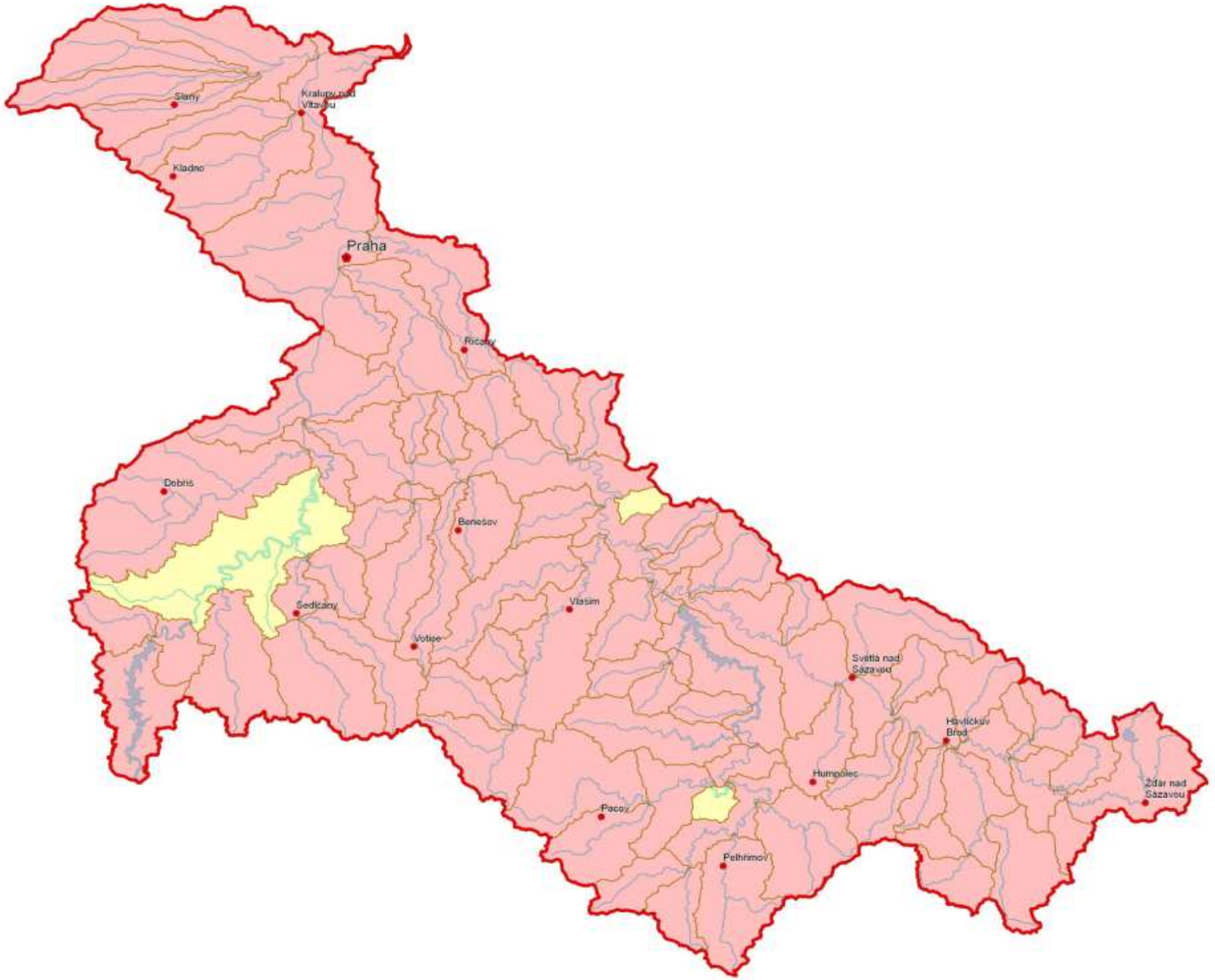
Project proposal of wetlands within the Želivka watershed

Ing. Markéta Hrnčírová

Ing. Jiri Holas,CSc.

A.R.C., spol. s r.o.

The River Basin of Lower Vltava



- hlavní město
- obce s rozšířenou působností
- hranice oblasti povodí
- hranice útvarů povrchových vod
- vodní nádrže
- vodní toky - sledované

