

# Protection measures to elimination of non point agricultural sources of pollution in partial river basin water supply reservoir Švihov na Želivce - **Pilot project**

Tomáš Kvítek  
Povodí Vltavy, státní podnik

tomas.kvitek@pvl.cz  
607 01 66 14

**Workshop MKOL**  
**Ústí nad Labem, 2017**

**Pilot project** is an integral part  
of  
the Project Povodí Vltavy, State Enterprise

„**Sheet type A** to elimination non point agricultural sources  
pollution in Partial River Basin Management Plan“

Whole project cover total area of river basin districts  
in Povodí Vltavy, State Enterprise

Time solving: **1/2015 to 6/2019**

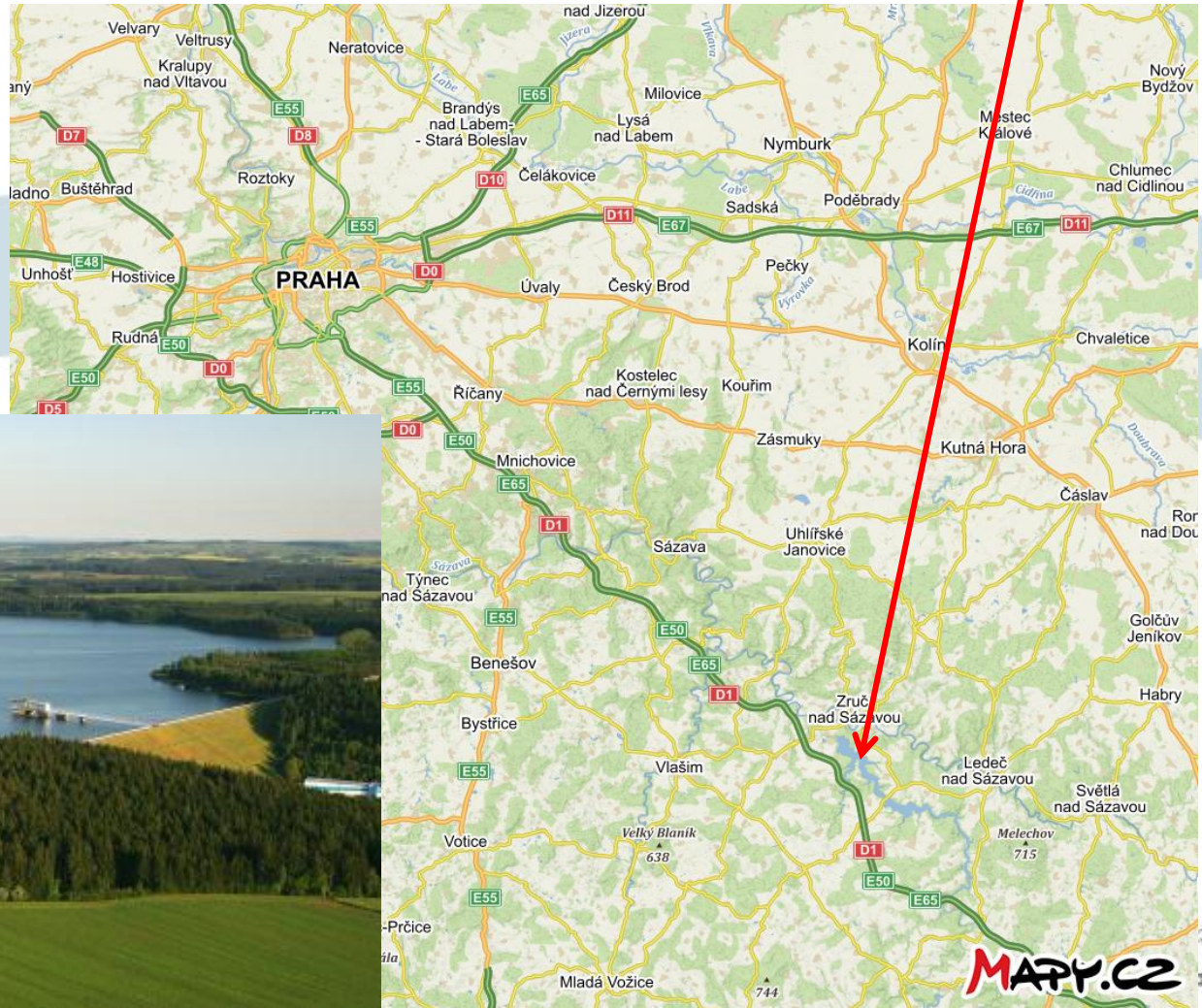
**Participating organizations:**

- Research Institute for Soil and Water Conservation, public research institution
