DEVELOPING THE CONCEPT PLAN FOR N(S)WRM IN RIVER BASIN

D.T2.3.1

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Pilot Catchment Kamniska Bistrica
Slovenia/ UL and Limnos

1. Introduction

The document takes a holistic look at small water retention implementation on a river basin scale. The main objective of a Concept plan is to locate, select, characterise and analyse appropriate measures for identified problem in the catchment.

Concept plan is an early phase of the design process, in which planning process of small water retention measures (SWRM) takes place. It is a necessary support document to accomplish water management goals.

In the concept plan, broad outlines of SWRM type are articulated. It includes initial design idea and involves different stakeholders. **Concept plans give information on best locations and type of measures with their cumulative effect.**

Vision for the pilot area Kamniska Bistrica
A problem that needs solving in Kamniska Bistrica catchment is flooding of urban areas. There are five areas of potential significant *flood risk:*

- Stahovica-Kamnik (A=1,08 km^2);
- Komenda-Moste-Suhadole (A=0,83 km^2);
- Nožice (A=0,25 km^2);
- Domžale (A=0,83 km^2);
- Ihan- farms (A=0,01 km^2).

A vision for the pilot area is to use dispersed SWRM as flood protection mechanism on a river basin scale and at the same foster other issues not directly included in the flood risk management such as climate change adaptation.

The concept plan follows established general methodology (concept plan steps);

- Engagement of stakeholders in order to gather their inputs;
- A compliance review of proposed SWRM with the spatial and planning requirements, regulations, standards and norms;
- Expert selection and placement of SWRM in the catchment;
- Assessment of SWRM (evaluation of effects) with use of static tool;
- Modelling the impacts of selected SWRM;
- Multi-criteria analyses of measures;
- Elaboration of the final concept plan;

Purposes of the concept plan are:

- to explain transparently the way how the analysis of information, data and context as well as the evaluation of experts knowledge and stakeholders preferences led to the chosen design principles;
- to show how the design and location of the selected N(S)WRMs respond to the opportunities & constraints identified during the analyses;
- to explain and justify the way the N(S)WRMs are set out;
- to demonstrate a genuine response to context and not simply justify predetermined design solutions;
- to provide a uniform guideline for the planning process.

0 Elaboration method of the concept plan

Figure 1 demonstrates the main steps of the concept plan elaboration, while details of the needed actions are discussed in the chapters below.

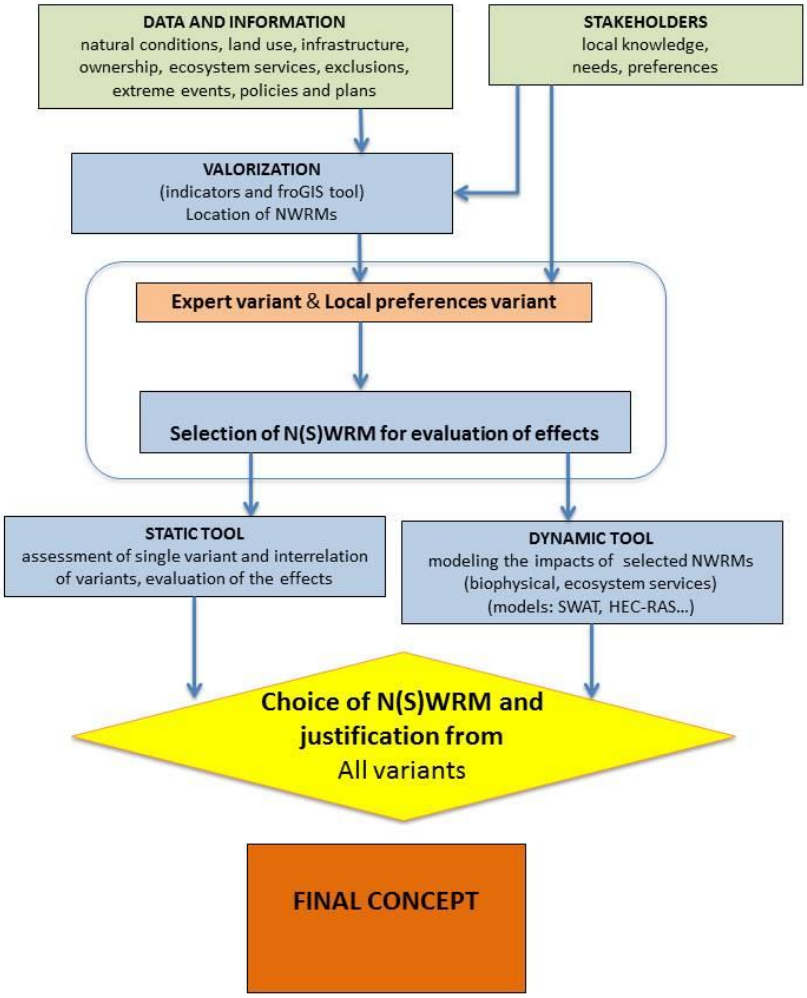

Figure 1: Main steps of the concept plan elaboration.