Syntéza celkového stavu

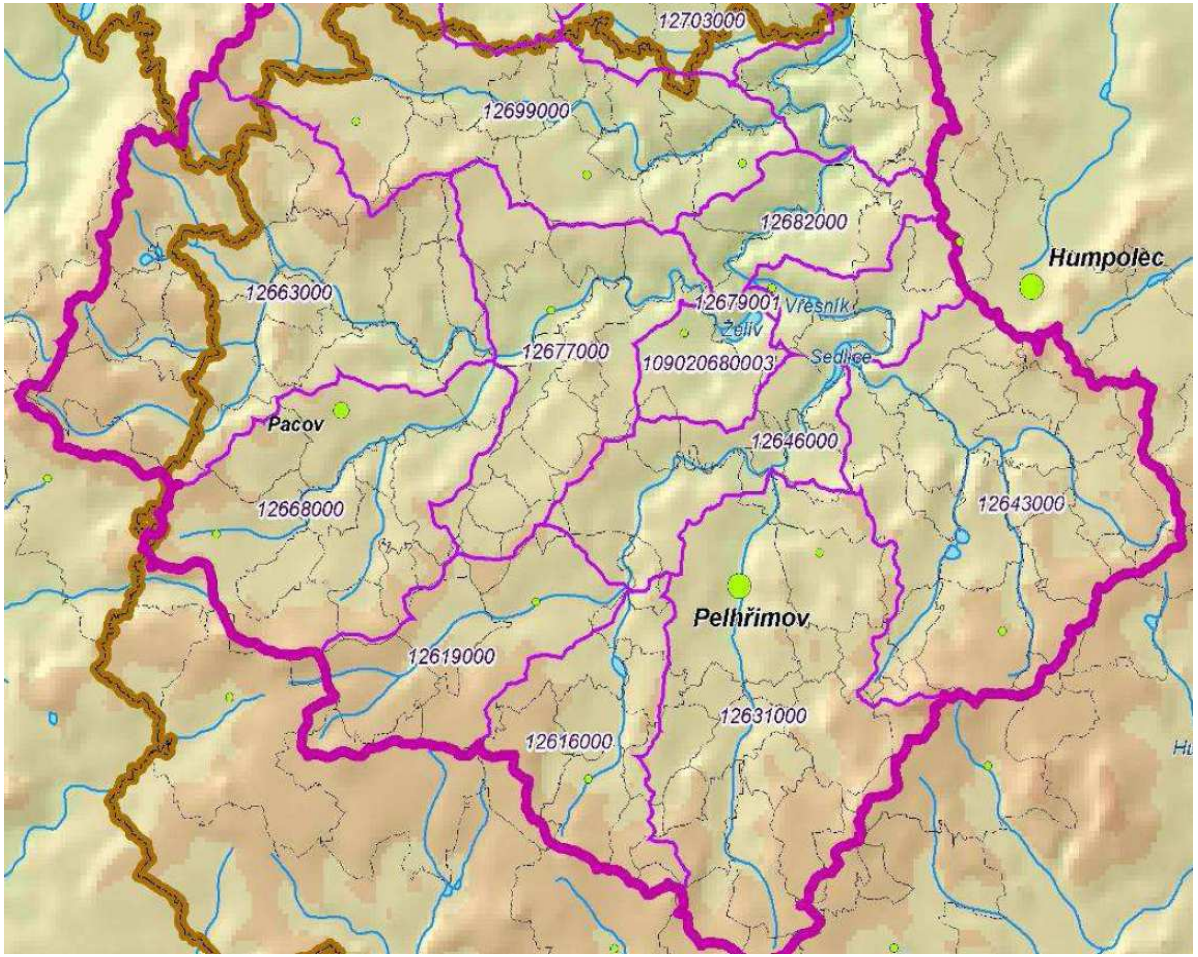
- nevyhovující
- potenciálně nevyhovující
- vyhovující

1:500 000

0 5 10 20 30 km

C.13 - Vyhodnocení stavu
- celková syntéza
- povrchové vody

Water bodies of Trnava and Bělá designated in the dRBMP of Lower Vltava with not achieved good status



mezinárodní seminář a workshop
11. a 12. února 2009
Magistrát hlavního města Prahy
Mariánské nám. 2, Praha 1

Voda v krajině – Management kvality a trvale udržitelného využívání

Paradigma trvalé udržitelnosti vodního zdroje Želivka

Generální partner:

VEOLIA VODA

Partneři:

