Danube river basin as well as at the European scale EFAS fosters knowledge exchange and data sharing amongst the national hydro-meteorological authorities.

Figure 1 Screenshot of the EFAS web interface for the forecast from 15 May during the Balkan floods in 2014. Triangles denote active EFAS warnings that have been sent to the national authorities. Red shaded river pixels denote the probability of exceeding the EFAS high warning threshold based on the probabilistic forecast

5.3.4 Raising awareness

It is the personal responsibility of anyone who lives and works in the area of potential significant flood risk, to adapt all his activities to flood risks. This requires communication to citizens in an appropriate and understandable way on flood risks and on opportunities how they can adapt to the natural circumstances. The awareness raising measures include presentation of flood hazard and flood risk maps, flood risk management plans (including natural water retention measures and

[2] http://ec.europa.eu/echo/en/what/civil-protection/emergency-response-coordination-centre-ercc

[3] http://emergency.copernicus.eu/mapping/ems/efas-european-flood-awareness-system

associated consequences to adaptive land use) and of emergency plans to public, organizing training campaigns and other educational activities focussing on flood preparedness among municipalities, introduction of water management issues into schools (from the elementary school to the university level) and increase of participation of population in the flood management and emergency response works. Involvement of public media is very helpful especially by producing flood leaflets, films or TV broadcasts. An essential issue for both flood resilience and awareness raising is making available of effective insurance policies and financial precautions.

	HUNGARY	**Status:** Ongoing
	Target group: regional and local stakeholders, politicians, mayors, local NGOs	
Activity:	**Stakeholder conferences promoting the flood management activity**	

In 2014 the General Directorate of Water Management (OVF) launched a series of conferences for regional and local stakeholders to draw attention to the characteristics of risks that are related to water like fluvial and pluvial floods, excess water and drought. The meetings take place in different regions quarterly and hosted by the responsible local Water Directorate.

Usually the patron of the event is a high level regional representative. The professional presentations cover the main directions of the national flood/water risk management planning and highlighting the territorial problems. The invited guests are regional and local stakeholders, politicians, mayors and representatives of local NGOs.

It has to be however pointed out that floods are natural events and the high probability floods provide positive effects on the ecosystem. They supply floodplains and connected wetlands with water ensuring fish reproduction and nutrient reduction. The combination of flooding with compatible land use leads to a range of positive effects for the well-being of the society.

	AUSTRIA	**Status:** Implemented
	13 rivers in Austria	
Project:	**“Flussdialog” (dialogue on rivers)**	

The project “Flussdialog” (dialogue on rivers) has been established in Austria and applied to 13 rivers. It aims at consulting relevant stakeholders in the field of WFD and FD implementation. Stakeholders are related to the sectors policy, administration, agriculture, tourism, fisheries, industry, trade, energy supply, education, nature conservation, people exposed and broad public. The consultation is organised in 4 steps (1) involvement of stakeholders, (2) involvement of public, (3) dialogue to discuss results and needs and (4) definition of further steps and reached an estimated 550 000 people in Austria and Bavaria (www.flussdialog.at, www.flussdialog.eu).

	SLOVAKIA	**Status:** Implemented
	whole Slovak Republic	
Project:	**Public information and participation**	

When the Act. No. 7/2010 Coll. On Flood Protection came into the force, the competent authority for the FD, Ministry of the Environment of the Slovak Republic, has started a number of information and coordination activities. To involve the competent institutions, organizations, private companies and academic sector active in flood evaluation, flood risk evaluation, flood prevention or protection, both on national and international level, special conferences "River Basin and Flood Risk Management" to start the discussion on different approaches and opinions were organized and seminars for municipalities were held as well: http://www.vuvh.sk/index.php/sk_SK/rozne/manazmentPovodi

http://www.vuvh.sk/index.php/sk_SK/konferencie/zbornik-manazment-povodi-a-povodnovych-rizik-2013

General public awareness and preparedness for upcoming flood events are strongly supported by public media. SHMI publishes on its webpage up-to-date information on hydrological warnings (http://www.shmu.sk/en/?page=1680) and on flood activity degrees (http://www.shmu.sk/en/?page=1&id=hydro_stpa&PAtab=PAtab). During flood events information about hydrological situation and flood warnings is provided to general public also through TV media. The public living in a potentially flooded area can use this information channels and react individually.

A documentary series "Slovak water" was produced by the Slovak Watermanagement Enterprise in cooperation with other water related organizations and public TV media. It provides general public with information about water including awareness raising, flood risks and possible flood protection measures.

See: http://www.ta3.com/clanok/1047350/slovenska-voda-z-22-septembra.html

http://www.ta3.com/clanok/1048244/slovenska-voda-zo-6-oktobra.html

5.3.5 Solidarity principle

Countries shall not apply measures which, by their extent and impact, significantly increase flood risks in the countries neighbouring upstream or downstream. Countries should take all possible steps not to export the flood problems to their neighbours.

Solidarity principle plays a key role in the prioritization of measures relevant for the international Danube River Basin District and therefore its further description including the practical examples of its application are provided in the chapter 11.

	HUNGARY	**Status:** Completed
	Target area: Austrian-Hungarian Water Commission	
Project:	**CEframe: Memorandum of flood protection – Leitha/Lajta river** **Recommendations for future cooperation between Austria and Hungary on the Leitha/Lajta River**	

In the last decade the joint river basin of the Leitha/Lajta River has been affected by several floods which caused widespread damage in the neighbouring regions of Austria and Hungary. The flood risk in these joint river basins can only be reduced efficiently by transnational cooperation and coordinated flood risk management in the border region as stipulated in the EU Flood Directive. The necessary basic information and possible measures for flood risk management have been elaborated by the project partners within the Ceframe project.

One of the major milestones in the CEframe project was achieved in January 2013: the signing of the CEframe Memorandum of Flood Protection. The project partners confess to further strategic cooperation and improving flood protection in the joint, border crossing area of the river Leitha/Lajta, even beyond the project end. The memorandum listing common tasks such as reciprocal exchange of information and in the joint coordination of flood protection measures in the border region, seek for measures integrating ecological improvement and flood protection in the border region, raising awareness and preventing the development of additional damage potential, keeping close contact between defence bodies, common enhance of the flood protection system and jointly develop a flood risk management strategy.

6 Water retention

6.1 Flood retention

Flood retention structures are artificial or natural constructions providing a retention volume to decrease a flood's peak. The retention can be provided by reservoirs, detention and retention basins, flood polders and by wetlands/floodplains. All flood retention structures contribute to flood attenuation and their planning, construction, operation, maintenance and reconstruction is given a top priority in this plan due to their substantial downstream effect.

<table>
<tr><td></td><td>CZECH REPUBLIC</td><td>Status: Implemented / planned</td></tr>
<tr><td></td><td colspan="2">Moravska Sazava river / Becva river</td></tr>
<tr><td>Activity:</td><td colspan="2">Dry reservoir Zichlinek / Dry reservoir Teplice</td></tr>
<tr><td colspan="3">Dry reservoir Zichlinek was constructed on Moravska Sazava River in 2005 – 2007 with a total retention volume of 5.9 mil. m^3 and the area of about 166 hectares. In the polder area the part of Moravska Sazava river was revitalized. The structure will reduce the flood Q100 = 126 m^3/s to about Q20 = 83 m^3/s.

Construction of dry reservoir Teplice with total retention volume about 35 mil. m^3 and the area of about 616 hectares is planned on the Becva River. The dam height is about 12.5 m. The structure will reduce the extreme flood of the year 1997 Q = 950 m^3/s to about Q_{20} = 650 m^3/s.

  </td></tr>
</table>

6.2 Towards better environmental options in flood risk management

Traditional measures to reduce negative impacts of floods include constructing new or reinforcing existing flood defence infrastructure such as dykes and dams. There are, however, other and potentially very cost-effective ways of achieving flood protection which profit from nature's own capacity to absorb excess waters. Such green infrastructure measures can play a major role in sustainable flood risk management in the Danube River Basin District. Win-win solutions need to be the focus of flood risk management.

Integrated flood risk management must focus on sustainable water management and measures which work with nature are becoming more important, as they contribute to the strengthening of the resilience of nature and society to extreme weather events.

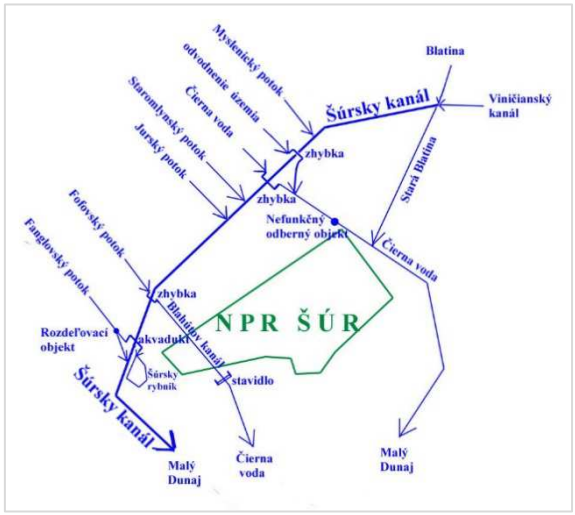
EU environmental legislation asks for the evaluation of better, feasible environmental options to the proposed structural changes to rivers, lakes and coasts, if these changes could lead to a deterioration of the status of these waters. The Water Framework Directive, Habitats Directive, Environmental Impact Assessment and Strategic Environmental Assessment Directive set out such requirements, and strive to balance maintaining human needs whilst protecting the environment with the ultimate goal of achieving a sustainable approach to water management. Natural flood management considers the hydrological processes across the whole catchment of a river or along a stretch of coast to identify where measures can best be applied, with a focus on increasing water retention capacities.

	SLOVAK REPUBLIC	**Status:** Implemented
	Catchment of Morava river	
Project:	**Measures for water regime conservation in the National Natural Reserve of Šúr**	

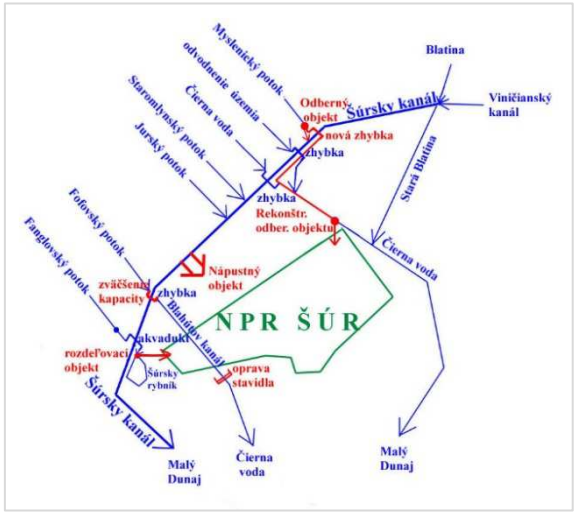
Flooding of meadows and insufficient drainage of the Šúr area in the second half of the 19th century initiated building of drainage canals and amelioration systems in this area. During 1941 – 1943 these activities were completed by the construction of the Šúrsky canal. This canal retains most of the water from the Carpathian streams flowing previously into the depression of Šúr. After floods 1999 when the left-bank dike of Šúrsky canal was overtopped and the excess water had flooded the area of the National Nature Reserve Šúr (NNR Šúr) without any negative effects, the idea arose to use the flood retention potential of the Reserve. The outlet object was built at rkm 10,197 of the left-bank dike in 2001. When the discharge in the Šúrsky canal is over Q5, the water is released into the area of the Reserve. This also partially substitutes the natural water regime of Šúr area before construction of the Šúrsky canal in the 19th century. The amount of discharged water depends on particular flood situation in the Šúrsky canal, and it can be up to 7,4 $m^3 \cdot s^{-1}$.

The aim of the project was to conserve and improve the biotope of this RAMSAR locality. The main realised measures were to build and reconstruct the functional objects for water supply of this area during the whole year. This project was carried out by the Slovak Water Management Enterprise. During 2003 – 2007 additional measures have been carried out in the frame a LIFE project „Recovery of the water regime in the NNR Šúr" supplying the NNR Šúr area by water from the Carpathians through a system of inverted siphons, canals and aqueduct during the whole year. For more information see: http://www.broz.sk/projekty-life-na-slovensku

Original status of existing amelioration canal system



Realised measures for NPR Šúr marked in red colour



Šúrsky canal leftbank dike overtopping in 1999

Water distribution in NPR Šúr

Outlet (intake) object in the dike of Šúrsky canal

6.3 Natural water retention measures

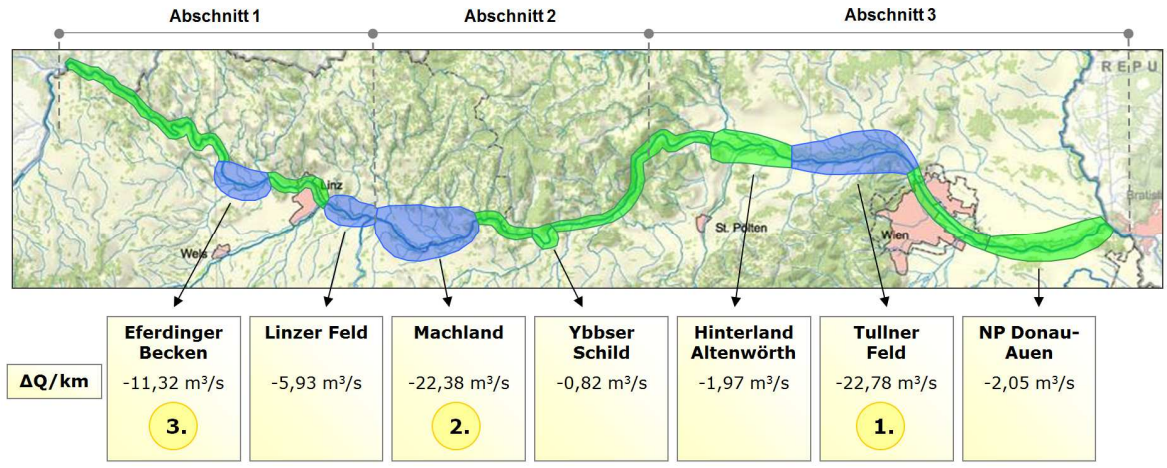
Natural water retention measures are measures that aim to safeguard and enhance the water storage potential of landscape, soil, and aquifers, by restoring ecosystems, natural features and characteristics of water courses and using natural processes. They support Green Infrastructure by contributing to

integrated goals dealing with nature and biodiversity conservation and restoration, landscaping, etc. NWRM provide multiple benefits, including flood protection, water quality and habitat improvement. They are adaptation measures that use nature to regulate the flow and transport of water so as to smooth peaks and moderate extreme events (floods, droughts, desertification). They reduce vulnerability of water resources to climate change and other anthropogenic pressures. They are relevant both in rural and urban areas.