- Czech Technical University in Prague, Faculty of Civil Engineering, Department of Irrigation, Drainage and Landscape Engineering
- T. G. Masaryk Water Research Institute, public research institution
- SWECO

Requirement Povodí Vltavy to output: 3 000 pieces **sheet type A**

Protective measures **sheet type A** = aimed measures on choice of arable land in  
**sub-catchment**

# Water supply reservoir Švihov na Želivce location in Czechia

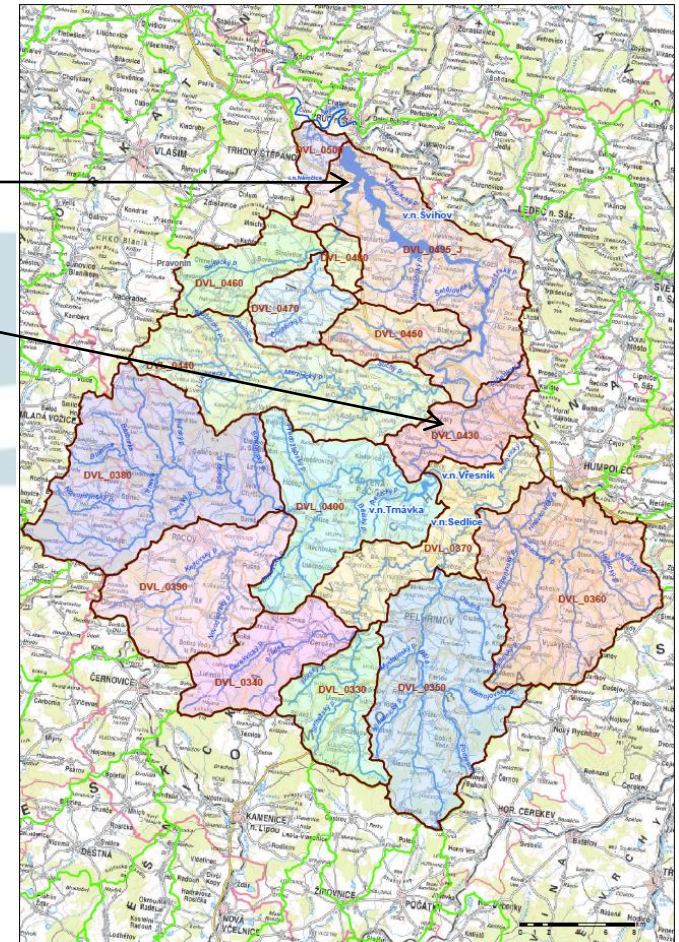




# Parameters of partial Želivka river basin

- Catchment area = 1 178 km<sup>2</sup>
- 16 river basin bodies
- Soil cover = cambisoil

Land use (year - 2010):	km <sup>2</sup>	%
• Arable land	543,1	46,1
• Forests	359,3	30,5
• Grasslands	150,8	12,8
• Other areas	70,7	6,0
• Water bodies	25,9	2,2
• Built-up areas	14,1	1,2
• Gardens	14,1	1,2