ČISTÁ ŽELIVKA · CzWA · ACE · CES · PRAHA PRAGUE PRAGA PRAG · ENSTRAS, Ltd. · NIKA

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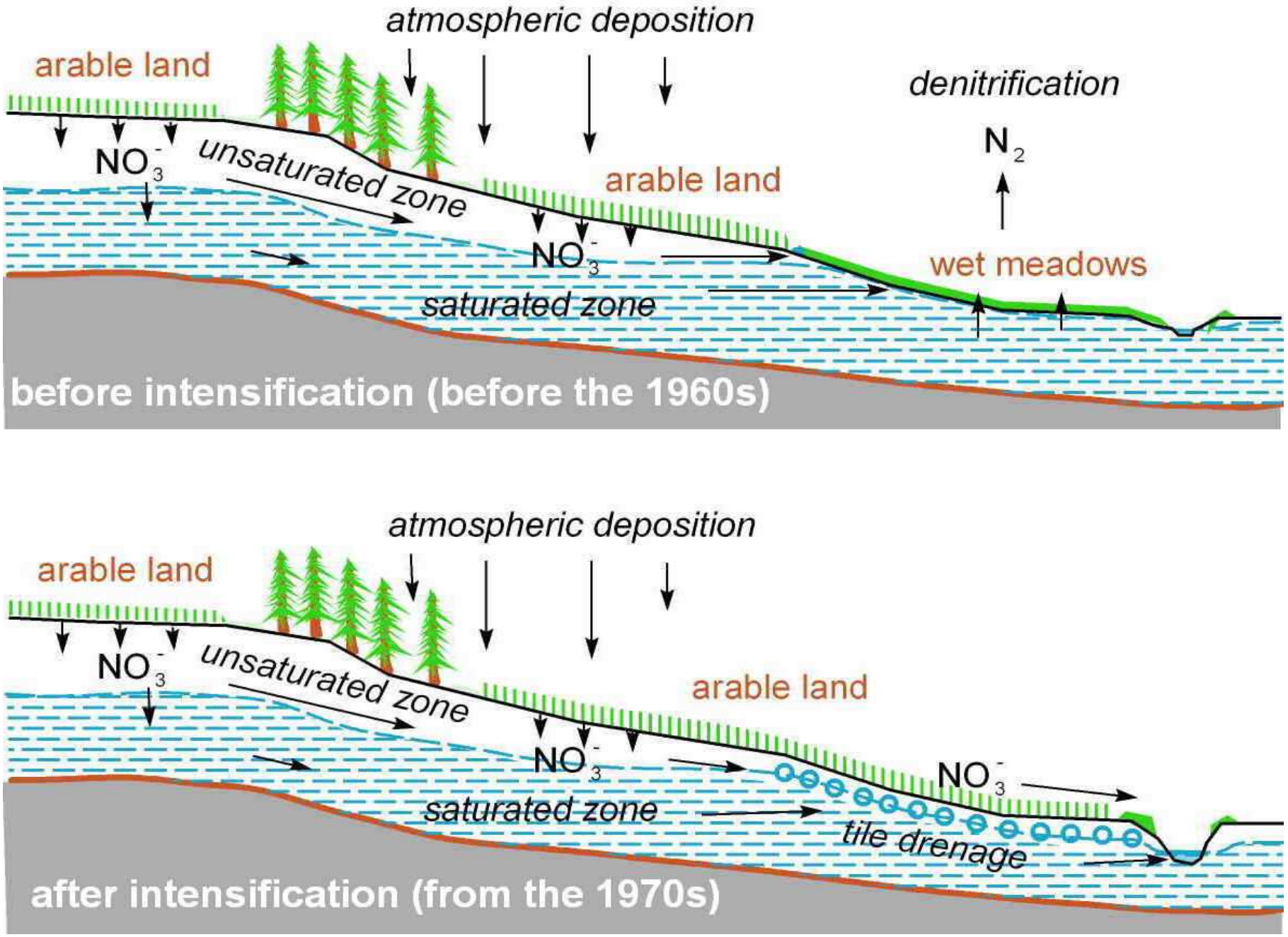

atmospheric deposition
arable land
denitrification
N_2
NO_3^-
unsaturated zone
arable land
NO_3^-
wet meadows
saturated zone
before intensification (before the 1960s)
atmospheric deposition
arable land
NO_3^-
unsaturated zone
arable land
NO_3^-
NO_3^-
saturated zone
tile drenage
after intensification (from the 1970s)