	AUSTRIA	**Status:** Implemented
	Austrian Danube	
Project:	**Floodplain evaluation matrix (FEM): An interdisciplinary method for evaluating river floodplains in the context of integrated flood risk management**	

During last decades, river floods accounted for enormous damages especially in highly developed and/or densely populated regions worldwide. Moreover, due to anthropogenic alterations of hydrology and river morphology (climate change, land use changes in the catchment, channelling and constricting rivers) and due to the ongoing accumulation of values (such as settlements, infrastructure facilities, etc.) in flood prone areas, this amount of damages is likely to rise in future. Integrated flood risk management is legally in force and aims at reducing the negative effects of floods by combining structural and non-structural flood protection measures. Non-structural measures such as the preservation or restoration of floodplains are considered by the EU Floods Directive as an effective tool for reducing flood risks. For most of the rivers, however, very little is known about the effectiveness of floodplains in regard to hydrological and hydraulical flood hazard reduction. This lack in knowledge often obstructs the integration of these natural flood retention processes into the concepts of integrated flood risk management. In the present study, the Austrian Danube was investigated along its entire 350 km length, determining reaches and floodplains with high relevance for flood water retention and thus for reducing flood hazards downstream. A novel analysis based on one-dimensional and two-dimensional hydrodynamic-numerical modelling, using hydrological and hydraulic parameters defined under the so-called floodplain evaluation matrix method (FEM; Habersack et al. in Nat Hazards, in print, 2013), was carried out to evaluate retention effectiveness on various spatial scales. The results illustrate the magnitude and the variability of flood retention and hydraulic parameters with respect to different hydrological settings (flood wave shape, recurrence probability).

Peak wave reduction:



NWRM often have lower costs than alternatives, such as grey infrastructure for flood risk management. Their cost-effectiveness, however, is often not well-known and in particular needs to be considered in terms of their multiple benefits.

Examples of natural water retention measures include:

- Sustainable Forestry Practices: e.g. riparian forests, afforestation

- Sustainable Agriculture Practices: e.g. buffer strips, crop practices, grasslands, terracing, green cover
- Urban Measures: e.g. Sustainable Drainage Systems (filter strips, swales), Green Roofs)
- Measures for increasing storage in catchment and alongside rivers: restoration of wetlands, floodplains, lake, basins and ponds, re-meandering, natural bank stabilization
- Other Measures for increasing Groundwater Recharge

For practical reasons for larger scale floodplain/wetland restorations the legal and financial background (like incentives for land use change) have to be clarified and solved at the national level. The land use change and the wide range of landownership requires special knowledge on proper stakeholder involvement for which trainings and capacity building for planners and responsible bodies would bring great benefit.

6.4 National activities towards water retention in the Danube River Basin District

6.4.1 Germany

A major pillar of the flood protection strategy in the Danube River Basin District in Germany is the new flood storage polder concept in Bavaria. In the last years several locations for new flood storage polders have been identified like Riedensheim/Danube, Öberauer Schleife/Danube, Katzau/Danube, Seifener Becken/Iller-Danube, Feldolling/Mangfall-Inn-Danube. The new flood storage polder Seifener Becken/Iller-Danube is in operating state since the year 2007. Start of the construction of the new flood storage polder Riedensheim/Danube will be in the year 2014, of Feldolling/Mangfall-Inn-Danube in the year 2016. Further locations for flood storage polders on the Danube river have been identified in a study of the TU München. Further studies will be carried out for possible locations for new flood storage polders in the catchment area of the Danube and Inn within the year 2014.

An additional field of this Bavarian flood protection strategy is to retain the water in case of a flood event in the state owned reservoirs and by natural water retention. The existing reservoirs like Sylvensteinspeicher/Isar-Danube will be improved. In June 2013 it was possible to retain some 129 mio. m^3 in the state owned reservoirs in the course of this flood event.

For the Danube River Basin in Baden-Württemberg the Integrated Danube Program (IDP) was launched in 1992. The aim of the IDP is the conservation and the development of natural habitats combined with the demands of flood protection on the Danube in Baden-Württemberg. Important measures of the program are for example the flood control basin in Wolterdingen and the renaturation of the Danube between Hundersingen and Binzwangen, both finished in 2012.

6.4.2 Austria

Austria strives to preserve natural water retention areas and where possible to restore or even create new water retention areas. Along the River Danube this has been recently done by relocation of settlements and dykes to provide more water retention during floods as well as by removal or adaptation of constructions along and in the river under ecological aspects. In some cases even cut off back waters had been reconnected to the main river stem (mainly in the national park east of Vienna). Further, numerous EU LIFE projects had been conducted to enhance the ecologic status (groundwater

recharge, habitat availability, dynamic morphology, water retention, etc.) by, at the same time, contributing to flood risk reduction.

	AUSTRIA	**Status:** Implemented
	Drau west of Klagenfurt (between Spittal i.Dr. and Oberdrauburg)	
Project:	**Revitalisation Upper Drau**	

The project is located in Carinthia, Austria. Several measures (reconnection of back-waters, establishing ponds, widening of the river channel, allowing self-development of structures) were implemented and supported in order to improve the river morphology (trend of river bed decrease) and ecology. In parallel a monitoring (morphologic and ecologic) was established to constantly evaluate the progress of development and, therefore, making benefits tangible. More info: http://www.life-drau.at/

6.4.3 Czech Republic

Water retention in the river basin is one of the possible flood protection measures and can be used where the suitable area is available. This approach is also mentioned in the Strategy for floods protection in the Czech Republic as important measure for areas with suitable geomorphological conditions. In the frame of the actual national programme “Support for flood protection III” in the Czech Republic the measures focused on increasing of water retention (like extension of floodplains, controlled inundations, dry reservoirs or water reservoirs with retention volume) have priority, primarily in the areas of potential significant flood risk.

As the contribution to the water retention can be included also the requirement of Czech Water Act No. 254/2001 Coll. to ensure first of all soaking and retention of rainfall in the built-up places.

6.4.4 Slovakia

Natural water retention measures belong to measures designed in the frame of preparation of flood risk management plans. Natural water retention measures belong to preventive flood protection measures that contribute to natural water accumulation at suitable locations in accordance with the article a) section 2) paragraph 4 of the national flood protection act no. 7/2010 Coll. This type of measures are generally applied at locations where natural flooding has already occurred and where it is applicable with regard to the ownership rights.

	**SLOVAKIA**	**Status:** Implemented
	Latorica River	
Project:	**Conservation of Senne and Medzibodrozie special protection areas**	

The application objective was to restore favourable conservation status of breeding and migrating birds from Birds Directive and Habitats Directive in the Senne and Medzibodrozie SPAs through improving habitats in key locations.

Management plans was drawn up by the project, and restoration projects was developed to ensure the implementation of the restoration works that aim to improve small water management infrastructure and achieve favourable water regimes at the respective localities.

The project also purchases some land within Senne SPA site in order to secure control over the core areas for breeding and migrating identification birds. Conservation management of meadows leading to the restoration and subsequent maintenance of the favourable conservation status of bird habitats is to achieve the acquisition of land under agro-environmental schemes at both SPAs.

More information: http://www.life-senne.sk/english/index_eng.php?page=download

6.4.5 Hungary

In Hungary the water storage capacity is limited by the low-land formations and 1-2 cm inclination in wide regions. Along the Danube river neither the subsoil conditions nor the lack of space makes the retention possibilities favourable. Beside the geographical problems the volume of the necessary storage is that high which is nearly impossible to handle with field retention. In case of Tisza river the ongoing New Vásárhelyi Plan has the water retention in the outmost focus aiming to establish numerous reservoirs and create sufficient storage capacity.

In 2014-2020 financing period the Hungarian Government decided to allocate almost 19 million EUR cohesion funds to support domestic projects focussing on developing the conditions of water management in hilly areas and establishment of reservoirs to control pluvial floods. This initiative gives a background to create additional natural retention areas and use them against flash floods in the coming years.

6.4.6 Slovenia

Important part of a holistic approach in preventive flood protection is the designation of flood areas without significant damage potential and determination of their potential effect on flood extent

(volume, peak). The appropriate regime for agricultural, forest and other type of areas must be established and a legal mechanism of their protection must be provided. Significant part of catchments consists of narrow inundation areas where no significant effect can be expected, but it is still an important approach in reducing the flood risk. Introduction of damage potential on existing flooding areas is already prevented by conditions and limitations on local, municipal and national level of planning, in case of changed hydrological conditions the compensatory measure must be provided to keep the retention capacity and not to worsen the hydraulic situation downstream. The identification of important bigger inundation areas is to be done for the whole country in connection with defined APSFRs on 17 river basins, and also the possibilities for their protection are to be provided as well as the regime and management of those areas in interaction with local authorities and other stakeholders. Prioritization should be focused on areas with potential to achieve different sectoral goals simultaneously (natural flooding), otherwise the controlled type of flooding should be provided for those areas through engineering works

6.4.7 Croatia

Croatia's draft Flood Risk Management Plan (FRMP) reflects the orientation towards emphasizing the natural water retention areas and flood retention areas for the flood prevention and flood protection. As a prevention measure, the FRMP provides for the continuation of ongoing activities on formal introduction of a special level of protection and maintenance of natural water retention and wetland areas and boundaries of the public water domain in the process of physical planning. As a protection measure, the FRMP encourages selection of technical solutions that will ensure:

- Retention of water in the watershed as long as possible and allowing room for watercourses to slow down the runoff;
- Preservation, restoration and enlargement of areas that can retain flood waters, such as natural water retention areas, wetlands and floodplains;
- Prevention of pollution of water and soil by harmful substances during flood events in areas reserved for flood water retention by land use restrictions and administrative measures;
- Continue creating lowland retentions in the areas of former floodplains for the purpose of flood flow reductions and flood protection of downstream areas;
- Usage of the existing lowland retention areas for meadows and grazing areas or for restoration of alluvial forests;
- Identification and preparation of protection and management programmes for floodplains and retention areas that could be used as natural water retention areas.

In the prioritization of the flood protection measures, the natural water retention and flood retention measures (i.e. Green Infrastructure measures) are emphasized over the structural flood protection measures where their application is technically and economically feasible.

Concerning the financing of the flood protection measures in Croatia from the EU structural funds, it is stated in the Operational Programme Competitiveness and Cohesion 2014-2020 that measures supporting the Green Infrastructure will be prioritized (over structural flood protection measures) where its application is technically and economically possible and effective in order to enhance natural flood risk management. Other structural measures such as retention reservoirs, embankments strengthening, drainage channels will be considered in line with appropriate environmental objectives, namely preserving coherence and connectivity of Natura 2000 sites.

6.4.8 Serbia

After May 2014 floods, there is a common understanding that water retention is needed to withhold future disastrous floods in Serbia. Comprehensive studies will be made in a due time to initiate the planning process, especially in the most affected Kolubara and Crnica river basins.

6.4.9 Bosnia and Herzegovina

In the river catchments in Bosnia and Herzegovina there is absence of larger areas in the river valleys that could be used for natural water retention purposes. Significant lowland areas are located only along the Sava river, in the north of the country, but these areas are, by building of protective dikes, separated from the streams and cannot be used for retention. River valleys, along with other watercourses in the Sava River Basin in Bosnia and Herzegovina, are relatively narrow and with a pronounced longitudinal angle so they are not suitable for the formation of natural retention, respectively for the purpose of flood control.

6.4.10 Romania

Permanent and temporary reservoirs are available for flood retention with a total volume of 6.1 bn. m^3. Creating polders for flood retention is one of main objectives of the medium & long term National Strategy for flood protection approved in 2010 by Governmental Decision.

In future, new polders will be put into operation as follows: Niraj in Mures basin, Crasna in Crasna basin, V. Luncsoara, Corbesti, V. Mides, V. Moneasa, V. Halmagel, Barcau, Poiana and Ginta in Crisuri basin, Vaten in Olt basin, Beuca in Vedea basin, Agigea and Lazu in Seashore basin. Also permanent reservoirs will be finished: Runcu in Tisa basin, Ibaneasa in Jijia basin, V. Campului in Siret basin, Zalau in Crasna basin, Calata and Calatele in Crisuri basin and V. Seinel in Somes basin.

In 1994 and 1996 two projects have been implemented regarding wetland restoration along the Danube respectively Babina – 2100 ha and Cernovca – 1580 ha and in 2007 in Giurgiu county Comana wetland - 1180 ha.

Ecological and economical programme for the Romanian sector of the Danube Floodplain approved by the Governmental Decision no. 1208/6.09.2006, is reconsidering the strategy for sustainable development and flood defence lines of settlements in the floodplain of the River Danube - strategy is based on an assessment of the suitability of various flooding scenarios and the public opinion. In this context during 2006 - 2008, the National Institute of Research-Development “Danube Delta” issued a study regarding Ecological and Economical Resizing of the Danube floodplain in the Romanian sector. The programme has been established as a decision tool and is structured on three levels - identification, assessment and suitability - as follows: reconsidering line of defence against flooding of localities, evaluating the suitability of the premises of economic activities designed for restructuring (agricultural/polders and water storage), returning to nature of polder leading to wetlands conservation. At present the implementation aspects are being analysed and stakeholder’s consultation is ongoing.

According to the existing legislation, each county has a Plan for flood protection (which is renewed every four years, last revision was done in January 2014) that includes possible zones identified as natural water retention in order to cut the peak flow (for controlled flooding).

	ROMANIA	**Status:** Implemented
	Prut River	
Project:	**Ciobarciu Wetland Restoration**	

In the valley of the Prut river, the objectives were to create 250ha of wetland by raising the water level and create a variety of deep spots with deep water. The project was implemented by a Romanian regional water authority with the support of Dutch partners and it served as a good experience in the field of ecological restoration, involving purchase of land, participatory planning and cooperation with other organizations. It was evaluated at the end of the project and after a period of five years by the project team and by a Romanian University.



6.4.11 Bulgaria

The analysis of the floods which occurred in past years and of their consequences made clear that the existing flood protection measures are insufficient and do not provide a long-term solution for effective flood protection, even more in the changing climate. This finding justifies the need of new more integrated approach to flood risk management, including wider use of non-structural measures. The natural water retention is contributing to water accumulation and decrease the damage potential of the floods. Bulgarian national catalogue of flood-protection measures includes a variety of measures for natural water retention: wetlands restoration; afforestation of river banks and floodplains; restoration of the natural river beds, meanders and floodplains. These measures will be planned on suitable locations depending on the existence and the efficiency of other flood protection facilities.

6.4.12 Ukraine

Potential volume for the flood runoff accumulation in existing four flood-protective reservoirs of the "Chornyj mochar" system is 28,64 mio m^3. By accumulating flood runoff these reservoirs protect 11,500 ha arable lands from inundation. At present construction of 39 accumulative mountain reservoirs is proposed in the Scheme on complex flood protection in the Tisza River basin in Transcarpathian region, 6 out of which are considered as urgent, 14 as immediate and 19 as perspective with total accumulation volume 257,3 mio m^3 . In addition 6 accumulative lowland polders (3 urgent and 3 immediate) with total accumulation volume 121,6 mio m^3 are proposed as well.