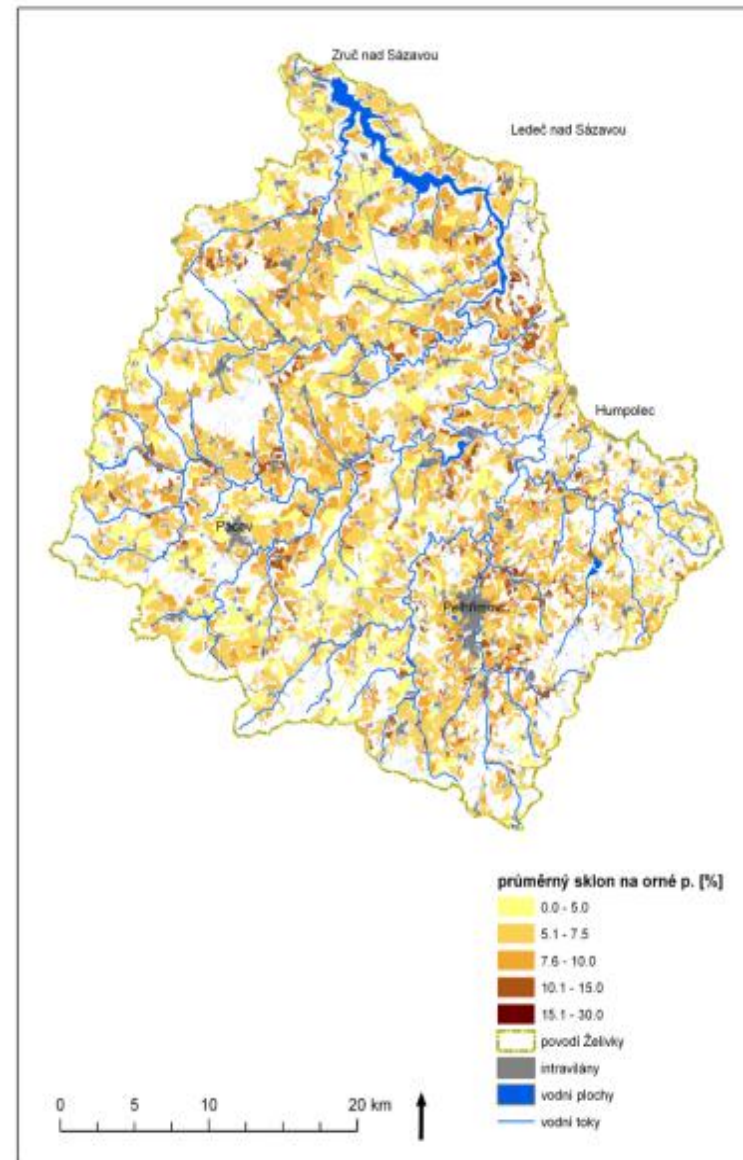


**Intensive agriculture on the arable land (70% = cereals, maize and oilseed rape)**

# Inclination in partial Želivka river basin

## Inclination agricultural land:

- 0–2 ° = 11,8 % of total catchment area
- 2–5 ° = 20,5 % of total catchment area
- 5–15 ° = 58,3 % of total catchment area
- 15–25 ° = 7,4 % of total catchment area
- more than 25 ° = 2,0 % of total catchment area



## Main sources of non point agricultural pollution in partial Želivka river basin

1. Water erosion – sediment particles and phosphorus in water streams, water reservoir, ponds = **random phenomenon**
2. Drainage water contamination - pesticides, phosphorus, marginally nitrates - **40%** of total outflow = **permanent outflow = permanent phenomenon**