Land use planning in accordance to dRBMP of Lower Vltava

Wetlands are natural sinks of nutrients

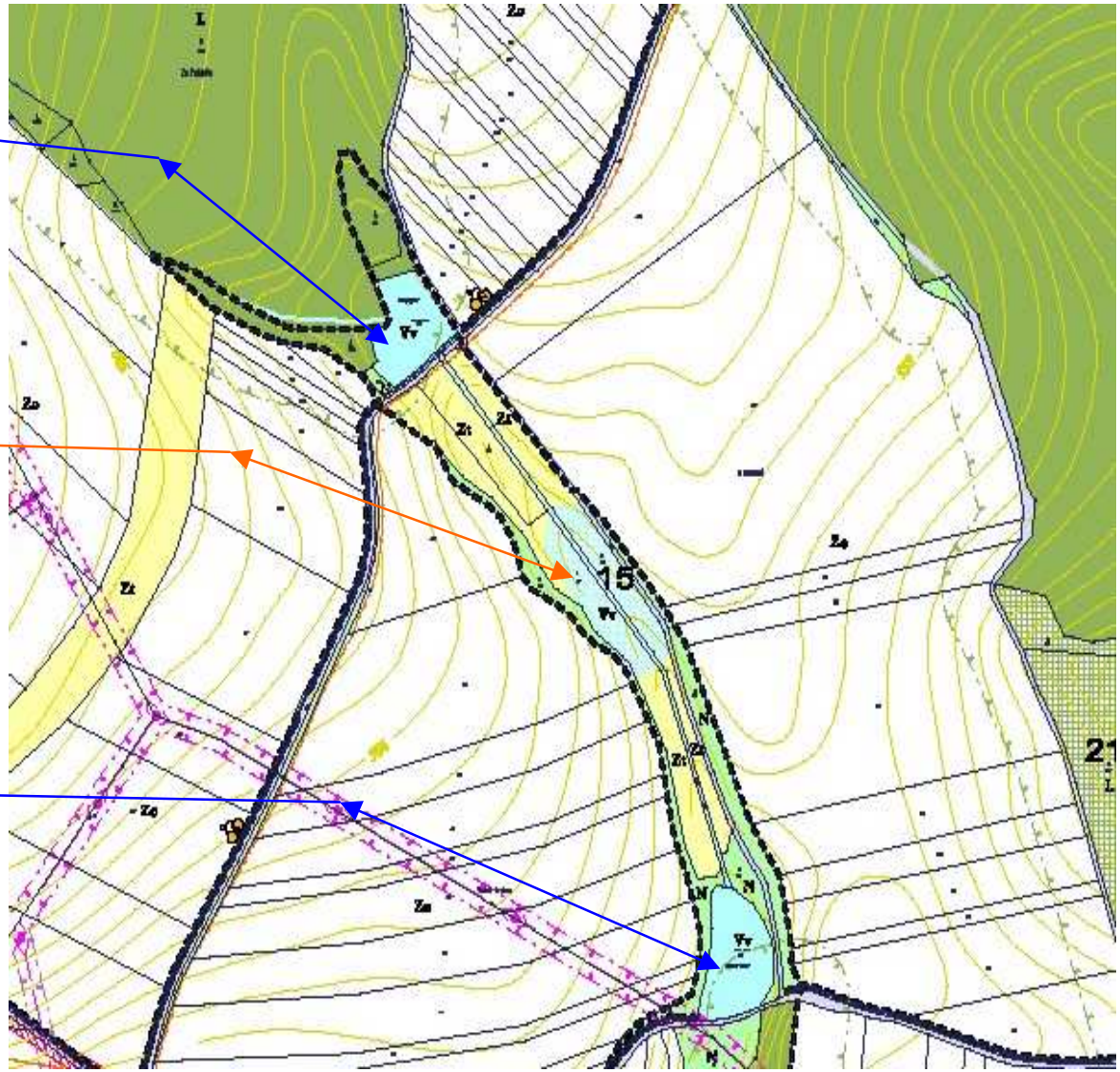
Buffers and soil erosion control

Landscape revitalization in the surroundings of village Techobuz

Existing pond with littoral zone

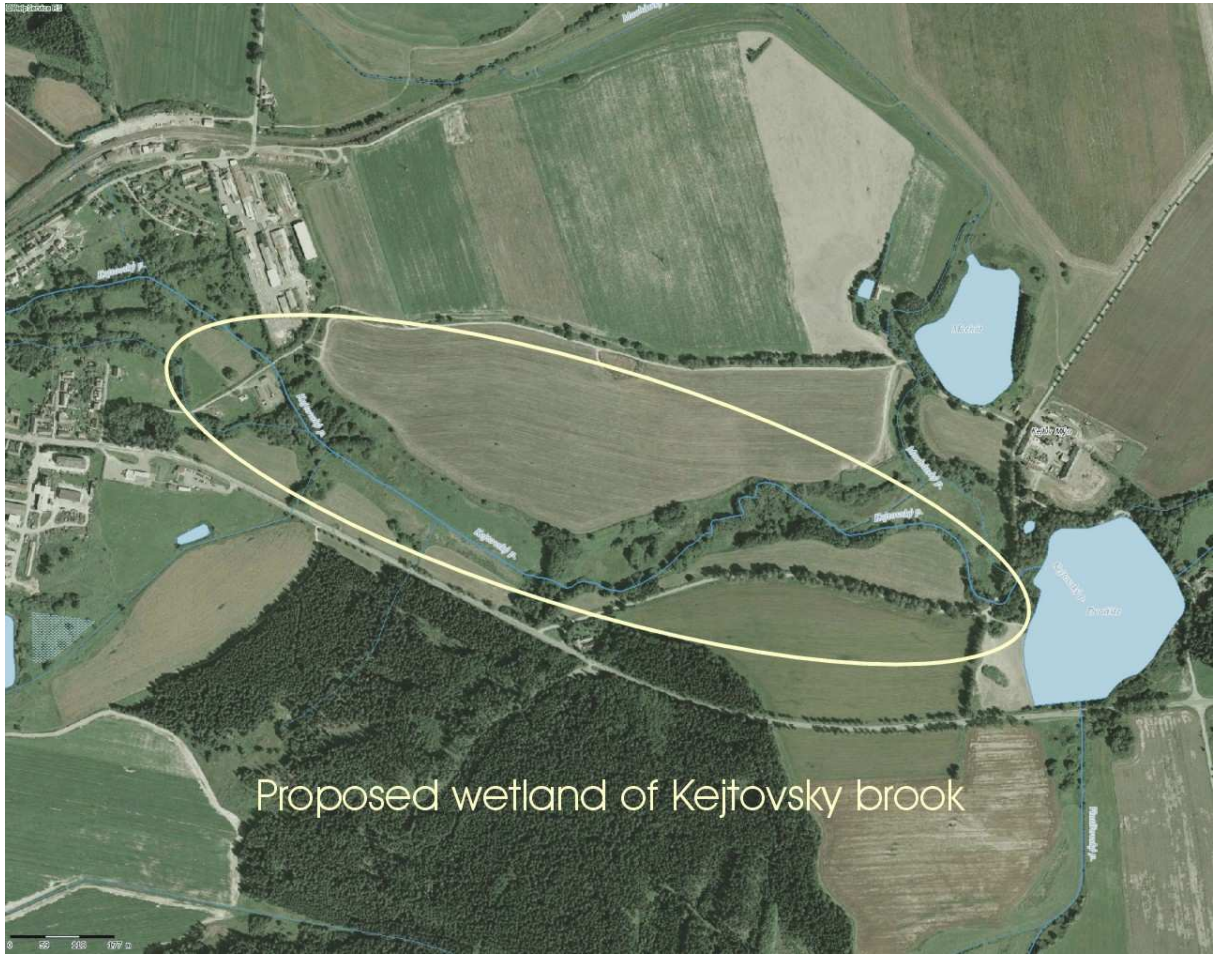
Newly proposed pond to prevent water flood

Existing pond with soil run off from the agricultural land



Rapidly grown plants as a soil runoff prevention

Other restoration projects within the Zelivka watershed not mentioned in dRBMP



How to construct new wetlands within the restoration projects?

A/ low dry polder with permanent flooded -swamped land

B/ old pond reconstructed to shallow particular swamp

C/ small impounding weir on the side tributary

D/ construction of new wetland by low new rampart across bottom land

E/construction of new wetland by surface taking away of soil layer, while leaving of some low islands

F/construction of wetland by irregular excavation of banks of the brook

Definition of natural wetland

- Wetland could be defined as permanently flooded, swampy land, but it is not lake, reservoir or river watershed. Land with shallow water, about 0,6 m or swamp with ground water level about 0,2 m.
- Water level depth varies in its parts forming various biotopes on the terrain, forming transitional environment between land and water which is appreciated and needed for various biological biodiversity of life forms.
- Flooded land (0-0,6 m depth) is convenient for submersed vegetation, swamped land is convenient for wetland vegetation. Besides these two main types of wetland environment there additionally could be combined with some isolated small low islands and some deep pools in wetlands.

Some technical parameters of natural wetlands

- Total area of the wetland
- Surface area of active wetland
- Surface area of coherent land
- Length of riparian line
- Retention capacity
- Flood load and flood retention capacity