The essence of the flood regulation is accumulation of the peak part of the floods in the specially envisaged flood-protective reservoirs and polders and operation of the accumulated volume during the flood diminution. The result of such regulation is a considerable decrease of maximal discharges and levels in the rivers, what, in turn, would allow to reduce hydraulic load on the existing flood protection system. At the same time the discharge decrease in the rivers will facilitate the slowdown of the negative riverbed processes: riverbed meandering, bank falling, motorway bed and railway erosion, protective dikes' base and pier erosion, alluvial filling of the bridge holes and hydro-technical structures and so on. But the most important is the fact that the decreasing of discharge in the river will considerably reduce the risk of protective dikes' base erosion and as consequence will increase its reliability.

7 Cost-benefit analysis

FD stipulates that when available, for shared river basins or sub-basins, a description of the methodology, defined by the Member States concerned, of cost-benefit analysis used to assess measures with transnational effects shall be provided in the flood risk management plan.

The summary of existing national approaches to the cost-benefit analysis (CBA) is provided below.

7.1 Germany

Economic evaluations constitute a regular part of German flood risk management. This reflects the idea that the use of economic instruments, methods and procedures support an effective flood risk management, such as decision-making, vulnerability and risk assessment, the analysis and prioritisation of measures and the financing of FRM-measures. The process of identifying and selecting measures constitutes the basis to a successful FRM. In Germany, this process runs across several levels of water management. Hereby, various regulations and requirements are to be followed. Economic evaluations are in the wider sense an integral part of the framework and the key factors that influence the FRM-process.

In Germany, the FD and its requirements met an existing operational system of FRM. However, the implementation of the FD requirements led to optimisations in the pre-existing planning processes. In consequence, flood risk maps were prepared (Article 6 FD) and areas with a significant flood hazard transparently made public for all actors involved. This constitutes the basis for the systematisation of the pre-existing and continuous process of joint flood risk handling across local and regional borders.

7.2 Austria

Cost-benefit analysis are inherent to Austria's funding system for structural flood protection measures. CBA is obligatory for measures with "substantial financial effort or wide macroeconomic range". Simplified CBA analysis are applicable to projects with total costs ranging from 110.000€ to 1.000.000€. Comprehensive CBA are obligatory for projects exceeding 1 Mio. € of total costs. CBA in Austria is structured in 15 work steps as follows:

1. geo information
2. characteristic flood scenarios
3. hydrodynamic modelling)
4. socio-economic information
5. vulnerability assessment
6. damage potential estimation
7. benefit estimation
8. cost estimation
9. benefit cost ratio and sensitivity analysis
10. assessment of people exposed
11. assessment of intangible effects
12. overall assessment
13. comparison of alternatives and choice of "optimal alternative"
14. description of residual risk
15. report and documentation

7.3 Czech Republic

No cost benefit analysis in flood risk management was applied as there was no methodology available for the evaluation of the benefit of the flood risk protection measures.

7.4 Slovakia

At present, there is no experience in Slovakia with the application of cost-benefit analysis (CBA) in flood risk management. For the purpose of the measures prioritisation in the first cycle (2015) of flood risk management plans, the National methodology for the evaluation of costs for implementation, operation, maintenance and repairs of flood protection measures and their economic benefits was prepared and adopted by the Slovak national Working group on Floods in January 2014. Ranking of measures is based on their efficiency indices. Efficiency index is calculated as the ratio between the estimated flood damages and the estimated overall costs of the measure (for preparation, implementation, operation, maintenance and repairs of given measure during its lifetime).

7.5 Hungary

In the Hungarian FRMP great importance is given to the efficiency measurement of the flood risk management measures. To put this across a so called “planning assistant tool” has been developed which includes each measure which is associated with the aims and principles of flood risk management. It calculates the effect of both the structural and the non-structural measures and their investment costs. Calculation of the effects is based on the risk reduction results; the costs consist of the specific investment and maintenance costs. According to the Hungarian application of the FRMP, the measures and measure-groups are compared with each other and ranked with Multi-Criteria Analysis.

The Multi-Criteria Analysis is divided into two groups, the economical and the non-economical evaluation, where the economical evaluation is the CBA (Cost-Benefit Analysis) itself. The non-economic effects are the impacts on human life and health, cultural heritage, ecological impacts, water-management planning and other aspects. Evaluation of these non-economic effects is done in two levels. The first level is a disqualifying or exhaustive level, where there are fixed conditions (minimum-terms) to keep, and when they are breached, the analysed plan-version is excluded from further investigation. The second level is an optimization task, where beyond keeping the minimum-terms we compare, analyse and evaluate the economical and non-economic effects and calculate their efficiency.

In the CBA it is calculated with a period of 30 years, where the number of the years can be set according to decision. The basis of the calculation is the comparison of the accumulated costs of the 30 years period and the resulting risk reduction of the same period. So the benefit consists of the risk reduction, the reduction of the prevention costs and extern effects of the 30 years, where the risk reduction is calculated with the re-preparation and re-calculation of the flood hazard and risk maps, which change according to the effects of the measures. The costs include the investment, design and implementation costs as well as the operational costs, which include the running and maintenance costs and production costs. As for the calculation, the effect of the real-term change of the asset values is taken into consideration. The future asset values are designed on 2013 base price, which means that inflation is not taken into account.

The cost-benefit ratio of the measure will be acceptable, if it is above the fixed minimum demand, which is 110% in our case. It was an interesting experience to examine the efficiency of the planned flood risk management measures on the pilot area of Zagyva-Tarna in Hungary. According to the results of the CBA calculations of one of the plan-versions, there could be remarkable efficiency differences on partial water-catchments, when applying uniformly designed measures for the whole

water catchment. The efficiency on the partial water-catchments varied between 5-10% and 3-400%, although the calculated efficiency of the measure for the whole pilot area was 121%. These results came from the plan-version where the level of the existing, but – according to the present legal regulations – unsatisfactorily built dikes were uniformly raised to the legally specified level.

7.6 Slovenia

According to the Decree on establishment of flood risk management plans (Official Gazette of the Republic of Slovenia, No. 7/2010) flood risk management plans should take into account the aspect of costs and benefits. Cost-benefit analysis is an important element in the process of selection and prioritisation of measures of the flood risk management plan. CBA is already obligatory for public funded investments in flood protection exceeding 300 000 EUR according to the Decree on the uniform methodology for the preparation and treatment of investment documentation in the field of public finance (Official Gazette of the Republic of Slovenia, No. 60/2006 and 54/2010), and many different methods and approaches for the assessment of benefits of flood protection measures were applied in the past. A unified method for the assessment of benefits is being developed for the purpose of flood risk management plans. Benefits are assessed as a reduced value of expected annual damage after the implementation of certain measure or combination of measures. For the development of the method the data on damages during past flood events were taken into account. Benefits of the measures for human health, environment, cultural heritage and economic activity are assessed in monetary terms. Besides direct and tangible values the monetary assessment includes also some indirect and some intangible values as well. Benefits, which are not assessed in monetary terms, are listed.

7.7 Croatia

For Croatia's draft Flood Risk Management Plan (FRMP), cost-benefit analyses (CBA) of individual measures (projects) have not been carried out. Costs of the structural measures are assessed in the *Multiannual programme of construction of water regulation and protection facilities and amelioration facilities*, which is the basis for implementation of the structural flood protection measures in Croatia. The overall potential damages for the high-probability, medium-probability and low-probability scenarios have been assessed for Croatia, but reductions of these damages due to implementation of individual measures (i.e. benefits) have not been assessed based on a consistent methodology and based on the current flood hazard and flood risk maps yet. There are ongoing studies for several river sub-basins in Croatia (Kupa, Krapina, Bednja and Karašica-Vučica in the Danube River Basin District), in which the alternative solutions for the flood risk management measures are evaluated, the optimal flood risk management measures are defined and evaluated by the CBA analyses for the purpose of securing the EU funding for implementation of these measures. It is planned to perform such CBA analyses during the first FRMP cycle (2016-2021) for all proposed measures in all sub-basins with potentially significant flood risks, which could lead to an economically-based prioritization of the measures for the second FRMP, due in 2021.

7.8 Serbia

Cost benefit analysis was not applied in Serbia.

7.9 Bosnia and Herzegovina

The application of partly modified cost- benefit analysis in flood risk management in the Federation BiH has begun through the creation of a strategic document entitled "Evaluation of the Current Flood Protection Level in the Federation of Bosnia and Herzegovina and Improvement Program Drafting "

which was conducted end of 2002. In this document, 31 flooded areas in FBiH (major river valleys and karts' fields) were considered for which the economic and financial analysis have been implemented in order to define the costs and benefits. Benefit is presented by reducing the damages on certain flood area, and the costs include the funds needed for the construction of structures as well as their maintenance and other expenses that may arise during the use of the facility. Based on the defined costs and benefits, using the internal rate of rentability, the ranking of flood areas was carried out from the aspect of profitability of their investment in flood protection of these areas. The internal rate of profitability is defined as the rate of interest for which all the costs and benefits are equal and it represents the maximum rate for which the loan is profitable.

After creation of the above ranking, no additional and separate cost-benefit analysis for the purpose of flood risk management was made. The necessity for such economic analysis is recommended by the adopted "Water Management Strategy of the Federation of Bosnia and Herzegovina 2010 - 2022". Recently, this method was used in the justification of investments in flood protection or in construction of flood control structures in relation to the value of the defended area.

7.10 Romania

Cost-benefit analysis aims to highlight the effects that the infrastructure will have for the beneficiary of the project. The effects can be divided into two main categories: financial effects (revenues and expenses generated/incurred by the beneficiary with the investment) and social effects (benefits and social costs made/induced by the infrastructure done by the project).
Quantifying the benefit is achieved in case of several scenarios, depending on exceeding probability. Profitability and efficiency of the proposed investment (financial effects) result from B/C ratio by comparing the updated avoided damages, provided for each studied scenario, with total costs to date, necessary to mitigate flood risk. The economic analysis is based on an incremental approach, considering the economic benefits instead of financial ones.
The net economic benefit of the project is equal to the difference between the amount of avoided damage due to project implementation and the economic costs of the project.

	ROMANIA	**Status:** Implemented
	Jiu and Somes-Tisa Water Basin Administrations	
Project:	**Cost recovery model related to flood protection**	

Currently situation in Romania is that there is *no specific financial system* to cover the costs of flood protection. Almost every year floods occur in Romania and people are affected, houses are destroyed and local economy is disrupted. At this moment the Romanian water authorities are upgrading their flood protection measures to increase the level of protection of the population and to get in compliance with the EU Flood Directive. The EU Water Framework Directive and the EU Floods Directive were the most relevant legislation boundaries for the project. Furthermore, this project was based on the knowledge and experience with the Dutch water governance system that has been in place in different forms since the Middle Ages.
The project aim was to explore different options and develop a sustainable financing system covering costs of flood protection adjusted to the Romanian situation.

7.11 Bulgaria

The CBA analysis of the programmes of measures in FRMPs in Bulgaria will be performed according to a national methodology which is still under development. The elaboration of the CBA-methodology is one of the activities of the project, funded by the OP "Environment" and the development of the methodology was contracted through an open tender procedure. According to the terms of contract, the methodology shall be finalized by the end of June 2015. The main stages of the elaboration include: development of methods for financial and economic analysis; development of an approach for analysis of risk and sensitiveness; development of additional method for assessment of the effect of measures which is difficult to estimate in monetary terms; development of an approach for the assessment and selection of economically effective Programme of measures; elaboration of National Guidance for implementation of the Methodology.

8 Coordination with WFD

FD article 9 stipulates that Member States shall take appropriate steps to coordinate the application of FD and that of Directive 2000/60/EC (WFD) focusing on opportunities for improving efficiency, information exchange and for achieving common synergies and benefits having regard to the environmental objectives laid down in article 4 WFD. In particular:

1. the development of the first flood hazard maps and flood risk maps and their subsequent reviews as referred to in articles 6 and 14 FD shall be carried out in such a way that the information they contain is consistent with relevant information presented according to WFD. They shall be coordinated with, and may be integrated into, the reviews provided for in article 5(2) WFD;

2. the development of the first flood risk management plans and their subsequent reviews as referred to in articles 7 and 14 FD shall be carried out in coordination with, and may be integrated into, the reviews of the river basin management plans provided for in article 13(7) WFD;

3. the active involvement of all interested parties under article 10 FD shall be coordinated, as appropriate, with the active involvement of interested parties under article 14 WFD.

Flood risk management is probably the policy with the best potentialities for synergies with other aspects of water management, provided that adequate strategies are implemented. The traditional engineering solutions (dams, channelisation or dykes) may not always deliver the expected results. The occurrence of floods may not be reduced completely and the consequences of future floods are likely to have an increasing social and economic impact. Moreover, floods are a natural phenomenon and the high probability floods can have obvious benefits for society and ecosystems, e.g. for ground water recharge or for fish production. Thus, another approach of flood risk management is now promoted: an integrated flood risk management focusing on prevention, protection and preparedness (including forecasting). In this framework, making space for river and coastal flooding in the areas where the human and economic stakes are relatively low, represents a more sustainable way of dealing with floods. The conservation and the restoration of the natural functions of wetlands and floodplains, with their ability to retain floodwaters and reduce the flood pulse, are a key feature of this strategy, thus allowing important opportunities for synergies with WFD implementation.

According to the EU WGF Resource document on Links between the Floods Directive (FD 2007/60/EC) and Water Framework Directive (WFD 2000/60/EC) the coordination between the WFD and the FD offers the opportunity to adopt a new approach to optimize the mutual synergies and minimise conflicts between them. There are a number of reasons why better coordination is required. These include:

- The overlap of legal and planning instruments in many Member States;
- Planning and management under both Directives generally use the same geographical unit i.e. the river basin which acts as natural “reference area” for both water quality and flood risk management;
- Aiding the efficiency of the implementation of measures and increasing the efficient use of resources. Measures taken under one Directive may have an influence the objectives under the other. Coordination provides an opportunity to reduce conflicts and maximize synergies by identifying cost-effective measures which serve multiple purposes and can result in “win-win” measures being implemented;
- An expectation from many stakeholders that an integrated approach will be taken.

A good cooperation with the agricultural sector is another important prerequisite for ensuring synergies between land use, flood risk management and river basin management. Land use values at risk from flood damage should be scrutinised in order to analyse whether (harmful) subsidies favour a land use type that is not favourable to WFD implementation and whether a shift of subsidies to WFD compliant land use makes a NWRM profitable. For example, wheat production on a floodplain area not favourable for this type of production might only be profitable because the farmer receives CAP funds. This pushes up the value of land and thus might favour a polder solution when in fact a floodplain restoration measure would have more benefits from a WFD and FD perspective. Shifting CAP funds to measures that support farmers in changing their land use in response to restoration might provide a higher return both for the individual farmer and society.