1 Characteristics of the pilot area

The Kamniska Bistrica River catchment was chosen as a pilot catchment because of its diverse character, ranging from wooded subalpine hills to lowland plains, which are highly urbanized. The main problem within the catchment are relatively frequent floods. As for water quality, Kamniska Bistrica River has moderate to very good ecological status.

Table 1: Characteristics of the catchment

Characteristic	***Unit***	***Value***
Character of catchment		*Upper part: highland; wooded, sparsely populated* *Middle and lower part: lowland; highly urbanized*
Catchment size:	*km^2*	*539*
*Average flow low/avg/high**	*m^3/s*	*2.2/7.9/67.2*
*Extreme flow low/high**	*m^3/s*	*0.9/282*
*Annual precipitation low/avg/high***	*mm*	*998/1383/1851*
*Annual air temperature min/avg/max***	*˚C*	*9/11/13*
Agriculture area	*%*	*34.5*
Urban area	*%*	*8.2*
Forest area	*%*	*54.1*
Open Water area	*%*	*2.8*
Flooded area (1/100 years)	*km^2*	*39.2*
Artificial drainage area	*km^2*	*12.7*

1.1 Natural conditions of the catchment

Kamniška Bistrica is a glacial valley, which starts in the gorges in the Kamniško-Savinjske Alps. The river of the same name springs at an altitude of 587 m. The upper part of the valley, which ends at the confluence of the Kamniška Bistrica and Korošica, is U-shaped, and the lower part is in the form of a letter V. The valley here already passes into characteristics of river valley and opens to the Kamniško-Bistriško field. Upper part of the Kamniška Bistrica valley is mostly highland on limestone and dolomite, covered with forest and sparsely populated, while middle and lower parts are lowland on quaternary alluvial sediments and are highly urbanized and intensively agricultural. Kamniška Bistrica flows into Sava River at an altitude of 266 m.

1.2 Land use and infrastructure

Upper part of the Kamniška Bistrica valley is mostly highland covered with forest. Middle and lower parts are highly urbanized lowland with intensive agricultural (app. 25 %) and a strongly branched network of watercourses. On the quaternary alluvial sediments fertile soils were developed. Urban areas are concentrated among watercourses and therefore threatened by floods.

Kamniška Bistrica catchment is rich in protected areas. In upper part of catchment Natura 2000 is present, and there is a lot of natural values in the entire basin.