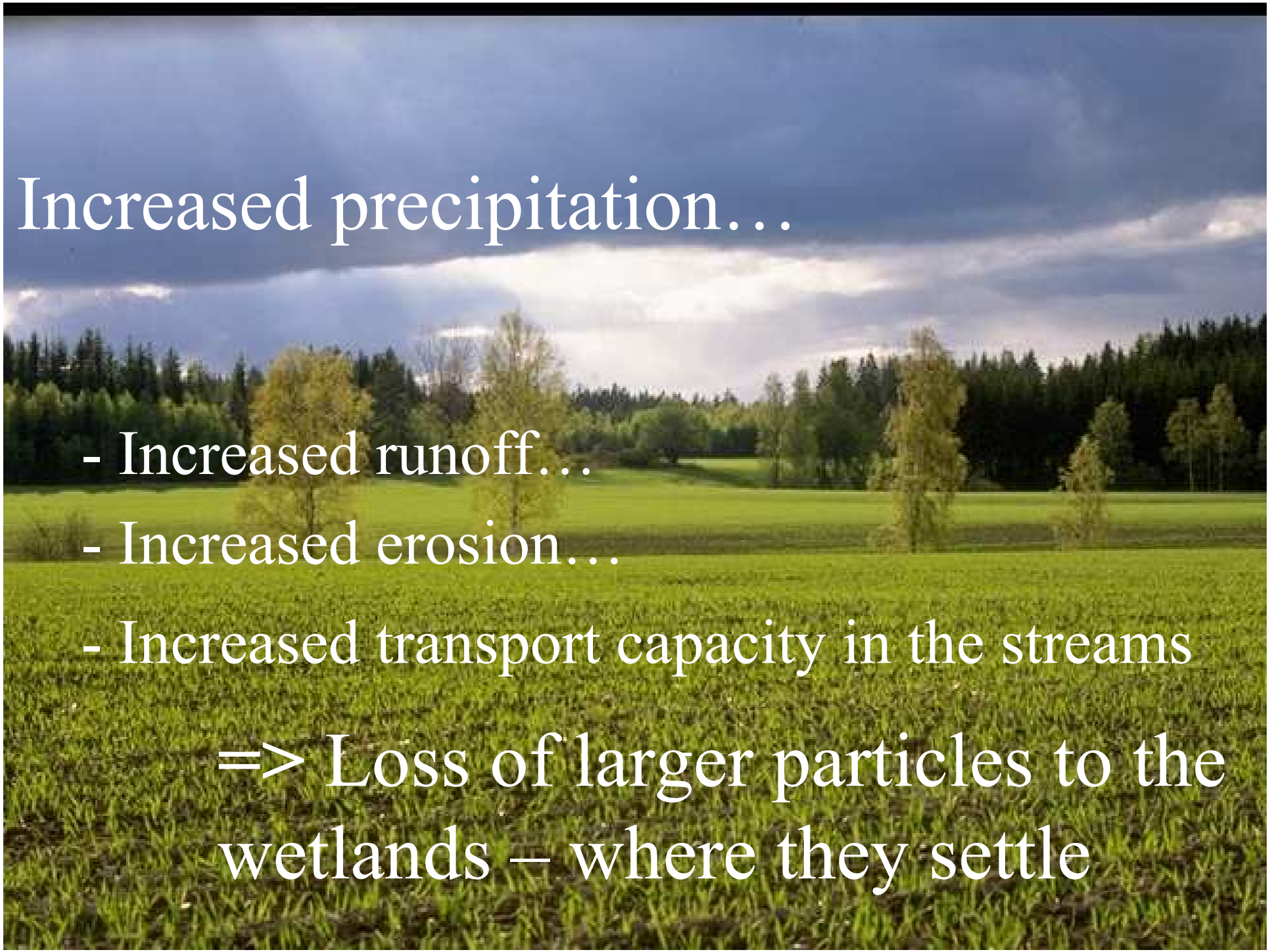
Ecological functions of natural wetlands

- Enhancing biodiversity
- Retention of water in the landscape
- Retention and fluiding of stormrunoff and floods
- Slowing the watercourses load
- Evapotranspiration improving local climate
- Stabilisation of ground water level
- Capture of CO2 into sediments
- Production of biomass

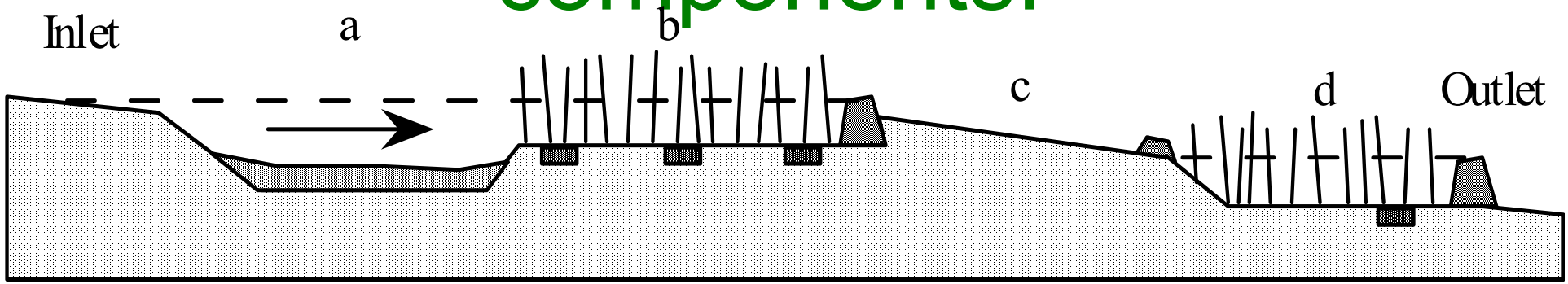
Water 2009-presentation of Dr. Bent Braskerud named „ Use of small constructed wetlands in agricultural watersheds“

Long time research experiences-retention results of soil, nutrients, pesticides in small constructed wetlands in Norway

results presented by Dr. Braskerud from Bioforsk Institute


Increased precipitation…
- Increased runoff…
- Increased erosion…
- Increased transport capacity in the streams
=> Loss of larger particles to the wetlands – where they settle

Typical Norwegian wetland components:



Sedimentation pond (1-2 m)