It must be emphasized that linking WFD and FD has to be respected in both directions and the WFD related measures should consider flood risk management aspects as well.

The overall coordination of implementation of WFD and FD in the Danube River Basin District is with the ICPDR which is a good prerequisite for maximum use of mutual synergies.

EU WGF Resource document on Links between FD and WFD shows an example of synergies between the WFD and FD in production of the PFRA for the Danube River Basin: To produce PFRA several ICPDR Contracting Parties used data that they had collated as part of the WFD process to assist with their contribution to the overall PFRA for the Danube. For example, in Austria the available geo-data on risk receptors such as population, infrastructure, potential pollutants, WFD protected areas and cultural heritage that had been collected as part of the WFD process were used. In Bulgaria the criteria used for the assessment of the significance of floods were: the number of people affected; affected important industrial and infrastructure objects; affected IED plants; polluted Natura2000 protected areas and drinking water protected areas. These data sets had already been collated digitally as part of the process to meet the requirements of the WFD.

Another example shown in the EU WGF Resource document shows the potential for coordination between FRMP and RBMP for the Danube: ICPDR has produced a plan to meet the requirements of the WFD and FD regarding public consultation and communication during the course of developing the second Danube RBMP and the first FRMP for the Danube River Basin, for the implementation cycle 2015 to 2021. Consultations measures include:

- All accredited observers actively participating in the ongoing work of the ICPDR and are providing their input in the development of the second Danube RBMP, but also the first FRMP
- Specific discussions held with selected key stakeholders about the activities of the ICPDR regarding the implementation of WFD and FD. These stakeholders include the navigation sector, hydropower, sector and agriculture. The results of these discussions will be publicly available

- Raising awareness and informing wider stakeholder groups about the opportunity for public participation, the activities and the timetable regarding the second Danube RBMP and first FRMP via wide range of engagement measures (e.g. websites, newsletters, meetings)
- After the identification of the SWMIs, a stakeholder workshop will be held to support the development of the plan. Through such a workshop, a larger and very focused group of people will be involved in the formalization of the second Danube RBMP and the first FRMP.

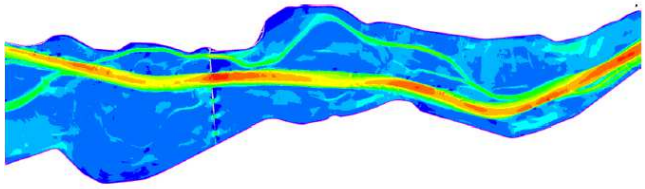
	SLOVAKIA, HUNGARY	**Status:** Completed
	Slovak-Hungarian section of the River Danube between Sap and Szob	
Project:	**DuReFlood** project: **Da**n**u**be floodplain **Re**habilitation to improve **Flood** protection and enhance the ecological values of the river in section between Sap and Szob	

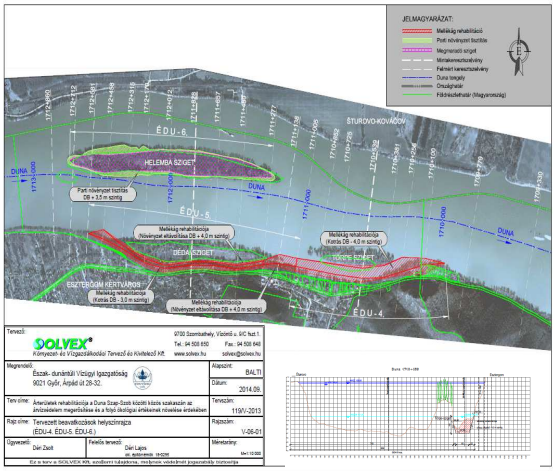
This project was carried out in the frame of the HU-SK CBC Programme 2007-2013. The Hungarian partners were BME and ÉDUVIZIG, Slovak was represented by VÚVH and SVP. The project budget was mostly funded through the ERDF fund.

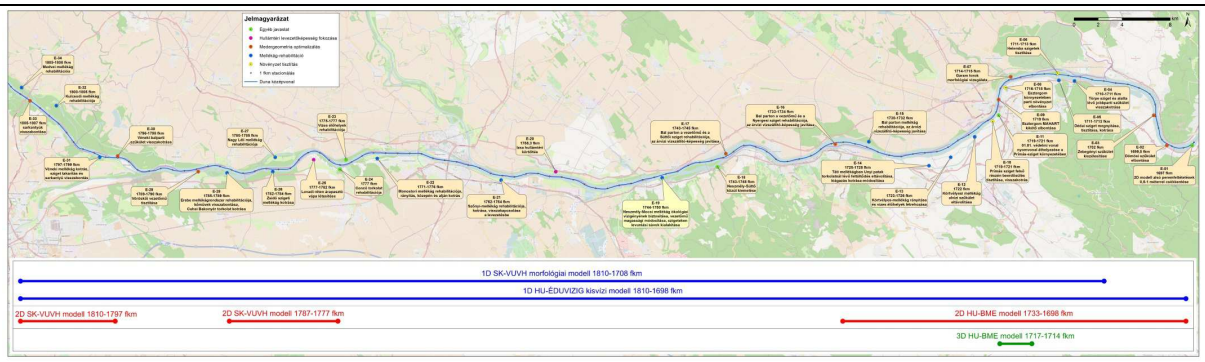
In the first phase detailed geometric data had been collected for the investigated stretch of the Danube and complex terrain model was built. It served 1,2 and 3D numerical modelling purposes. The scope of the hydrodynamic and morphological models was to evaluate the present status and the effects of different predefined measures on the flood conveyance capacity and the ecological status. There were 34 possible interventions identified out of which 19 conceptual technical plans were carried out.

In details the bilateral project focused at:

- assessment of the current state of the river in the project area in terms of flood protection and morphological changes of the river channel, taking into account classification of the river´s morphological state according to the Water Framework Directive;
- evaluation of the Danube channel morphological development since the putting into operation of the Gabčíkovo HPP and short-term (10 years) prognosis of expected morphological development using 1D morphological model
- investigation on the conveyance capacity and conditions of the Danube stretch with 1D modeling at Q1% discharge and low water regime;
- proposal of measures for improving flood protection and enhancing the ecological value of the Danube floodplain in selected areas, typical with complex flow conditions ;
- evaluation of the effectiveness of the flood protection and restoration scenarios and measures proposed and their optimisation using 1D and 2D hydrodynamic models in selected areas, furthermore with a local 3D model;
- design of technical plans of the selected measures with preliminary mass calculations (groups: side arm rehabilitation, optimization of riverbed geometry, cleaning vegetation, enhancing the conveyance capacity of the floodplain, ecological improvement and modelling scenarios)







See: http://www.dureflood.eu/eng/project_information.html

8.1 Examples of win-win measures

The examples of flood risk mitigation measures that contribute to WFD objectives are as follows:

- restoration of former wetlands/floodplain areas, increasing their territory, demolition of existing dykes (like summer-dykes) or dyke relocation
- creation of new wetlands
- restoration of meandering capacity of rivers
- restoration of side-branches
- restoration of oxbows and lakes, use them for water storage
- elimination of invasives on the active floodplain
- reforestation on catchment
- retention of water, precipitation and sewage
- building reservoirs on the floodplain, change of land use
- regulations in land use (e.g. no new buildings on floodplains, increase area of grass-lands/wet meadows next to the main channel instead of low profitable arable lands)
- change land use that is resistant to floods (e.g. to grasslands/wet meadows on the floodplain instead of sensitive crops)
- modify agriculture subsidy systems in order to ensure incentives for nature friendly land use change (e.g. change to wet meadows, grazing areas like grasslands, reed management, bee keeping)

These examples of measures are put for consideration to the flood managers and more details on these measures are presented in the Chapter 5.

8.2 Floodplains/wetlands reconnection

The Danube River Basin Management Plan (DRBMP) underlines that wetlands/floodplains and their connection to river water bodies play an important role in the functioning of aquatic ecosystems and have a positive effect on water status. Connected wetlands/floodplains play a significant role when it comes to retention areas during flood events and may also have positive effects on the reduction of nutrients and improvement of habitats. As an integral part of the river system they are hotspots for biodiversity, also providing habitats for e.g. fish and waterfowls that use such areas for spawning, nursery and feeding grounds.

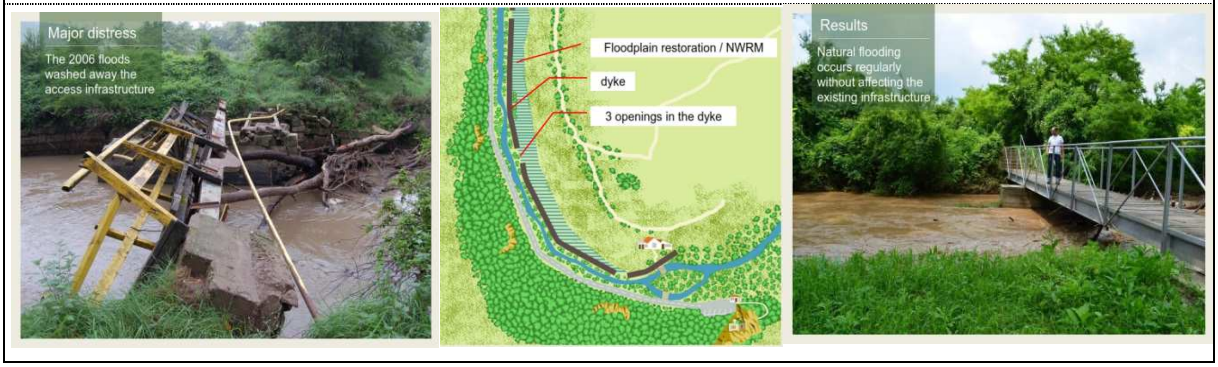
The 1st DRBM Plan from 2009 concluded that compared with the 19th Century, less than 19% of the former floodplain area (7,845 km^2 out of a once 41,605 km^2) remain in the entire DRB. This is caused in particular due to the expansion of agricultural uses and the disconnection from water bodies due to river engineering works concerning mainly flood control, navigation and hydropower generation. The disconnected wetlands/floodplains are potential pressures to aquatic ecosystems on the basin-wide level and the highest possible area of those which have a reconnection potential should be re-connected in order to support the achievement of the environmental objectives. The pressure analysis in the DRBMP focuses on analysing the location and area of disconnected wetlands/floodplains (>500 ha or which have been identified by the Danube countries of basin-wide importance) with a definite potential for reconnection, taking into account those wetlands/floodplains which are reconnected until 2015 as part of the JPM implementation of the 1st DRBM Plan.

In total 291,096 ha of wetlands/floodplains in the DRB have been identified to have a reconnection potential on a basin-wide scale. Out of these and as part of the JPM implementation, 89,954 ha are totally and 46,089 ha are partly reconnected where some of the required measures were already completed but further measures are planned, having positive effects on water status and flood mitigation. The remaining wetlands/floodplains, covering an area of 155,053 ha, have a remaining potential to be re-connected to the Danube River and its tributaries in the next WFD cycles (see fig).

	BULGARIA	**Status:** Implemented
	Russenski Lom River near Ivanovo Rock Monasteries	
Project:	**Russenski Lom river restoration**	

In the mid-20th century biggest part of the lower stream of Russenski Lom River have been strengthened and almost completely diverted and embanked. The floodplain in the lower river section has been converted into fish ponds, currently abandoned. High waters frequently flooded the road, restricting the access to the monasteries and damaging the infrastructure. In 2006, the floods damaged the dykes – they had been partially broken at 3 points in the area near Ivanovo village and the river claimed back its floodplain. The water itself suggested the solution to the problem One year after, the dyke was removed on three sections reconnecting the former fishpond to the natural dynamic of the Lom River. Nowadays river can overflow its banks and soon after – to get back to its bed, without leaving inundated land. Natural flooding occurs regularly without affecting the existing infrastructure.

The project is realized by Directorate of Natural Park Russenski Lom and WWF, funded by the German Federal Environmental Foundation (DBU). This is the first project in Bulgaria applying the principle "more space for the river – more safety for people"



8.2.1 Summary of measures of basin-wide importance – DRBMP update 2015

Wetlands/floodplains play an important part of the ecological integrity of riverine ecosystems and are of significant importance when it comes to ensuring/achieving good ecological status of adjacent

water bodies. As 80% of the former wetlands in the DRBD are considered to be disconnected[4], ongoing restoration efforts and measures are needed in order to further improve the reconnection of wetlands/floodplains in the entire DRBD, although restoration projects have been undertaken by the Danube countries in recent years. The approach chosen for the JPM to protect, conserve and restore wetlands is a pragmatic one, taking into account a background of 80% wetland loss. The Danube countries provide information on:

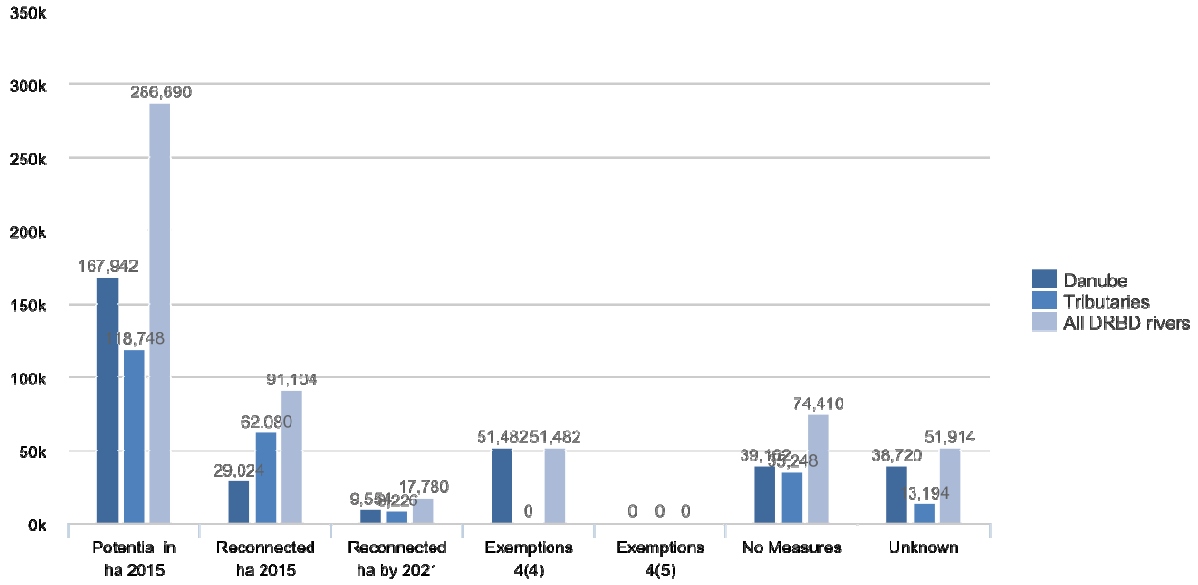
- national wetlands/floodplains >500 ha with a potential to be reconnected to the adjacent river;
- respective reconnection measures to be undertaken by 2021 or beyond regarding WFD Art.4(4).