## Water erosion in partial Želivka river basin

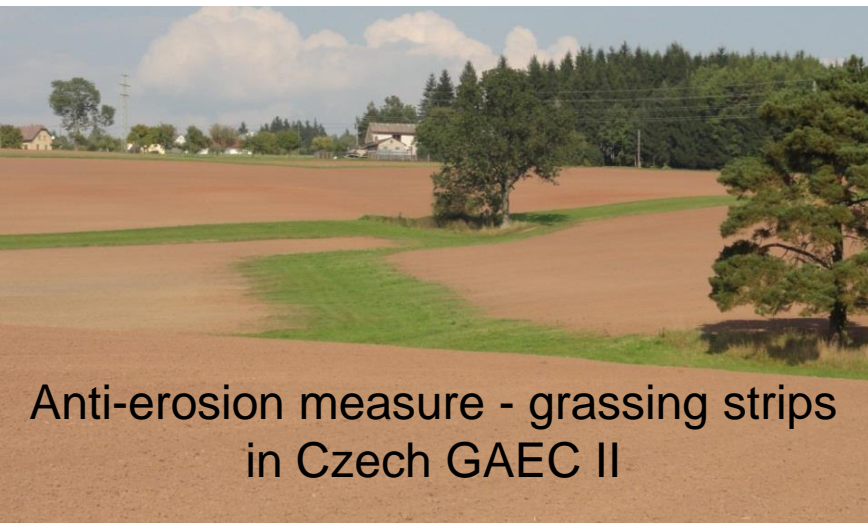


## Stern reality on arable land





# Outflow and water erosion: stern reality



Anti-erosion measure - grassing strips  
in Czech GAEC II

Real life in small agricultural sub-catchments:

Example Dehtáře (56 ha) with grassing (15 ha  
- 23 % of total area)



Sediments in firefighting reservoir

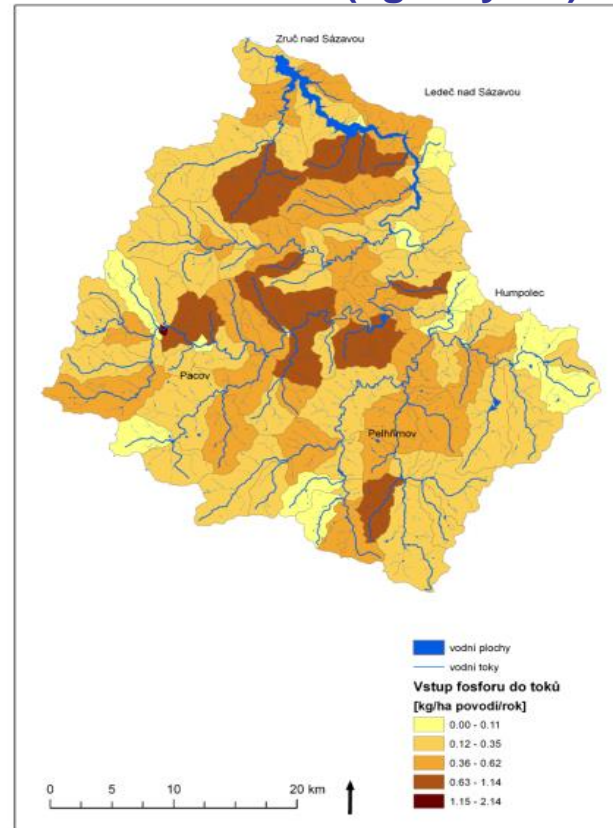
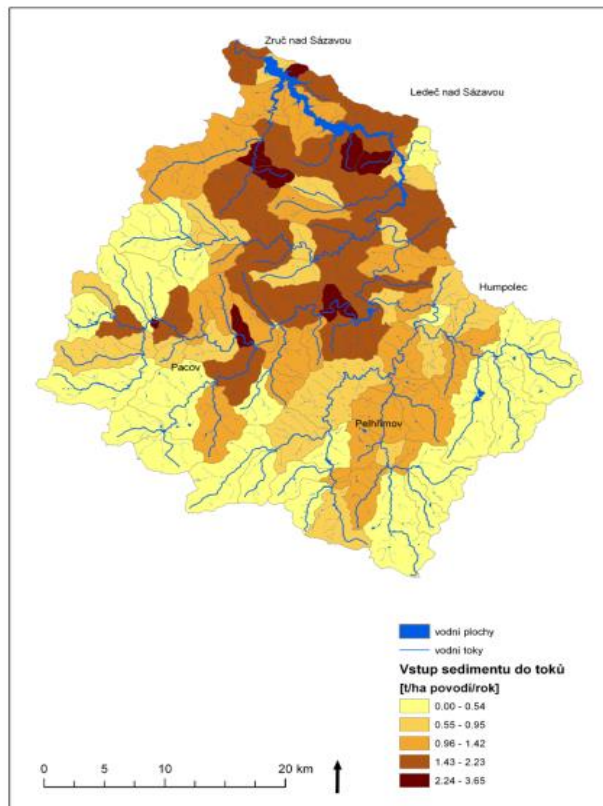
## Conclusion:

Grassing strips or partially grassing in sub-catchment can't solve extreme precipitation (probability of occurrence  $N > 2$ ,  $N_2 = 32,5$  mm/day)

# Project results: sediments particles and phosphorus (total) in partial Želivka river basin in catchment IV. order

Long-time average sediments particles inputs to the river basins (t/ha/year)

Long-time average phosphorus inputs to the river basins (kg/ha/year)



Yellow = 0,00 - 0,54 t/ha/year sediments  
Dark brown = 2,24 - 3,65 t/ha/year sediments

Yellow = 0,00 - 0,1 kg/ha P  
Dark brown = 1,15 - 2,14 kg/ha P

## Drainage systems in partial Želivka river basin



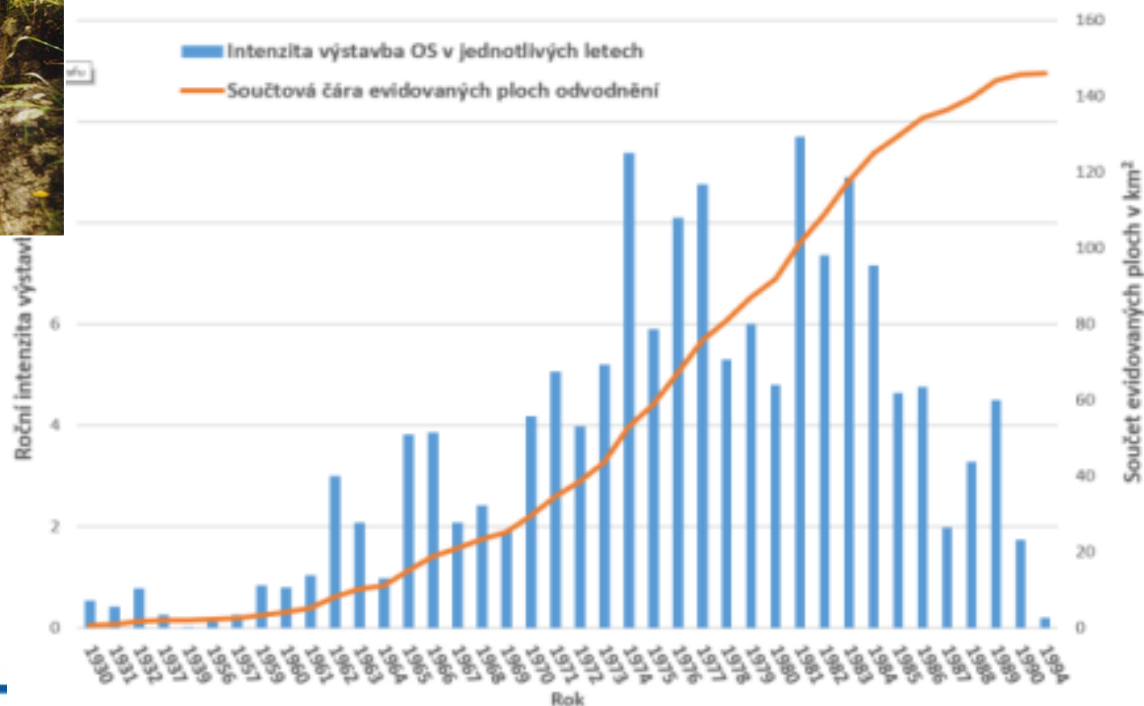
# Intensity of building-up drainage systems (in km<sup>2</sup>) - **blue columns** in year 1930-1994 and progress of total drainage area in partial Švihov river basin – **yellow line**



## Drainage water contamination:

- pesticides,
- metabolites of pesticides,
- phosphorus,
- nitrates.