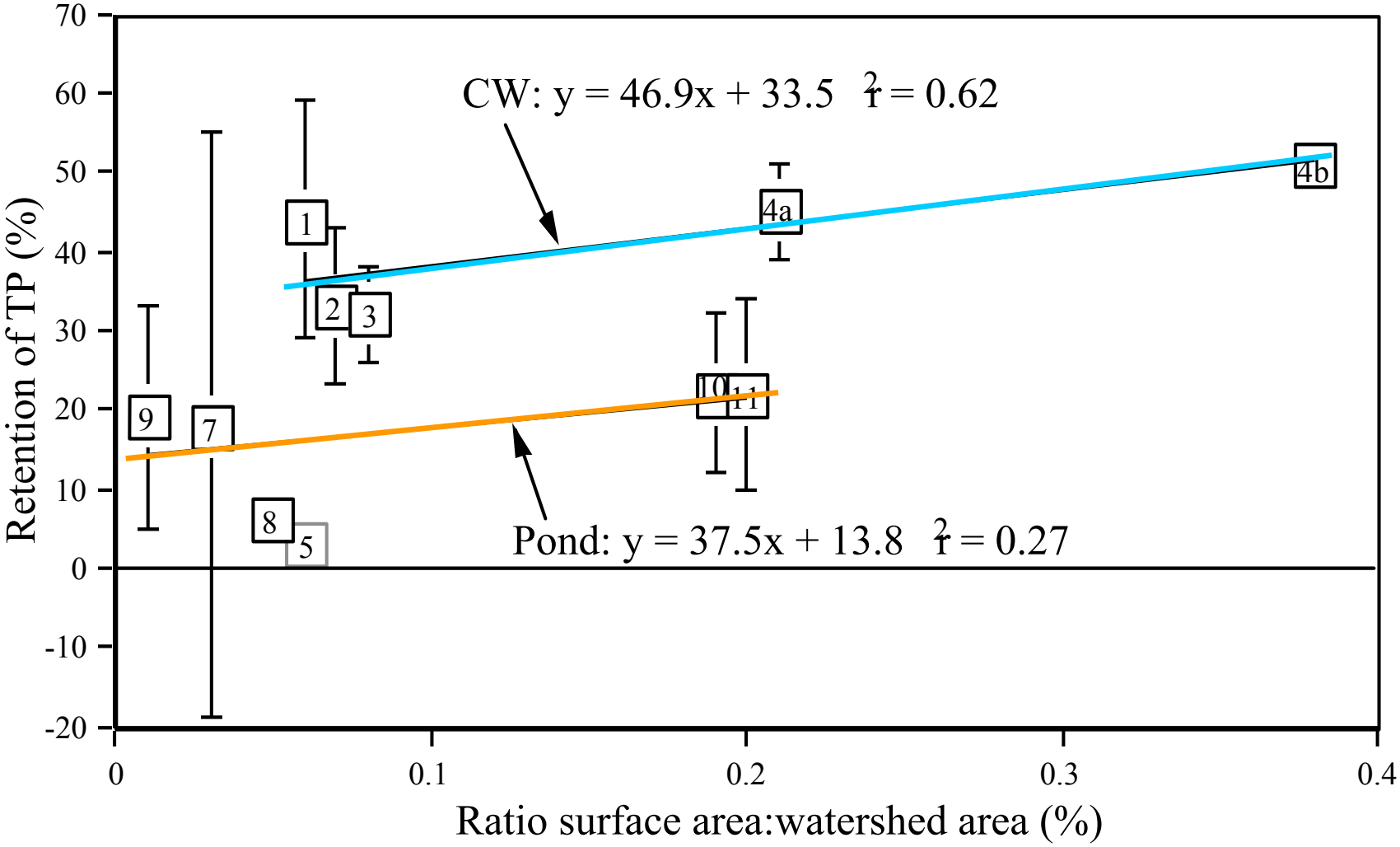
Vegetation filters (0.3-0.5 m)