The analysis shows the area of floodplains/wetlands to be reconnected by 2021 for both the Danube River and its tributaries. The inter-linkage with national RBM Plans is vital for wetland reconnection as significant areas are expected to be reconnected to rivers with catchment areas < 4,000 km^2 and with surface areas <500 ha having nevertheless positive effects on the water status of larger rivers.

Activities on the implementation of the FD in the Danube River Basin and the elaboration of the Danube Flood Risk Management Plans are significantly contributing to the compilation of inventories of connected and disconnected wetlands/floodplains and therefore increase the knowledge on the reconnection potential. This is considered as important also due to the multiple benefits of wetlands/floodplains reconnection for flood and drought mitigation, groundwater recharge and climate adaptation[5].

Figure 2 illustrates that from the 286,690 ha of wetland areas which were identified with potential for reconnection, 91,104 ha are already reconnected in 2015 also as a results of measures implementation from the 1st DRBM Plan. An area of 17,780 ha is planned to be reconnected by 2021. For 74,410 ha no measures were yet indicated and for 51,914 ha it is still unknown whether measures will be implemented. Table 1 further below provides more detailed information for each Danube country.

Figure 2: Measures for the reconnection of wetlands/floodplains by 2021 and exemptions



[4] Danube Basin Analysis 2004: Danube Pollution Reduction Programme report: Evaluation of Wetland and Floodplain Areas in the DRB (1999).

[5] More information can be obtained from the EU Policy Document on Natural Water Retention Measures available at https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures_Final.pdf

Table 1: Measures on the reconnection of wetlands/floodplains by 2021 and exemptions for each country

Country	Wetlands/flood plains with reconnection potential 2015	Wetlands/flood plains totally reconnected in 2015	Wetlands/flood plains totally reconnected by 2021	Exemptions WFD Article 4(4)	Exemptions WFD Article 4(5)	No measures yet indicated	Unknown
DE	5,964	3,038	2,926	-	-	-	-
AT	9,554	-	9,554	-	-	-	-
CZ	-	-	-	-	-	-	-
SK	4,842	-	-	-	-	-	4,842
HU	85,396	85,396	-	-	-	-	-
SI	-	-	-	-	-	-	-
HR	-	-	-	-	-	-	-
BA	-	-	-	-	-	-	-
ME	-	-	-	-	-	-	-
RS	30,959	-	-	-	-	-	30,959
RO	72,895	-	5,300	51,482	-	-	16,113
BG	-	-	-	-	-	-	-
MD	33,524	-	-	-	-	33,524	-
UA	43,556	2,670	-	-	-	40,886	-
Total	**286,690**	**91,104**	**17,780**	**51,482**	**-**	**74,410**	**51,914**

The ICPDR's basin-wide vision is that floodplains/wetlands in the entire DRBD are reconnected and restored. The integrated function of these riverine systems ensure the development of self-sustaining aquatic populations, flood protection and reduction of pollution in the DRBD

According to the DRBMP update 2015 the following management objectives will be implemented by the EU Member States, Candidate Countries and Non EU Member States by 2021 as steps towards the vision:

- Protection, conservation and restoration of wetlands/floodplains to ensure biodiversity, the good status in the connected river, flood protection, pollution reduction and climate adaptation by 2021.
    - Specification of number, location and area of wetlands/floodplains that will be reconnected and restored by 2021 by each country.
    - Ensuring exchange with relevant experts on the implications of the measures for sustainable flood risk management.
- An inventory, priority ranking and steps for implementation will be developed for the restoration and reconnection of lost floodplains and wetlands along the Danube River and its tributaries, taking the effects on biodiversity, flood risk management, nutrient reduction, water retention and climate adaptation into account.
- Implementation of the "*no net-loss principle*"[6]

The flood risk managers shall be aware of these management objectives and shall take them into account when planning the concrete retention measures at the national level.

8.3 Interruption of river continuity and future infrastructure projects

[6] No net loss principle = avoidance of converting floodplains and wetlands whenever possible - if conversion to other uses is not prohibited by law or unavoidable, the total wetland resource base has to be offset through restoration of comparable other wetlands.

The DRBM Plan reports that the key driving forces causing continuity interruption are hydropower generation (50%), flood protection (18%) and water supply (12%). Construction of fish migration aids and other measures at existing migration barriers is needed to achieve/improve river continuity. New barriers for fish migration imposed by new infrastructure projects shall be avoided; unavoidable new barriers shall incorporate the necessary mitigation measures like fish migration aids or other suitable measures already in the project design according to BEP and BAT.

In addition to already existing hydromorphological alterations, a considerable number of future infrastructure projects (FIPs) are at different stages of planning and preparation throughout the entire DRBD. These projects, if implemented without consideration to effects on ecology, are likely to provoke impacts on water status due to hydromorphological alterations.

The pressure analysis in the DRBM Plan concludes that 35 FIPs have been reported for the DRBD. 22 of them are located in the Danube River itself. In total 20 (57%) are related to navigation; 11 (31%) to flood protection, and 4 (11%) to hydropower generation. Therefore, it can be concluded that flood protection belongs to the key drivers that may provoke impacts on water bodies in the DRBD by 2021.

According to the DRBMP update 2015 the following management objectives shall be implemented by the EU Member States, Candidate Countries and Non EU Member States by 2021:

- Conduction of a SEAs and/or EIAs in conjunction with WFD requirements.
- Improvement of ecological status in case of new flood risk management measures, and improvement of ecological situation in case of required refurbishment / maintenance / reconstruction of existing structures by making best use of synergies.
- New infrastructure projects should be planned and conducted to ensure that water status is not deteriorated. Deterioration should only be allowed in exceptional cases and following the requirements as set in WFD Article 4(7).

The flood risk managers shall be aware of these management objectives and shall take them into account when planning the concrete retention measures at the national level.

8.4 National activities towards coordinating FD & WFD implementation

8.4.1 Germany

The Flood Risk Management Plans in Germany were coordinated with the correspondent River Basin Management Plans. According to article 9 FD both directives were coordinated particularly with regard to improving efficiency, to information exchange and common advantages for the achievement of environmental objectives laid down in WFD (article. 4).

Before the processes started the German Working Group on water issues of the Federal States and the Federal Government (LAWA) provided the „Recommendations for the coordinated implementation of FD and WFD" which names the requirements and the possibilities of coordination and provides a structured approach. This was done to ensure the coordination between the two directives during the preparation of the FRMP and the RBMP.

Although the objectives of both directives differ, nevertheless, both appeal to the environment as a subject of protection. Also both directives operate in nearly identical area, the river basin units. Hence, it is appropriate to examine the intended measures of each directive in order to identify potential synergies or conflicts for the objectives of the respective other directive. Generally, potential synergies are expected during the planning process, in prioritization and realization of measures and their effect to the objectives and also in the active involvement of all interested parties and the public, taking into account the common schedule for the reporting as well as for the data supply.

Synergies are mainly to be expected in the choice of measures for the FRMP and the measure programs of WFD. Potential conflicts between the objectives of both directives, for example the realization of measures of technical flood protection systems, cannot be excluded a priori. Those conflicts can make it necessary to adapt the achievement of objectives or terms according to WFD or to adapt the measures for the special water body / waters segment according to one of both directives. In individual cases a careful consideration is to be carried out. If necessary, an exception to the objectives of management in favour of essential measures of flood risk management is conceivable.

	GERMANY	**Status:** Under implementation
	Wertach / Donauwörth	
Project:	**Wertach vital**	

The Wertach, formerly a widely branched wild river was straightened in the second half of the 19th century. The so constricted river dug deep into his bed. Thus the groundwater level sank, bridges and bank reinforcements were undermined by water. The lack of flood plains intensified additionally the flood hazard. In the lowland forest were hardly any natural habitats, numerous barrages prevented the fish on their passage in the river.

Therefore in 1997 the water management office Donauwörth launched the project "Wertach vital". The plan is to transform the Wertach on the 14 kilometers from the mouth of the Lech river ecologically. At the already completed sections dikes protect the residents against flooding. Stone ramps, in some areas open ground protection, prevent the river from further erosion. In the broadened sections, the Wertach can shape their bank multivariously, fish have again free passage and in the flood plains develop numerous habitats. In some sections new dikes have been moved back from the Wertach to create additional retention area. With these measures Wertach vital combines the goals of Water Framework Directive and the EU Flood Directive. Even as a recreational area the river is now attractive again.

In a first step, a joint LAWA-catalogue of measures was developed which includes the measures of FRMP and RBMP. In connection with the development of this joint LAWA-catalogue a general preliminary examination of the desired effects of measures already took place. All measures of the catalogue were assigned to one of the following categories:

M1: measures which support the objectives of the respective other directive.

M2: measures which can cause a conflict. These will be checked individually in the further planning process.

M3: measures which are not relevant for the objectives of the respective other directive.

A detailed explanation of the categories M1, M2 and M3 as well as the allocation of measures to these categories are described in the recommendations mentioned above.

8.4.2 Austria

In Austria the competent authority for implementing the WFD and FD is the Federal Ministry of Agriculture, Forestry, Environment and Water Management and, therefore, inherently has a strong link in the national implementation of both directives. This will also be expressed by common activities especially in the frame of public participation. Both, the flood risk management plan as well as the river basin management plan consider and discuss synergies and possible conflicts in the frame of implementation. On project level numerous EU life projects had been established and conducted contributing to both directives. To ensure implementation of WFD Article 4.7 when planning flood protection measures fulfilling the requirements of this article is obligatory for receiving funding in AT.

	**AUSTRIA**	**Status:** Implemented
	Danube East of Vienna (Thurnhaufen / Hainburg)	
Project:	**Revitalisation of the Danube Embankment" Thurnhaufen area**	
The project Removal of existing stone protecting structures (embankment protection and old water regulating structures) in the area of Thurnhaufen (across from Hainburg). The removal of riverbank protection structures in the Donau-Auen National park within the Thurnhaufen section is a big step forward in rehabilitation of morphodynamic processes. It is a good demonstration that even in situations where there are different needs and utilisations (navigation, river morphology by means of sediment transport and ricer ecology), there are ways to provide more dynamics for the rivers while, at the same time addressing different aspects of river basin management.		
		

8.4.3 Czech Republic

Basic principles of coordination of water management planning are based on the Water Act (Act no. 254/2001 Coll.) and the Decree of Ministry of Agriculture and Ministry of the Environment no. 24/2011 Coll. on the river basin management plans and plans for flood risk management. Commission on planning in water sector is a joint body of the two ministries. Other members of the Commission

are representatives of river boards, regional authorities and expert institutions. The Commission covers the planning processes in the water sector, particularly the planning under the Water Framework Directive on water policy, with the aim to achieve good water status.

There is Flood Directive working sub-group for coordination of activities of the Floods Directive implementation, which supports the decisions of competent ministries in the managing the flood risk. Sub-group members are representatives of ministries, the Czech Hydrometeorological Institute, Water Research Institute and all river boards of the CZ. Since 2008 the subgroup meets and discusses the procedures of implementation of the Directive and links to the entire flood protection system in the Czech Republic and brings the information to the Commission on planning in water sector.

Coordination of Flood Risk Management Plans (under FD) and River Basin Management Plans (under WFD) is based on the production of basis for meeting the objectives of both directives at the level of River Management Plans for sub-basins. The measures proposed in the River Management Plans for sub-basins to meet the objectives of the WFD are designed to have a positive effect on the reduction of flood risks. These include particularly measures to improve the hydromorphological conditions, which also lead to increase of natural overflowing, measures supporting the retention of water in the landscape, infiltration of rainwater into the groundwater and etc.

Coordination from the Plans for Flood Risk Management side lies in finding such measures, which do not deteriorate mainly ecological status of water.

8.4.4 Slovakia

According to the valid Slovak water Act and WFD, the first flood risk management plans (FRMP) will be coordinated with the updated river basin management plans (RBMP). Implementation timeplans of WFD and FD at the national level are synchronized, in order to enhance tools of water management in the river basins. The synergies are strongly emphasized by the fact, that there is one common competent authority responsible for the implementation of both WFD and of FD and it is the Ministry of the Environment of the Slovak Republic. The first national FRMP and its follow-up updated versions will be approved by the Slovak Ministry of the Environment (MoE) and will form component of the RBMP. According to timeplan endorsed with the Slovak WG Floods, the first draft FRMPs are coordinated with updated RBMPs and submitted for environmental assessment and public consultations in December 2014. The assessment shall finish in June 2015. Comments from public consultations shall be reflected in the updated draft FRMPs and the final versions of FRMPs prepared by the end of August 2015. Final versions of the first FRMPs will be submitted to the MoE in September 2015 for approval.

8.4.5 Hungary

One of the initial steps of progress is monitoring of measures defined in the sustainable floodplain management plans, which are considered as important flood risk management tools. The locations of the proposed interventions were linked to the water bodies or sub-units defined by the river basin management plans. The feasibility of the actions to be taken is under investigation by the Water Directorates from the viewpoint of an impact on the good ecological status or potential and it is being evaluated how they interact with the local conditions. The result of this assessment procedure will be included in the consultation documents.

8.4.6 Slovenia

The planned flood protection measures are to be included in RBMP after considering their effect on possibility of achieving environmental objectives. In case of significant pressure of planned measures on ecological status of surface water or quantitative status of groundwater the exceptions provided through WFD Article 4.7 can be applied. In the process of choosing the appropriate flood protection measures certain principles are followed: holistic approach on river basin level for solving local or

river basin problem, usage of a unified CBA method in the process of selection and prioritisation of measures, finding synergies with goals of WFD and other environmental policies by the usage of natural water retention measures where appropriate and possible - especially for reducing the high probability hazard areas, usage of compensatory measures for the maintenance of flood and water status situation downstream of applied measures, resolving conflicts with WFD objectives on water bodies and protected areas, providing the coherency with national and municipal spatial plans.

8.4.7 Croatia

Croatia's first Flood Risk Management Plan (FRMP) is an integral part of its second River Basin Management Plan (RBMP). Both planning processes (river basin management and flood risk management) have been carried out in parallel, with the same lead agency (Croatian Waters) responsible for preparing both the RBMP and the FRMP. In this planning process, links between the Water Framework Directive (WFD) and the Floods Directive (FD) were emphasized. Measures which can simultaneously contribute to the objectives of the RBMP and the objectives of the FRMP are prioritized.

As a protection measure, the FRMP provides for the improvement to the integrated water management and flood risk management in the aspect of planning of measures of construction and maintenance of flood protection structures and systems through:

- Development of a methodology for establishment of ecologic potential of the heavily modified water bodies under the influence of flood protection structures and systems,
- Establishment of a classification system for the ecologic potential of the heavily modified water bodies under the influence of flood protection structures and systems,
- Monitoring of conditions of the heavily modified water bodies under the influence of flood protection structures and systems (according to the established classification system)

By implementation of this measure during the first FRMP cycle (2016-2021), coordination between the WFD and the FD will be further enhanced.