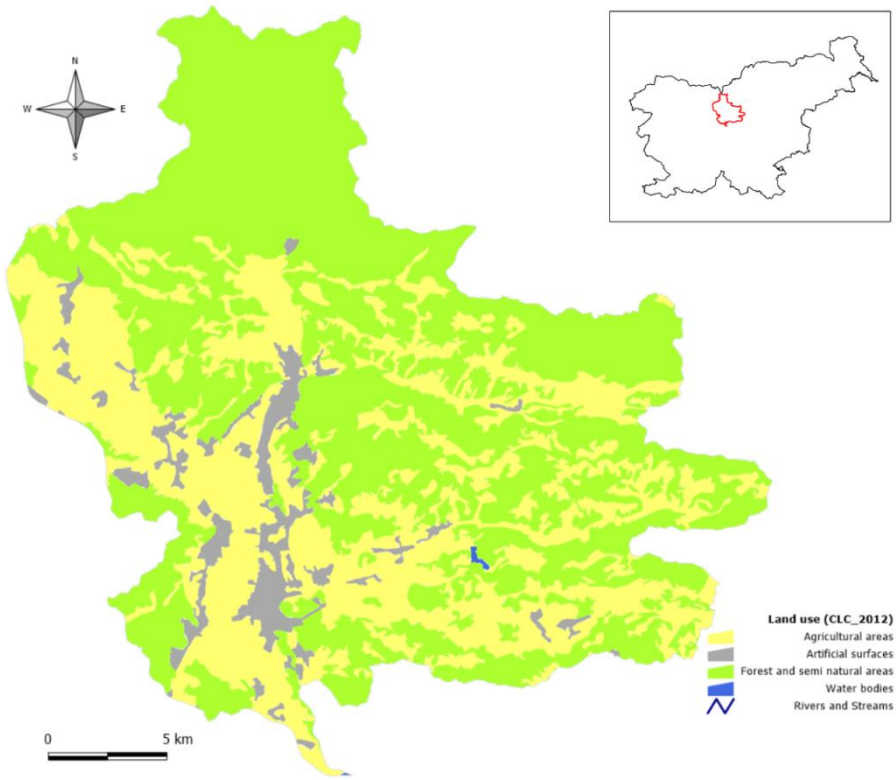

Figure 2: Kamniška Bistrica catchment land use.

1.3 Ecosystem services

The following ecosystem services have been mapped for the Kamniška Bistrica:

Table 2: Ecosystem services in Kamniska Bistrica

Section	Division	Group	Description
Provisioning	Nutrition	Biomass	Biomass production from grassland
		Water	Surface water for drinking with minor or no treatments
	Energy	Biomass-based energy sources	Fuel wood
Regulation & Maintenance	Mediation of waste, toxics and other nuisances	Mediation by ecosystems	Filtration of surface water by ecosystem types
			CO2 sequestration by forest and bogs
	Mediation of flows	Mass flows	Protection against avalanches, mudslides and rock falls
	Maintenance of physical, chemical, biological conditions	Lifecycle maintenance, habitat and gene pool protection	Symbolic alpine plants and animals, landscapes
Cultural	Physical and	Physical and	Outdoor recreation

Section	Division	Group	Description
	intellectual interactions with biota, ecosystems, and land- /seascapes [environmental settings]	experiential interactions	activities

1.4 Extreme events

There are 5 water bodies within the catchment: Kamniska Bistrica, Psata, Radomlja, Raca and Nevljica. In Kamniska Bistrica catchment there are five areas of significant areas of floods impacts: Stahovica-Kamnik, Komenda-Moste-Suhadole, Domžale, Nožice and Ihan- farms.

The main extreme events (heavy rain and floods) in Kamniška Bistrica catchment occurred at the following dates:

- 18-19.9.2007
- 17-18.9.2010
- 26-28.10.2012
- 4-5.11.2012
- 4-8.11.2014

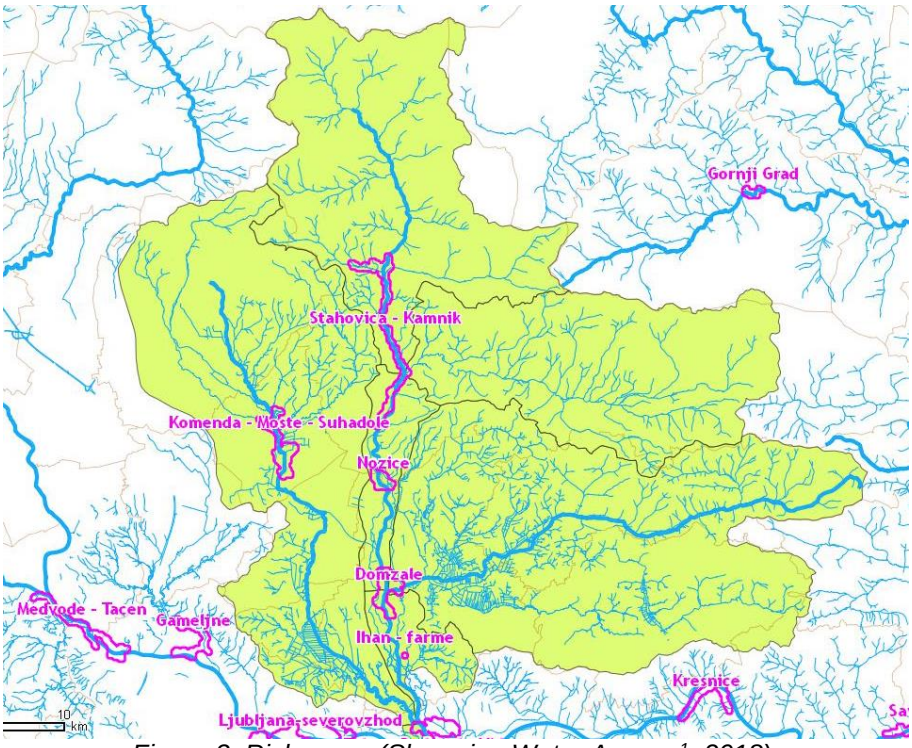

Figure 3: Risk areas (Slovenian Water Agency[1], 2018).