Drainage systems = 149 km<sup>2</sup> = **12,7 %** of total river basin area,  
or **17 %** of agricultural land





## Protection measures against **2** main sources of pollution and another natural disasters

1. Water erosion and sediment particles, surface outflow
2. Drainage water with pesticides, phosphorus

**Pilot project solves protection of surface and subsurface water quality (point 1. and 2.) and partially eliminates other problems in partial Želivka river basin,**

### **mainly:**

4. Retention of water – partly local flood
5. Accumulation of water – partly drought
6. Increase of groundwater table

**Package/set of measures!!!**

**This pilot project solves water quality and water quantity all together!**

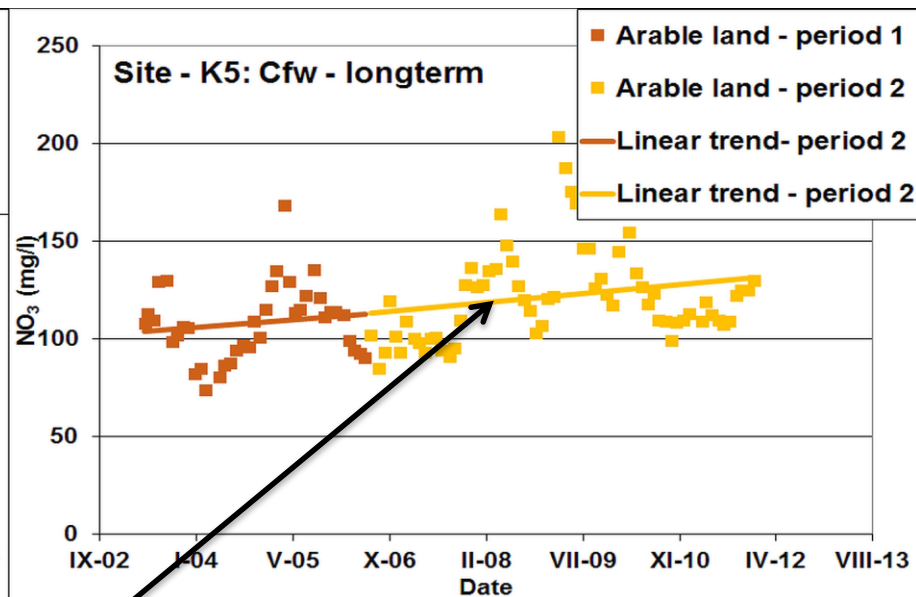
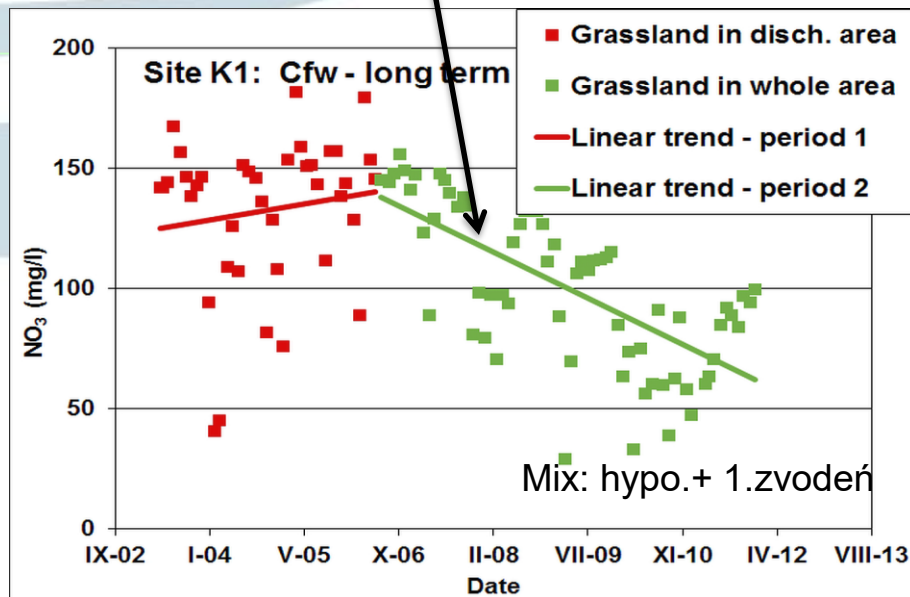
## Protective measures (point A., B. and C.)