8.4.8 Serbia

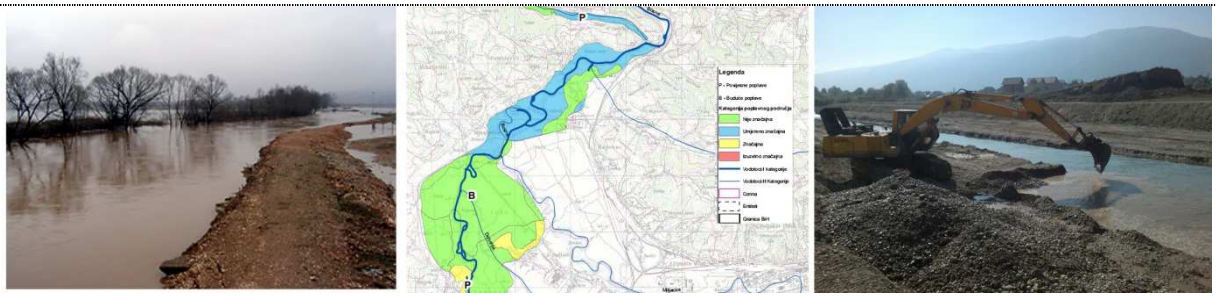
The links between flood risk management and river basin management are indicated in the draft Water Management Strategy. The Strategy will be adopted in 2015.

8.4.9 Bosnia and Herzegovina

As a part of the project "Strengthening Capacities in the Water Sector of BiH", financed by the EU IPA funds in 2011, activities on drafting the Sava River Basin Management Plan (RBMP) started in early 2014. In accordance with the terms defined by the local legislation - the Water Law , draft of the plan will be prepared by mid 2015. The final version will be completed by the end of 2015, after the public hearing which will be conducted in period of six months. The deadline for making the first Flood Risk Management Plan (FRMP) for Sava River, as defined by the local legislation, is April 2017. Although there is a discontinuity in terms of making the above plans, the maximum efforts will be made during their development in order to make them coordinated and harmonized.

	**BOSNIA AND HERZEGOVINA**	**Status:** Under construction
	Bosna River Training / Flood Protection Works	
Project:	**Training works on Bosna River from Željeznica confluence to Reljevo Bridge (8 km)**	

Bosna River is one of the major tributaries of Sava River which is a “principal” tributary of Danube. The area West from Sarajevo is frequently flooded from Bosna river, after its confluence with Željeznica. Based on AFAS, parts of the flood area is determined as “significant”. Detailed design of river training works with main purpose of flood protection is finalised. Proposed construction works are divided in “Phases”. First phase is under construction while the next is being tendered for construction. The Project documentation and construction works are financed by Agency for river basin District Sava, Sarajevo.



8.4.10 Romania

The national authority for implementation of the requirements of Floods Directive (FD) and Water Framework Directive (WFD) is the National Administration „Romanian Waters” (NARW), according to the provisions of Water Law no. 107/1996 with further amendments. Through its 11 River Basin Authorities (RBAs), NARW assures the coordination and implementation of the integrated water management at the river basin level (including coordination between river basins), based on the River Basin Development and Management Schemes, which are elaborated according to the Ministerial Order no. 1258/2006, for each River Basin (11 in Romania) and at the national level (district level).

In this respect both River Basin Management Plans (RBMP) and Flood Risk Management Plans (FRMP) are elaborated by the same institution (NARW through its 11 RBAs), with scientific support of the National Institute of Hydrology and Water Management, which is also part of the NARW. The River Basin Management Plans are elaborated at the national level (National Management Plan - national part of the Danube River Basin District) and at the RB level (11 River Basin Management Plans). The National Management Plan is the synthesis of the 11 River Basin management Plans. The same approach is applied in the process of elaboration of the Flood Risk Management Plans.

Related to the calendar, presently the drafts of the National and River Basin Management Plans are in the public consultation process (22 December 2014 – 22 June 2015). According to the WFD requirements, updated National and River Basin Management Plans will be finalized by 22 December 2015 in order to be approved through Governmental Decision. The Flood Risk Management Plans will be finalized by the same date.

8.4.11 Bulgaria

According to the Bulgarian legislation, the units of management under the Directive 2007/60/EC (FD) are the same as those used for the WFD implementation – the River Basin Districts. River basin directorates are the competent authorities in charge for the elaboration of the Flood risk management plans coordinated by the Ministry of Environment and Water. According to the Bulgarian Water act, the first FRMP shall be produced in coordination with the update of the River basin management plan within the same time-limit. According to the provisions of Art.146i(2) of the Water act, information and data collected for the development of river basin management plans shall also be used for producing the FRMP. The Bulgarian FRMPs will be adopted by the Council of Ministers.

	BULGARIA	**Status:** Implemented
	Vesselina River	
Project:	**Restoration of Vesselina River m eander near the Mindya Village**	
The Vesselina River is known for its natural beauty but also for the number of meanders the river formed along its flow,		

many of them, unfortunately, being cut off from the system by flood protection dikes. In 2008 a meander near the Mindya village in the region of Veliko Turnovo was reconnected to the river. When the river meander was cut off in previous times, the river dug nearly 150 cm deeper into its bed, so a sill had to be built to raise the river level enough for enabling water to run back to its old bed . Nowadays the Vesselina River flows again down its old meander, where slower and warmer waters provide breeding conditions for many fish species and birds and also provides additional protection at high water. The project was realized by WWF together with local people from Mindya village.

9 Impacts of climate change

A general question to be considered in the implementation of the Floods Directive is if the potential changes to flood risks induced by climate change require a changed flood risk management approach. Examples are: changes of duration, intensity and frequency of floods, intensified coastal flood risks (related to both sea level rise and increased storm surges), floods in ephemeral rivers (in particular in drying regions), changed patterns in snowmelt, ice-jam floods and more regulated rivers due to hydropower production. Flood risk management should take into account the impact of climate change on the hydrological behavior of the catchment, both in natural (reference) and altered (modified) conditions - for instance rivers regulated for hydropower production or with flood defenses - since it may change the floods regime; this requires the integration with the river planning process under the WFD. Risk reduction responses may also include different approaches to land use planning, the role of climate change in civil protection policies, and learning to live with and adapt to floods preventing them is not possible.

EU WFD CIS Guidance document n° 24 - River Basin Management in a Changing Climate provides support to river basin managers in incorporating climate change in the next river basin management cycles. It also addresses the specific issues relating to flood risk having in mind the need of close interlinking of flood risk management and river basin management in future.

Guidance document point out that future changes in the intensity and frequency of extreme precipitation events, combined with changing land use, are expected to cause an increase in flood risk across much of Europe. The Flood Directive shares many features of the WFD, such as the cyclical approach to risk assessment, preparation of management plans, and consultation process. However, what distinguishes the Flood Directive from the WFD is that the risk assessment places safety issues at the centre. Many of the guiding principles formulated for the river basin management are therefore directly applicable to flood management.

The Flood Directive further highlights the need for coordinated action on climate change throughout the RBD, particularly where there are transboundary or shared flood risk issues. Some information collected under the WFD is of relevance to flood management. The Preliminary Flood Risk

Assessment also requires that past floods are taken into account, so efforts to homogenize and remove biases from river flow records will be helpful to trend detection more generally.

WFD and flood risk management objectives potentially overlap in several places with respect to climate change. For example, more frequent floods can have benefits for aquatic ecology, soil fertility, groundwater recharge and biodiversity. WFD Article 4.6 makes provision for temporary deterioration in the case of extreme floods, but should not be used by Member States as a means of avoiding WFD obligations.

At the Danube Ministerial Conference in 2010, Ministers emphasized that the impacts of climate change will increase and develop into a significant threat in the Danube River Basin if the reduction of greenhouse gas emissions is not complemented by climate adaptation measures. In order to be able to take the required steps on adaptation, the ICPDR was asked to develop a Climate Adaptation Strategy for the Danube River Basin until the end of 2012.

Germany was nominated as Lead Country for this activity in the frame of the ICPDR. In this function, the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety supported a study with the aim of providing foundations for a common, Danube-wide understanding of future impacts of climate change on water resources and suitable adaptation measures as a basis for the development of the Danube Climate Adaptation Strategy.

The Danube Climate Adaptation Study was developed by the Ludwig-Maximilian University of Munich in coordination with the ICPDR. The study was finalized in January 2012 and was made available to the public following the link:

http://www.icpdr.org/icpdr-pages/climate_adaptation_study.htm

With respect to floods the Danube Climate Adaptation Study highlights that it is less reliable to model the future development of extreme events like floods than changes in the average water balance. This is especially the case at the local scale. Some studies even clearly affirmed that future flood predictions include a high uncertainty. According to the partially contradicting findings of the investigated research projects and studies on floods, there is no clear tendency in the development of future flood events for the Danube River Basin District as a whole. Most studies predict an increase in flood intensity and frequency, especially in winter. Small and medium flood events are likely to be more frequent in future. However, other findings show no clear trend for changes in the return periods. Seasonal changes are triggered by changes in precipitation and snow cover. Within the Danube River Basin District there are different local tendencies, especially for the development of extreme flood events.

For the Upper Danube River Basin, some studies show an increase in the frequency of extreme flood events (100−year frequency) whereas others indicate a slight decrease or point out that the future development lies in the range of the natural variability. However, most studies indicate an increase in and a shift of flood hazards in the Alps, triggered by changes in winter precipitation and snow storage changes. Particularly for the Middle Danube River Basin, studies show a pronounced increase in flash floods due to more extreme weather events (torrential rainfall) for small basins, e.g. in the Carpathian Range or the Sava and Tisza headwaters. The very few studies of the Lower Danube River Basin show an increase in flood frequency. The uncertainty of flood prediction is especially high in small catchments, because of relatively low spatial resolution of climate models.

Despite the high uncertainty in climate change impacts on floods, according to the Danube Climate Adaptation Study the adaptation measures are mentioned most often in the analyzed activities. Summing up, mainly the maintenance, improvement and enlargement of flood protection services and constructions are addressed. Thereby, often the functions of natural retention areas, both for ecological and safety reasons, are mentioned. Furthermore, there seems to be a common understanding for the demand of restrictions in future development along flood prone areas.

The finalized Danube Climate Adaptation Study allowed for the development of the "ICPDR Strategy on Adaptation to Climate Change", which was adopted at the 15th Ordinary Meeting of the ICPDR in 2012. The key tools identified in the Strategy are River Basin Management Plans and Flood Risk Management Plans. The 6-years cyclic approach of both directives allows for step-wise adaptation and the implementation of the required adaptation measures. As a follow-up, at the 15th ICPDR Ordinary Meeting in December 2012, the Heads of Delegations asked all relevant EGs to ensure that the ICPDR Strategy on Adaptation to Climate Change is fully taken into account in the preparation of the 1st Danube Flood Risk Management Plan (DFRM Plan). Following related discussions on climate change adaptation in the frame of the 38th RBM EG Meeting, in December 2013 the Heads of Delegations asked to prepare a document for a targeted discussion in the relevant EGs and TGs on the necessary steps and input of these EGs and TGs for the integration of climate adaptation issues in the draft 1st DFRM Plan. Thus a respective questionnaire was prepared and information was collected leading to following findings:

- The communication and coordination on climate change adaptation issues between different levels of management within the Danube RBD is ensured at the national level, at the Danube RBD level through the ICPDR and also through different projects such as CCWater, CCWare or Ceframe.
- The climate change aspects are discussed between the relevant public administrations. E.g., the issue of low discharges & droughts is widely discussed in CZ, discussions between the relevant public administrations is ongoing in AT. KLIWA project is carried out in DE and the discussion on how to cope with more frequent extreme events floods and droughts is high on the agenda in HU.
- The cross-sectoral integration of adaptation measures and coordination of flood risk management activities with land use planning is being carried out. Cross-sectoral coordination is part of the national strategy on climate change adaptation in AT. The activities on floods and on water scarcity & droughts are coordinated in CZ. Discussion on ways to cope with frequent extreme events (floods and droughts) is high on the agenda in HU.
- Adapting flood risk management to climate change issues has to be included in the next cycle of flood risk management plans. Similarly climate check of flood risk measures will be performed in the future reviews of FRMP. Austria is performing a climate check of flood risk measures already in the first cycle and adapting flood risk management to climate change is being dealt with in Germany as well.
- Studies are still ongoing and relevant measures are being taken. Study on climate change impact on hydropower generation is being carried out in AT. Program for irrigation is planned in HU. CZ and SK are taking efforts to protect the future possible locations for water accumulation reservoirs. There is still however a need to support the future research on impacts of climate change.

10 International coordination

FD in its articles 4,5,6,7 and 8 requires that all elements of FD implementation in an international river basin district are coordinated by all countries sharing that river basin.

The international coordination of the implementation of FD including preparation of basin-wide preliminary flood risk assessment, flood hazard and flood risk maps as well as flood risk management plan has been accomplished through the ICPDR. There has been a vast experience existing from preparation and implementation of the ICPDR Action Programme on Sustainable Flood Protection in the Danube River Basin that has been utilized in the process of achieving the goals of FD.

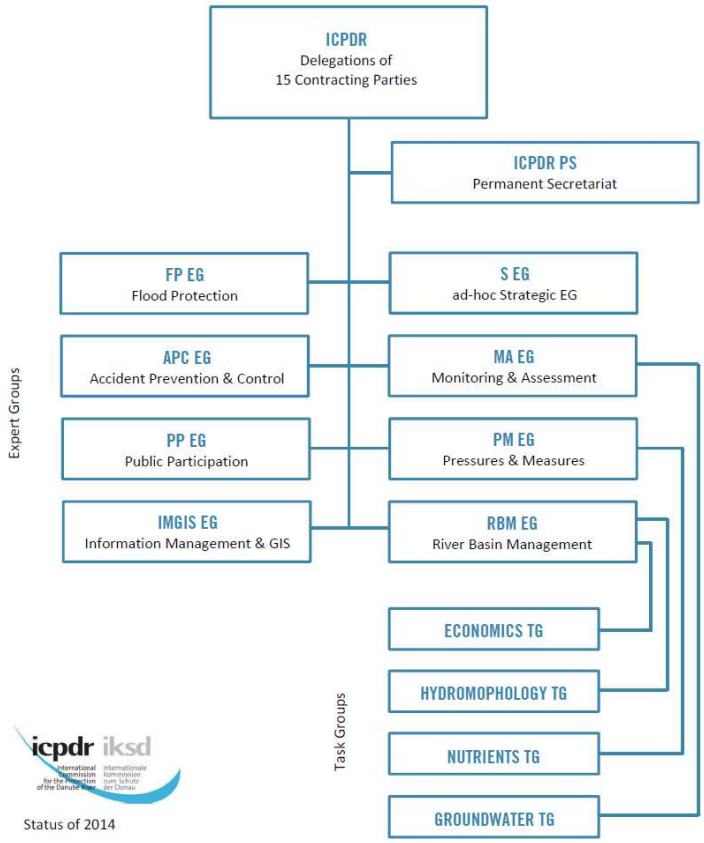
10.1 ICPDR

The International Commission for the Protection of the Danube River (ICPDR) is an International Organization consisting of 14 cooperating states (Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Slovakia, Slovenia, Serbia, Ukraine) and the European Union who have committed themselves to implement the Danube River Protection Convention. The ICPDR deals not only with the Danube itself, but also with the whole Danube River Basin, which includes its tributaries and the groundwater resources.