[1]http://www.mko.gov.si/fileadmin/mko.gov.si/pageuploads/podrocja/voda/opvp/09_Kamniska_Bistrica_OPVP.jpg

2 Valorisation: a multi-criteria analysis

2.1 The valorisation method and tool

The valorisation method is developed for:

- identifying the locations where N(S)WRM are needed, and
- assessment of measures.

It is based on a multi-criteria analysis of topographic, hydrological, meteorological and economic data. The method is developed in cooperation with the APs and stakeholders from national level.

In the frame of the valorisation method the FroGIS tool was developed, where users are able to fill in the tool with their data and after the calculations are performed, to review the resulting maps and statistics. Project partners tested it in cooperation with their stakeholders and APs in their selected pilot catchments. The Pilot Action Reports summarize the testing of the valorisation tool. After the testing, partners can provide a set-up of the most appropriate locations for NSWRM implementation in their river basins.

2.2 Results of the valorisation for flood mitigation purpose

Results of valorisation showed areas with from high to low need for water retention. The best results were obtained from equal width method of division into classes. However, valorisation map indicates high need for water retention on steep upstream slopes (SPU 12 and 36) where measures are not feasible; map by division into classes by natural breaks eliminates SPU 12 from areas with high need for water retention, which is correct. None of the method does not show SPU 79 as area with high need for water retention even thou there are planned three water retention basins. Division in natural breaks with variable weight shows greater potential for water retention in the western part of the catchment, which coincidence with planned measures.

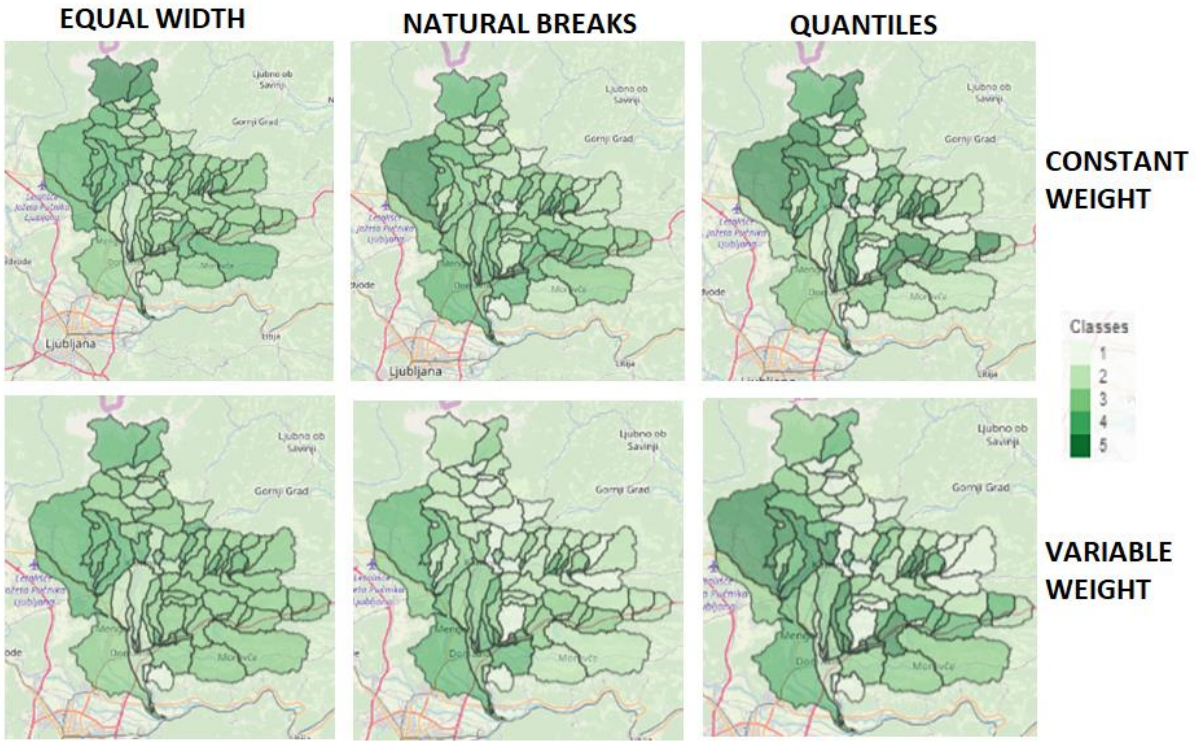

Figure 4: Division into classes.