A. Grassing of infiltration (recharge) zones – water quality improvement (groundwater and subsurface-drainage water)



# Experimental example

## Results of grassing: Nitrate concentration trend after grassing of infiltration (recharge) zone in small sub-catchment (56 ha)



Nitrate concentration trend without grassing

## B. Anti-erosion technical management - retardation of water outflow and decrease of direct surface outflow and sediment particles in water bodies

### Examples of technical measures

Intercepting contour channel  
max. water retardation: 5 m<sup>3</sup>/1m length



Intercepting ditch+grassing strip





## C. Combination of natural (A.) and technical (B.) system on agricultural land

**Grassing of infiltration areas**



**Dike terracing**



**Grassing of inundation areas**



**Small wetlands with drainage water**



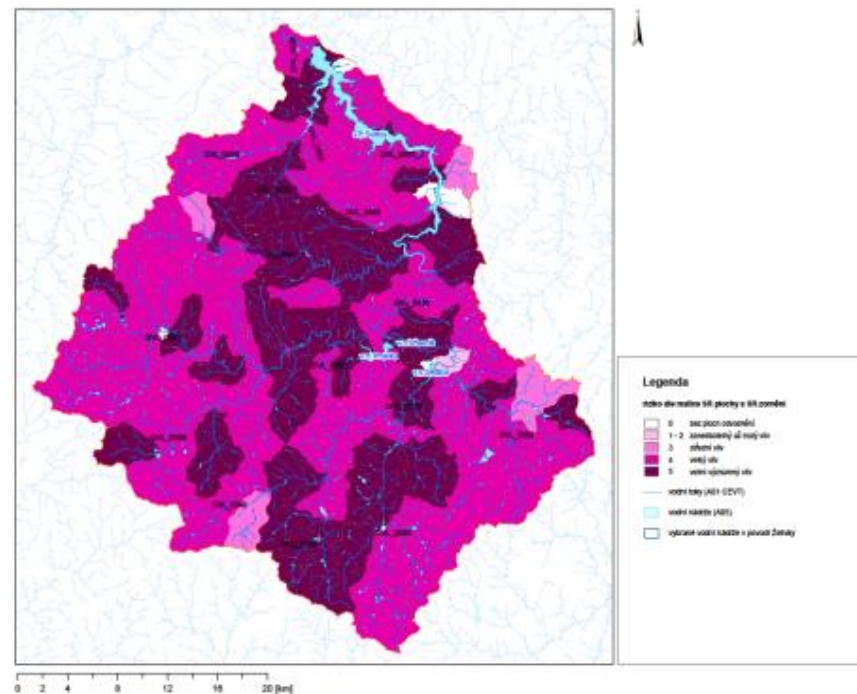
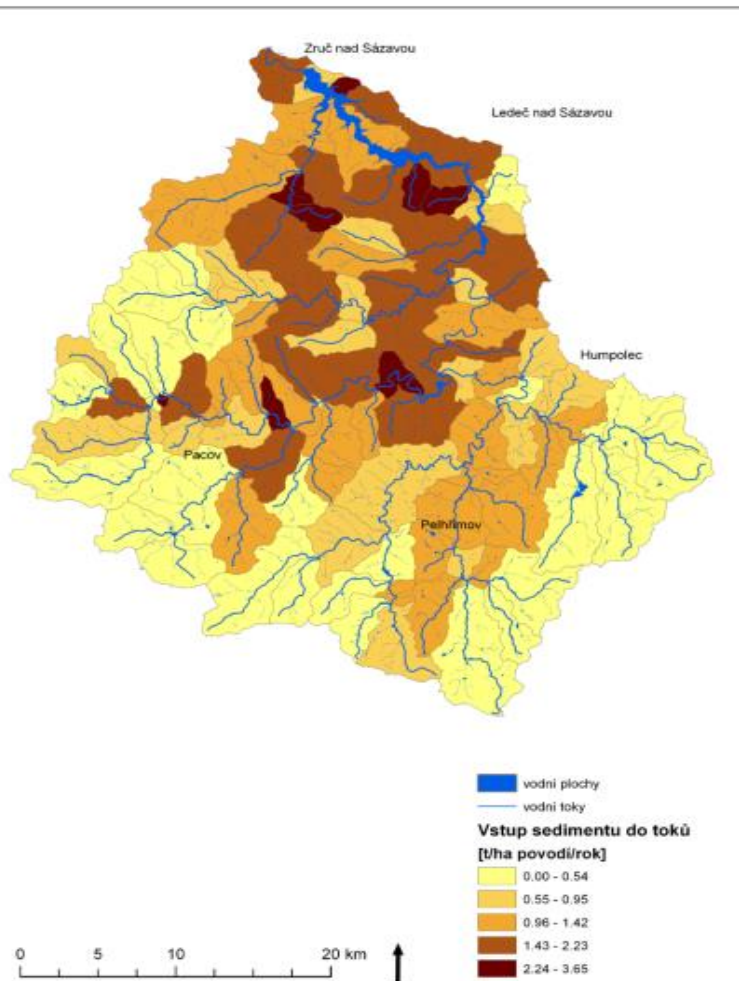
**Small water reservoir**