The goal of the ICPDR is to implement the Danube River Protection Convention (DRPC) and make it a living tool. In addition, the ICPDR is the body that coordinates the implementation of EU Water Framework Directive and EU Floods Directive in the Danube River Basin.

The ICPDR mission is to promote and coordinate sustainable and equitable water management, including conservation, improvement and rational use of waters for the benefit of the Danube River Basin countries and their people. The ICPDR pursues this mission by making recommendations for the improvement of water quality, developing mechanisms for flood and accident control, agreeing standards for emissions and by assuring that these are reflected in the Contracting Parties' national legislations and applied in their policies.

Figure 3 ICPDR Organigram



10.2 Flood risk management in the Danube River Basin District

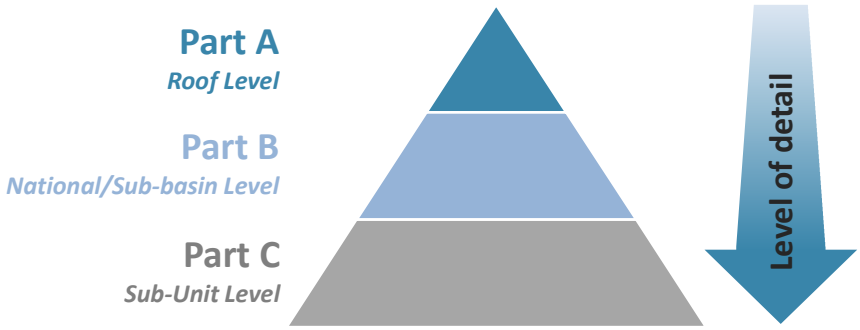
River basins, which are defined by their natural geographical and hydrological borders, are the logical units for the management of waters. This innovative approach for water management is followed by the EU WFD and has been adopted by the EU Floods Directive. In case a river basin covers the territory of more than one country, an international river basin district has to be created for the coordination of work in this district.

The Danube and its tributaries, transitional waters, lakes, coastal waters and groundwater form the Danube River Basin District (DRBD). The DRBD covers the Danube River Basin (DRB), the Black Sea coastal catchments in Romanian territory and the Black Sea coastal waters along the Romanian and partly Ukrainian coasts.

Due to reasons of efficiency, proportionality and in line with the principle of subsidiarity, the management of the DRBD is based on the following three levels of coordination (see):

- ⇨ **Part A**: International, basin-wide level – the Roof Level;
- ⇨ **Part B**: National level (managed through the competent authorities) and/or the international coordinated sub-basin level for selected sub-basins (Tisza, Sava, Prut, and Danube Delta);
- ⇨ **Part C**: Sub-unit level, defined as management units within the national territory.

Figure 4: Three levels of management for WFD implementation in the DRBD showing the increase of the level of detail from Part A to Part B and C



The investigations, analyses and findings for the basin-wide scale (Part A) focus on rivers with catchment areas >4,000 km^2

The ICPDR serves as the coordinating platform to compile multilateral and basin-wide issues at Part A ("Roof Level") of the DRBD. The information increases in detail from Part A to Parts B and C.

The list of competent authorities is provided in the Annex 3.

The coordination at the basin-wide level (level A) has been accomplished through the activities of the ICPDR Flood Protection Expert Group

The flood risk management issues in the international sub-basin of the Sava River are managed by the International Sava River Basin Commission (ISRBC, http://www.savacommission.org/).

The flood risk management issues in the international sub-basin of the Tisza River are managed by the Tisza Group of the ICPDR (http://www.icpdr.org/main/activities-projects/tisza-group).

The transboundary aspects of flood risk management between the neighboring countries in the DRBD are covered by the bilateral agreements and are dealt with on a regular basis by the bilateral commissions. The list of bilateral agreements is provided in the Annex 4.

11 Solidarity principle

Solidarity principle is one of the objectives of the Flood risk management plan for the Danube River Basin District as described in the chapter 4.5.

The ICPDR is fully aware of importance of application of the solidarity principle; one should not pass on water management problems in one region to another. In line with the EU Best practices on flood prevention, protection and mitigation the appropriate strategy shall include retaining, storing and draining (first make every effort to retain rainfall at the spot, store excess water locally, only then let the water be discharged to the watercourse).

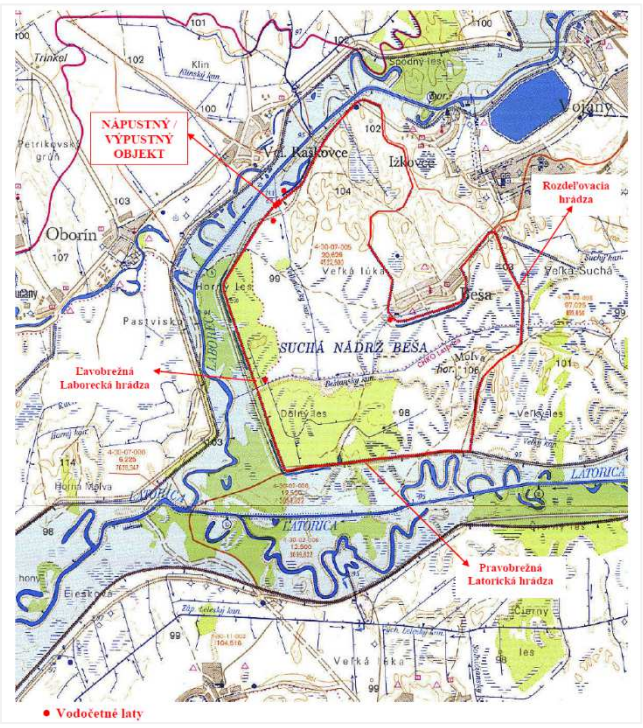
That is why the ICPDR agreed that the measures with downstream effects shall have the key priority at the basin-wide level (i.e., measures like natural water retention, warning systems, reduction of risk from contaminated sites in floodplain areas, exchange of information).

	**SLOVAKIA**	**Status:** Implemented

	Catchment of Bodrog river
Project:	**Beša polder in the catchment of the Bodrog river**

Polder Beša - a dry reservoir, which is part of the complex of water structures and installations built in the area of the East-Slovakian lowland as a protection against extreme fluvial and pluvial floods. Polder is filled only in case of extreme flood situation in the Medzibodrožie area and also in case of endangering of areas in the Bodrog river catchment in Hungary. The conditions of the polder operation are defined in the bilateral treaty between SK and HU.
Its purpose is to decrease the extreme water (Q100) in the Laborec river at mouth of Uh river by about 600 $m^3.s^{-1}$, to secure the water level in the Bodrog river at the railway bridge and to keep max. 936 cm water level at the highway bridge at Streda nad Bodrogom. The inundated area covers 1 568 hectares and volume of the polder is 53 mio. m^3. Discharging of water into the Beša polder is realized through an intake/outlet structure located at rkm 4,7 of the left-bank dike of the Laborec river. Once the water level in the Laborec river decreases, water is discharged back into the Laborec river. The area of polder is covered by forests and permanent green crops, mostly used as pasture land. The operation of the Beša polder started in 1965.

Situation:- area of Beša polder demarked by red line



Intake/outlet structure *Area of the Beša polder – pasture land*

To avoid the negative downstream effects the national legislation shall contain provisions stipulating that flood risk management plans shall not include measures which, by their extent and impact, significantly increase flood risks in other countries (as it is the case in e.g., the German Federal Water Act (WHG)).

The top measures applying the solidarity principle rely on natural water retention and flood retention by making every effort to retain rainfall at the spot, storing excess water locally, only then letting the water be discharged to the water-course and further downstream to the neighbouring country. These measures include natural water retention in the catchment, in wetlands and in settlement areas, soil sealing reduction, restoration of flood plains and sedimentation areas, land-use changes (grassing, afforestation) and planning and construction of flood retention systems.

Instrumental to the efficient application of the solidarity principle is transboundary cooperation. Establishing efficient bilateral cooperation with all neighbouring countries, including common actions on transboundary rivers during flood and ice defence is an effective tool to reducing downstream impacts of floods. More information on the international cooperation is provided in chapter 10. An efficient cooperation is also needed between the national flood monitoring and warning services

enabling rapid exchange of data on flood events and warnings. A supportive element is the use of the Danube EFAS – the flood warning system among Danube countries.

12 Public information and consultation

This chapter will be finalized after the public consultation will have taken place. Coordinated approach with the WFD will be highlighted here.

12.1 Danube River Basin District

12.1.1 Objectives for Public Participation

The ICPDR is committed to active public participation in its decision making. The commission believes that this facilitates broader support for policies and leads to increased efficiency in the implementation of measures. The ICPDR pursues the consultation of stakeholders in the entire cycle of ICPDR activities: from conceptualising policies, to implementing measures, to evaluating impacts.

In practice, the ICPDR pursues public participation primarily through two avenues: (1) through the involvement of observer organisations in its ongoing work; and (2) through specific activities that are dedicated to public participation and information.

12.1.2 Observers to the ICPDR

Observers of the ICPDR can actively participate in all meetings of ICPDR expert groups and task groups, as well as plenary meetings (Standing Working Group and Ordinary Meetings). Observers represent a broad spectrum of water stakeholders in the Danube River Basin, covering social, cultural, economic and environmental interest groups. As of 2014, there were 23 organisations approved as observers, all of which had the opportunity to contribute to the development of the Flood Risk Management Plan. Observers are accepted upon approval of the ICPDR and have to meet a defined set of criteria.

12.1.3 Public participation, communication and outreach

Under the umbrella of public participation, the ICPDR pursues a range of activities. These include (1) the provision of public information such as the development of technical public documents and general publications (e.g. the quarterly magazine Danube Watch); (2) environmental education, awareness raising and outreach (e.g. the annual river festival Danube Day or the teacher's kit Danube Box); and (3) public consultation activities directly linked to the development of river basin management plans.

12.1.4 Public Consultation for the Flood Risk Management Plan for the DRB

To accompany the development of the Flood Risk Management Plan, public consultation is strongly interlinked with the work done in this field for the update of the Danube River Basin Management

plan according to Art. 14 of the Water Framework Direcive. It is done in three main stages[7]: comments from the public are collected on (1) a timetable and work programme including public consultation measures; (2) flood risk maps and flood hazard maps; and (3) the draft flood risk management plan.

The timetable and work programme was published for comments from 22 December 2012 to 22 June 2013; the flood risk maps and flood hazard maps and the draft Flood Risk Management Plan will enter the public consultation phase in 2015 and will convene in summer of the same year. The opportunity to participate in each of these steps was promoted through the ICPDR network of contracting parties and observers; the ICPDR website icpdr.org; and the magazine Danube Watch.

For the consultation on the draft Flood Risk Management Plan, a number of additional activities will also be pursued to actively involve stakeholders and the interested public. These include a questionnaire to collect opinions on all major chapters of the management plan; and a stakeholder workshop to discuss the management plan in detail in early July 2015. These consultation activities will be supported by information materials on the Food Risk Management Plan, such as a brochure or an information video.

12.1.5 Links to public consultation for the DRBMP update 2015

All activities related to public consultation described here were aligned as much as possible with the steps towards the finalisation of the 2015 update of the Danube River Basin Management Plan. This applies in particular to the publication of the timetable and work programme including public consultation measures in 2013; and the public consultation measures for the draft management plan. For example, the stakeholder consultation workshop is a joint activity to highlight the interlinkages between both plans and also to enable an attendance back to back; questionnaires were developed jointly and referred to each other.

12.2 Links to public consultation on the national level

The Flood Risk Management Plan for the Danube River Basin provides a catchment-wide umbrella and is complemented by national and sub-basin management plans. These management plans are developed with national endeavours in the field of public consultation. To support the information exchange between the responsible authorities and link national public consultation activities with the basin-wide level, information on national steps towards the development of Flood Risk Management Plans was collected. Meetings of the ICPDR and its Expert Group for Public Participation further supported a basin-wide exchange on the national consultation work.

A summary of the public information and consultation taking place at the national level is provided below (*based on information received by 14 November 2014*).

12.2.1 Germany

In Germany public information and consultation are stipulated in § 79 WHG. All results of the preliminary flood risk assessment, the flood hazard maps and flood risk maps are available for the public in "WasserBLIcK" www.wasserblick.net/servlet/is/136377/ .

The federal states provide more detailed information:

[7] See ”WFD & EFD: Public Participation Plan”. ICPDR document number: IC WD 517.

Baden-Württemberg: http://www4.um.baden-wuerttemberg.de/servlet/is/110805/

Bayern: www.lfu.bayern.de/hochwasserrisikomanagement

Public consultation attends the development of Flood Risk Management Plans and is running similar to the consultations for the WFD.

12.2.2 Austria

The public information and consultation process for the flood risk management plan in coordination with the river basin management plan had officially been started on 21 January 2015. The consultation process lasts for 6 months, until the 21 July. The plans will be published by 22 December 2015 according to the EU Floods Directive and EU Water Framework Directive.

Information referring to the three steps of FD implementation and a Web GIS application is publicly available under http://wisa.bmlfuw.gv.at

PFRA/APSFR: http://wisa.bmlfuw.gv.at/fachinformation/hochwasserrisiko/risikobewertung.html

FHRM: http://wisa.bmlfuw.gv.at/fachinformation/hochwasserrisiko/Gefahren--und-Risikokarten.html

FRMP: http://wisa.bmlfuw.gv.at/fachinformation/hochwasserrisiko/hochwasserrisikoplan.html

Information specially processed for the public is provided under: www.wasseraktiv.at

12.2.3 Czech Republic

Flood Directive (Art. 9, 10) as well as Water Framework Directive (art. 3, 14) require public to be informed and involved. The obligation to publish and make available for public comments of following documents is defined in Czech legislation, namely in the Water Act (Act no. 254/2001 Coll.):

- Preliminary flood risk assessment and identification of areas with significant flood risk (2011)
- Timetable and program of work on river basin management plans and flood risk management plans (2012)
- Flood hazard maps and flood risk maps (2013)
- Production of draft river basin management plans and draft flood risk management plans (2014)
- River basin management plans and flood risk management plans amended according to the evaluation of consultations with water users and the public (2015)

These documents must be available to the public for comments for a period of 6 months. They are published on the websites of relevant ministries, river boards and regional authorities. The announcement of publication is done via official boards of the relevant ministries and regional authorities. Draft flood risk management plans are submitted together with the draft national river basin management plans and draft river management plans for sub-basins.