3 Defining variants

3.1 Planned measures

Kamniska Bistrica lies in Danube river basin district. Development of RBMPs and FRMPs under Directive 2000/60/EC are elements of integrated river basin management. Adopted strategic documents

- River basin management plan for the Danube RBD (Danube RBMP 2016-2021);
- Flood risk management plan (FRMP 2017-2021).

were reviewed in order to identify already planned SWRM in the Kamniska Bistrica catchment. The planned measures are presented in the table below.

Table 3: Overview of flood protection measures in implementation (FRMP[2], 2017-2021)

FRMP measures (U7)*	Cost estimation [EUR]
Kamniška Bistrica regulation from the outflow to Domžale	4.000.000,00 €
Kamniška Bistrica regulation in Bišče	1.060.000,00 €
Kamniška Bistrica regulation from Volčji potok to Kamnik	1.000.000,00 €
Retention basin on Tunjščica (Komenda)	-
Retention basin on Pšata (Komenda)	-
Retention basin on Knežji potok (Komenda)	-

*Structural flood control measures in planning or construction phase.

Table 4: Overview of measures

Complementary measures
Measures to reduce the negative impact of land use in the riparian zone on water status (Pšata)
Measures to reduce the negative impact of regulation and other arrangements of watercourses, retention basins, lakes and coastal waters on water status (Kamniška Bistrica, Pšata and Rača with Radomlja)
Measures to reduce dispersed nutrient pollution in agriculture (Pšata).

3.2 Stakeholder inputs

First National event within FramWat project in Slovenia took place on 10th of May 2018. The main concern of stakeholders regarding NSWRM is their placement in environment due to geographical conditions and different interests. Water retention needs were confirmed where SWRM are already planned. They identified potential locations for NSWRM at Knežji Potok, Pšata, Doblič and Tunjica.

[2] http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/podrocja/voda/nzpo_2017_2021.pdf

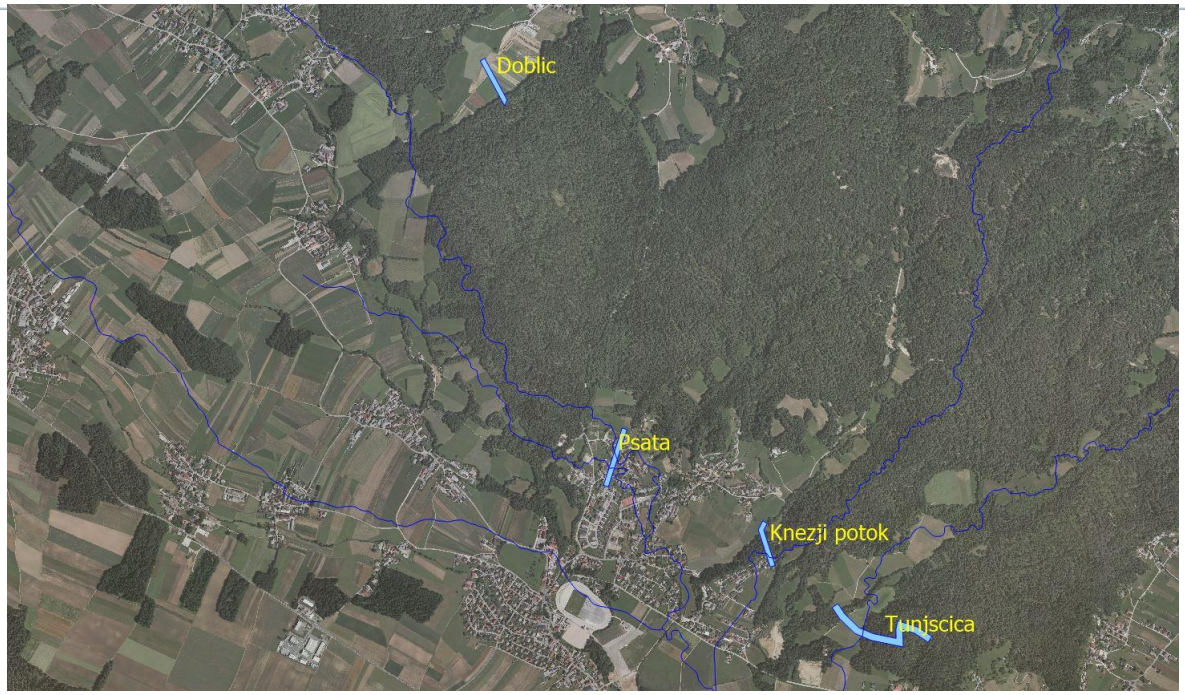

Figure 5: Identified measures by stakeholders at Knežji Potok, Pšata, Doblič and Tunjica