# Measures localization in partial Želivka river basin (brown and dark pink colour)

**Surface water vulnerability** from erosion in catchment IV. order

**Subsurface water vulnerability** from drainage in catchment IV. order (system)

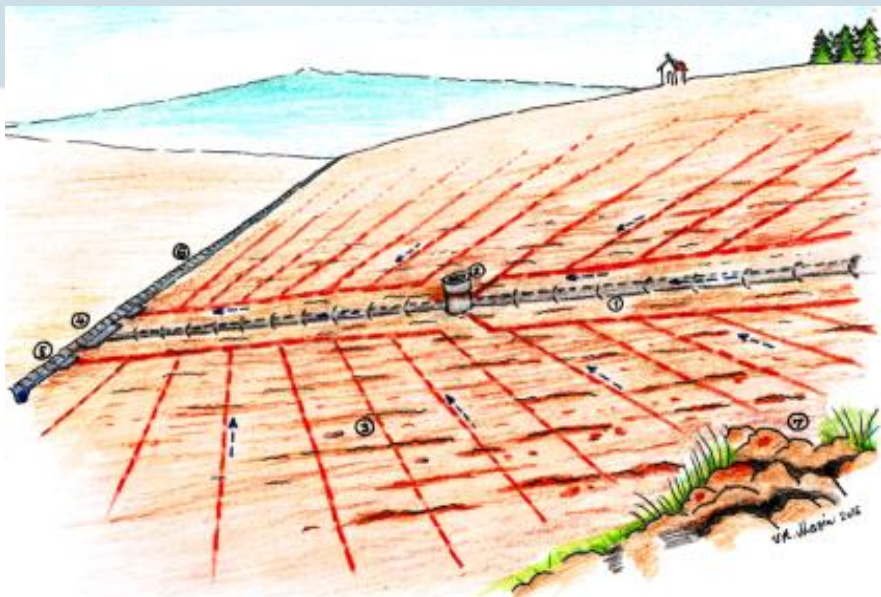




## Vision

Situation before and after realization protection measures of our project

### Now



### After



Thank you