The Flood information system (POVIS) at http://www.povis.cz is used to inform professionals and the general public about basic documents and news from the field of flood protection and implementation of the Flood Directive.

Results of mapping of flood hazard and flood risks have been made available for public on 22 December 2013 on the website of the central data warehouse http://cds.chmi.cz . During March and May 2014 the Ministry of the Environment organized 15 seminars in county seats on this subject.

In accordance with the terms of Flood Directive and Czech legislation the draft Flood Risk Management Plan in the Danube basin has been published for comments of public on the POVIS website since 22 December 2014. At the same time river management plans for sub-basins have been published on the websites of the respective river boards together with their annexes containing documentations of areas with significant flood risk are. Comments to the published documents can be stated within 6 months, which mean until 22 June 2015.

In order to discuss the proposed draft flood risk management plans proposals and documentations of areas with significant flood risk Ministry of Environment in cooperation with respective regional authorities and river boards have been organizing seminars during February and March 2015.

12.2.4 Slovakia

Ministry of the Environment of the Slovak Republic (MoE SR) is the competent authority for the implementation of the Directive 2007/60/EC (FD). Active involvement of all interested parties, coordination of the flood risk management plans with river basin management plans as well as public information are established in the Act No. 7/2010 Coll. on Flood Protection. Into this national law the Directive 2007/60/EC has been transposed.

The completion of the first draft flood risk management plans for the national sub-basins, identical with national subunits designated under the Directive 2000/60/EC (full texts with attachments in their entirety under the Decree No. 112/2011 Coll., laying down the details of the content, review and updating of the flood risk management plans) shall be ready according to the Time and task schedule for the preparation of the first draft flood risk management plans by December 22, 2014. All information compiled under the requirements of FD (Preliminary flood risk assessment, Time and task schedule for the preparation of the first draft flood risk management plans, Flood hazard maps and Flood risk maps) are according to Art. 10 FD published for general public on the website of the MoE SR (http://www.minzp.sk/sekcie/temy-oblasti/voda/ochrana-pred-povodnami/manazment-povodnovych-rizik/).

Under the Act No. 7/2010 Coll. on Flood Protection Article 9 Paragraph 4 the first draft flood risk management plans shall be carried out in coordination with the reviews of the river basin management plans under the Directive 2000/60 /EC (Water Framework Directive, WFD) and after the approval by the Ministry of the Environment of the Slovak Republic, they also become the part of a revised management plan of relevant river basin and of revised management plan of relevant national sub-basin. These two strategic documents are jointly submitted for the assessment under the Act No. 24/2006 Coll. on Environmental Impact Assessment for the public consultations to receive written comments and suggestions by December 22, 2014. First draft flood risk management plans will be available to the public on the website of the Ministry of the Environment of the Slovak Republic until June 22, 2015.

During 6 month period of the disclosure of the first draft flood risk management plans to the public, special seminars should be organized throughout Slovakia by the MoE SR in cooperation with the Environmental Divisions of the District Authorities. The scope of seminars will be to inform the public about the content and the preparation process of flood risk management plans, proposed flood protection and proposed flood protection measures and to create space for discussion. The audience should be mayors of the municipalities or representatives of communities united in micro-regions, employees of offices of self-governing regions dealing with the protection of property against floods (e.g. employees of regional road administration, etc.), employees of the Divisions of crisis management of District Authorities, employees of the Environmental Divisions of the District Authorities and further public.

When FD entered into force, the competent authority has started a number of information and coordination activities. Seminars were organized by the MoE SR to inform the public about the preparation process and results of the Preliminary flood risk assessment and about the further steps in

the process of the implementation of the FD, about Flood hazard maps and Flood risk maps, about the Flood risk management plans and proposed flood protection measures. Special seminars were held in the period from November 30, 2012 to December 11, 2012 in each regional capital organized by the Regional Environment Offices (District Authorities) in cooperation with the Branches of the Slovak Water Management Enterprise. At the conference Floods 2010: Causes, characteristics and experiences held in November 2010 participants could discuss flood risk issues. Information for general public about floods and their consequences are published and updated on a regular basis on the website of the MoE SR (http://www.minzp.sk/sekcie/temy-oblasti/voda/ochrana-pred-povodnami/informacie-priebehu-nasledkoch-povodni-od-roku-2001/).

To inform general public, as well as the professionals, and to raise awareness about the flood risk, possible flood protection measures, and to open the forum for dialog of the professionals from different interested parties the international scientific conferences "River Basin and Flood Risk Management"were organized in 2011 (http://www.vuvh.sk/index.php/sk_SK/rozne/manazmentPovodi) and in 2013 (http://www.vuvh.sk/index.php/sk_SK/konferencie/zbornik-manazment-povodi-a-povodnovych-rizik-2013).

The professionals can present to the general public their knowledge, opinions and experience in the field of flood protection in the Water Management Journal, which is available on the website of the Slovak association of employees in water management (ZZVH) http://www.zzvh.sk/index.php?ID=24

In May 2006, the Working Group Floods was officially established as one of the working groups of the MoE SR, which is involved in the implementation of the FD. Working Group Floods provided professional support and space for consultation during the processing of the Time and task schedule for the preparation of the first draft flood risk management plans, Preliminary flood risk assessment, Flood hazard maps and Flood risk maps and Flood risk management plans. Members of the working group include representatives of the MoE SR, Slovak Water Management Enterprise, Water Research Institute, Slovak Hydrometeorological Institute, District Authorities, State Nature Conservancy of the Slovak Republic, Slovak Environment Agency and other external scientific and research organizations.

12.2.5 Hungary

In Hungary the basic planning units of the flood risk management plans are the embanked floodplains. These areas have the threat to be inundated by fluvial floods or by groundwater floods (excess water). The numbers of the designated areas are 151 and 90 respectively and they are stated in the legislation. These coverages overlap with municipality and county borders, institutional operational borders, furthermore in some cases the national border, but each of them are handled by only one Water Directorate. The Water Directorates are responsible for constructing the plans, coordinate the local and regional discussions with contributing parties and the wider audience.

The EU Flood Directive in Article 10 declares that Member States shall make available to the public the preliminary flood risk assessment, the flood hazard maps, the flood risk maps and the flood risk management plans. In Hungary the links are the following:

PFRA
http://www.vizugy.hu/index.php?module=content&programelemid=1&id=826

FHRM
http://www.vizugy.hu/index.php?module=content&programelemid=62

The Directive also says that Member States shall encourage active involvement of interested parties in the production, review and updating of the flood risk management plans. The Directive have been implemented to the national law in the 178/2010 (V.13.) governmental decree. In the 10§ (2) section the legislation obligate the involvement of the Regional and National Water Management Committees for the development process. The 13. § (2) section instructs the designer to organize information

exchange platforms and discussion forums for the affected population. It also emphasizes the need for the strong connection to the institutes that are dealing with the accomplishment of the Water Framework Directive. From the beginning of 2014 these task are also the responsibility of the Water Directorates, so the cooperation is fundamental. The national flood risk management plan will have to be approved by the Government.

In the regional planning phase the Regional Water Management Committee has to be involved, where the maximum 25 members with voting rights are (1382/2013. (VI. 27.) gov.dec.) the delegated representative of the:

- ministries responsible for water protection and water management
- responsible water directorate and water authority
- competent environmental protection, natural protection and water authority
- national park directorates or the notary of the municipality (if locally protected)
- competent institute for public health and agriculture
- municipalities in the area of interest
- county municipalities in the area of interest
- regional tourism board
- chamber of agriculture, industry and engineers
- water management associations and companies for public works
- NGOs and scientific organizations in the area of interest with focus on specific topics
- additionally the national world heritage committee with commenting rights

The same legislative document described the National Water Management Committee as well, that has even longer list of involved high level stakeholders. At the national level strategic questions are addressed. The practical discussion takes place at the regional level.

12.2.6 Slovenia

Results of PFRA and FHRM are available to the public through websites http://gis.arso.gov.si/evode/profile.aspx?id=atlas_voda@Arso and http://gis.arso.gov.si/atlasokolja/profile.aspx?id=Atlas_Okolja_AXL@Arso .

Monitoring of FRMP progress is available in the table that can be found at: www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/podrocja/voda/opvp/OPOPO.xls .

Public consultation for FRMP is planned to be made in a similar way as for the RBMP.

12.2.7 Croatia

All results of the preliminary flood risk assessment, the flood hazard maps and flood risk maps are available for the public at the www site of Croatian Waters at http://korp.voda.hr/

The draft River Basin Management Plan (RBMP), which includes the draft Flood Risk Management Plan (FRMP), was published at the www site of Croatian Waters at http://www.voda.hr/hr/plan-upravljanja-vodnim-podrucjima.

The public consultation procedure will be carried out based on the applicable laws and regulations, i.e. Art. 39 of the Water Act (Official Gazette 153/09, 63/11, 130/11, 56/13 i 14/14) and the associated bylaws.

12.2.8 Bosnia and Herzegovina

Formal consultation/information/participation process regarding Flood risk management plan in FBIH is defined in "Regulation on type and content of plans for flood protection", from 2009. In two articles of this Regulation it is stipulated:

- Flood risk management plan includes (among other) summary of activities related to public information and consultation (article 11.)
- Public participation in Flood risk management plan preparation and adoption shall be implemented according to article 38. of FBiH Water Law (article 13).

As FBiH Water Law entered into force in 2006., article 13. of the Regulation might be understood as request to follow up procedure for public participation as it is requested for Water management plan.

Therefore, Water Agencies in FBIH should publish Draft of the Plan at least a year before the beginning of the period to which the plan applies. On request of legal or private subjects, Water agency is obliged to allow an access to the documents on basis of which the draft plan was prepared. Legal and private subjects may submit to the Water Agency written comments on the draft plan, within six months after its publication. Within three months of the receipt of complaints from legal and private subjects, Water Agency needs to prepare a report containing adopted or rejected objections to the draft plan with an explanation. The report is an integral part of the plan.

Public consultation in water management sector might be defined by legal acts on state level. In case of transboundary river basins, public consultation might be regulated by an additional legal act.

12.2.9 Bulgaria

The public information and consultations in the process of development of FRMP are regulated by the Bulgarian Water act. The draft documents elaborated at each stage of the FRMP-development are being published and made available to the public for consultation and written comments. The legislation requires publishing of the documents and the start of public consultation to be announced via a special announcement in the national media. In order to ensure an active involvement of the public in the process of flood risk management, a cycle of stakeholders-meetings is organized during the process of consultation. Representatives of various types of stakeholders are invited to participate in the meetings: local authorities - municipalities and regions; civil protection units, water users; scientific organizations, NGO's etc. Additionally, the documents published for consultations are being presented on the Basin Board – a state-public advisory commission which assists the operation of the Basin Directorate. All comments and recommendations received in the process of public consultation are being considered in the final version of the document. The published documents, including information about the public consultations are available on following links:

PFRA:

The report - http://www.bd-dunav.org/content/upravlenie-na-vodite/upravlenie-na-riska-ot-navodneniia/predvaritelna-ocenka-na-riska-ot-navodneniia-v-dunavski-rayon-za-baseynovo-upravlenie/porn-v-dunavski-rayon/

Information about the stakeholder's meetings: http://www.bd-dunav.org/content/konsultacii-s-obshtestvenostta/konsultacii-pri-izgotviane-na-porn/

Comments and recommendations received: http://www.bd-dunav.org/uploads/content/files/upravlenie-na-vodite/upravlenie_na_riska_navodneniya/PORN/10_1_PORN_final__BDUVDR_Pril_10_1(1).xls

APSFR

http://www.bd-dunav.org/content/upravlenie-na-vodite/upravlenie-na-riska-ot-navodneniia/rayoni-sas-znachitelen-potencialen-risk-ot-navodneniia/

Information about the stakeholder's meetings: http://www.bd-dunav.org/content/konsultacii-s-obshtestvenostta/konsultacii-pri-opredeliane-na-rzprn/

Link to comments and recommendations received: here

FRMP

will be published on the web-address http://www.bd-dunav.org/content/upravlenie-na-vodite/upravlenie-na-riska-ot-navodneniia/plan-za-upravlenie-na-riska-ot-navodneniia/

12.2.10 Romania

The results and reports of the EU 2007/60 Directive Flood Risk Management are available for public information and consultation on „Romanian Waters" National Administration portal www.rowater.ro

The links for specific steps of implementation are:

- Preliminary flood risk assessment - http://www.rowater.ro/EPRI/EPRI.aspx ;
- Flood hazard and risk maps - http://www.rowater.ro/HHHRI/HHHRI.aspx ;
- Flood risk management plan - http://www.rowater.ro/PMRI/PMRI.aspx .
- other statistics resulting from the Flood Directive –

http://www.rowater.ro/Directiva%20analizat%20statistic/Directiva%20analizata%20statistic.aspx

13 Conclusions and next steps

Danube Flood Risk Management Plan provides for tailored solutions towards flood protection, prevention and mitigation according to the needs and priorities of the Danube River Basin District (DRBD). It ensures relevant coordination of the implementation of the EU Floods Directive within DRBD and also promotes the achievement of environmental objectives laid down in EU WFD especially by refraining from taking measures or engaging in actions which significantly increase the risk of flooding between the ICPDR Contracting Parties. With a view to giving rivers more space, Danube Flood Risk Management Plan considers the maintenance and/or restoration of active and former floodplains and application of natural water retention measures. Development of river basin management plans under Directive 2000/60/EC and of flood risk management plans under this Directive are elements of integrated river basin management. The two processes therefore use the mutual potential for common synergies and benefits, having regard to the environmental objectives of Directive 2000/60/EC, ensuring efficiency and wise use of resources.

Danube Flood Risk Management Plan summarizes the results of the preliminary flood risk assessment (PFRA) which were undertaken to provide an assessment of potential risks stemming from floods and presents the areas of potential significant flood risk (APSFR). For the APSFR in catchments >4000km^2 the flood hazard maps and flood risk maps have been produced and are presented in this Plan.

The Plan presents the strategic basin-wide level measures to prevent and reduce damage to human health, the environment, cultural heritage and economic activity. Special attention in the Plan is given

to measures employing areas which have the potential to retain flood water, such as natural flood plains as well as the other areas enabling controlled flooding. The ICPDR is fully aware of importance of application of the solidarity principle in the flood risk management stipulating that one should not pass on water management problems in one region to another. That is why the ICPDR agreed that the measures with downstream effects shall have the key priority at the basin-wide level (i.e., measures like natural water retention, warning systems, reduction of risk from contaminated sites in floodplain areas, exchange of information). The impact of climate change on the occurrence of floods has also been taken into account. An overview of the public information and consultation both on the national level and on the basin-wide level is also provided in the Plan.

The elements of the Danube Flood Risk Management Plan will be periodically reviewed in future on a regular basis respecting the flood risk management planning periods, and after each review they will be updated to reflect the latest level of knowledge.

The final version of Conclusions addressing also the next steps and the recommendations for future will be prepared in 2015 upon receiving all data from countries.