3.3 Local authorities inputs

National training on how to asses effectiveness in Slovenia took place on 18th of April 2019. Participating municipalities identified problems and proposed SWRM measures in the catchment. The identified measures are shown in the table below.

Table 5:Identified measures by stakeholders.

Proposed Measures	**Nr.**	**Proposed Measures**	**Nr.**
dam heightening	*1x*	*erosion control measures*	*2x*
new levee	*4x*	*flood diversion*	*2x*
new dam	*4x*	*bed-load trap cleaning*	*2x*
bridge reconstruction	*2x*	*new bed-load trap*	*3x*
stream regulation	*3x*		

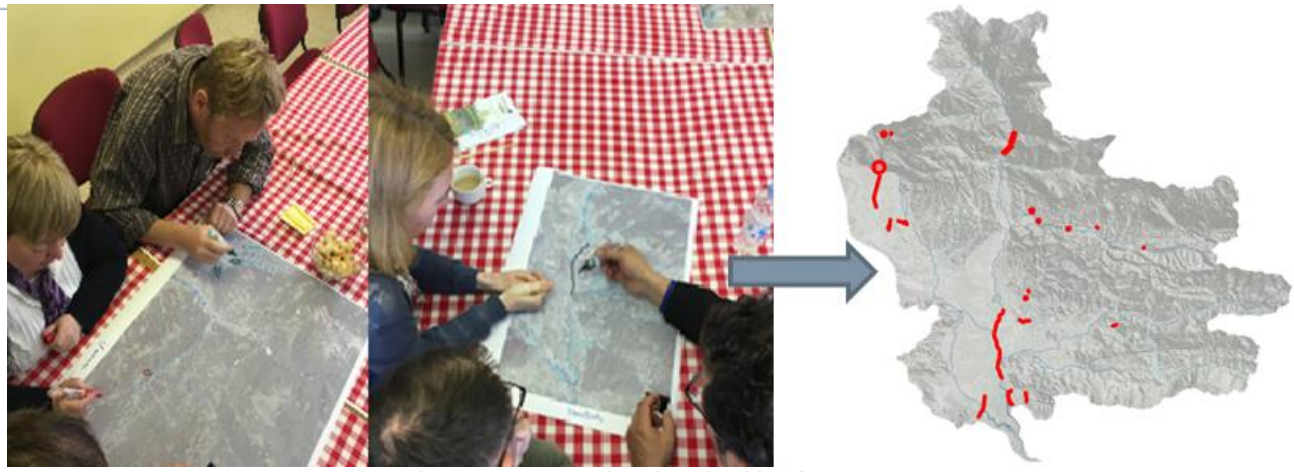

Figure 6: SWRM local authorities input.

3.4 Expert knowledge list of measures

Expert knowledge list of SWRM is based on understanding of catchment and how SWRM affect it. Proposed measures are taking into the account planning process and participation of catchment stakeholders, including local authorities. Chosen measures, shown in the next Figure, will be re-evaluated with the use of static and/or dynamic tool.

Figure 7: Expert based list of measures.

Table 6: Expert-based measures

N(S)WRM Catalog	Measures	No.
Peak flow control structures	*Dam - retention (i.e. reservoir)*	*13x*
	River regulation	*5x*
Afforestation	*Erosion control measures (i.e. afforestation)*	*2x*
	Flood diversion channels (restoration of natural infiltration to ground water)	*15x*
Flood plain restoration and management	*Protected flood retention area ("natural")*	*4x*
Basins and ponds *Wetlands*	*ponds, wetlands*	*8x*
	Earth fill removal	*1x*
	Complex measures	*24x*
Elimination of riverbank protection	*Widthening of river channel*	*1x*
	Removal of illegal interventions	*/*
	Other	*2x*
	TOTAL:	***75***
	EXISTING MEASURES:	***>50%***