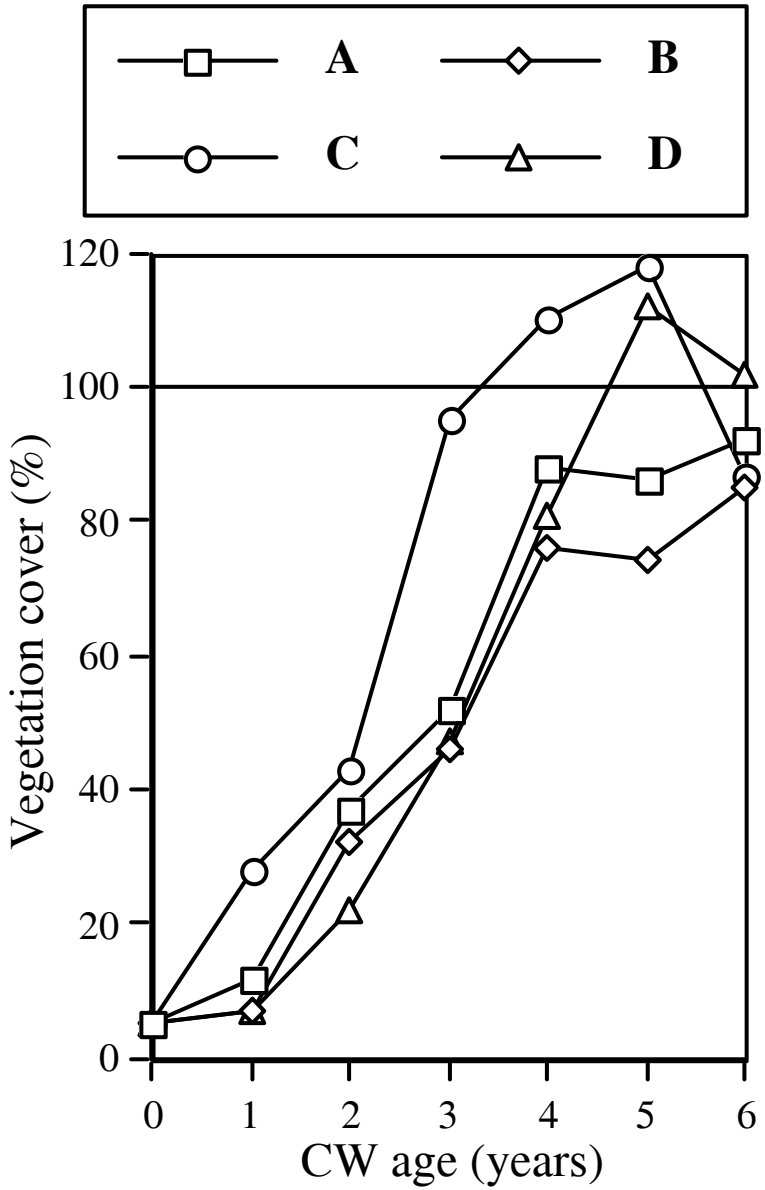
Overflow zones (0-0.1 m)

Vegetation filter

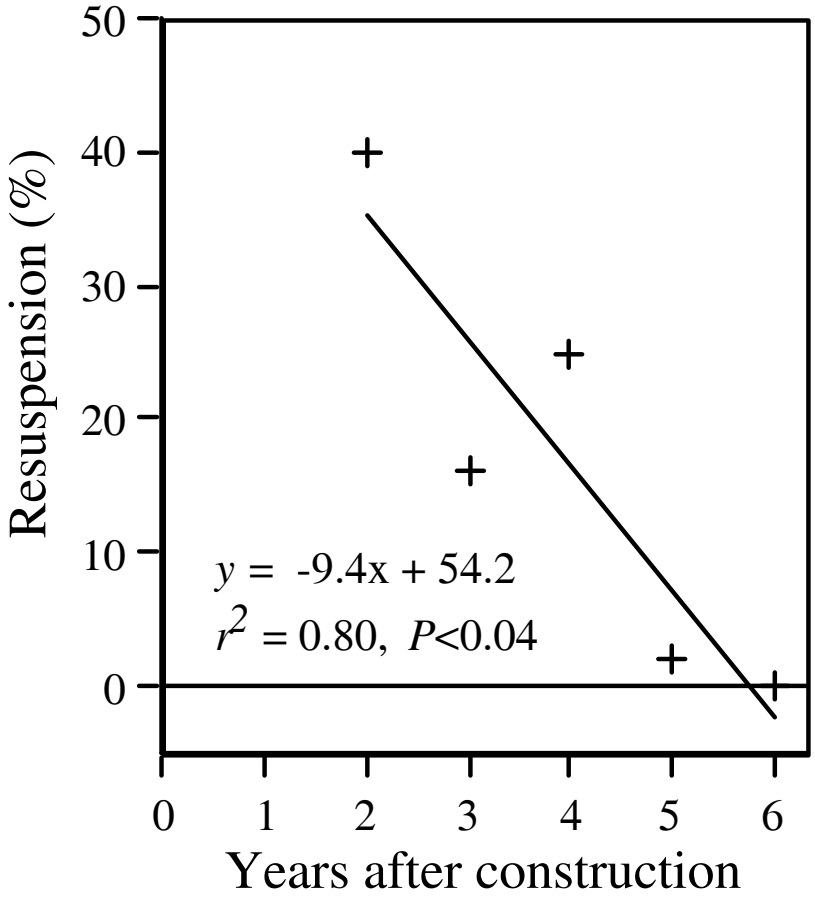

Small contructed wetlands retention results
The wetland retention performance is very dependent of the soil and P-loss from the watershed!

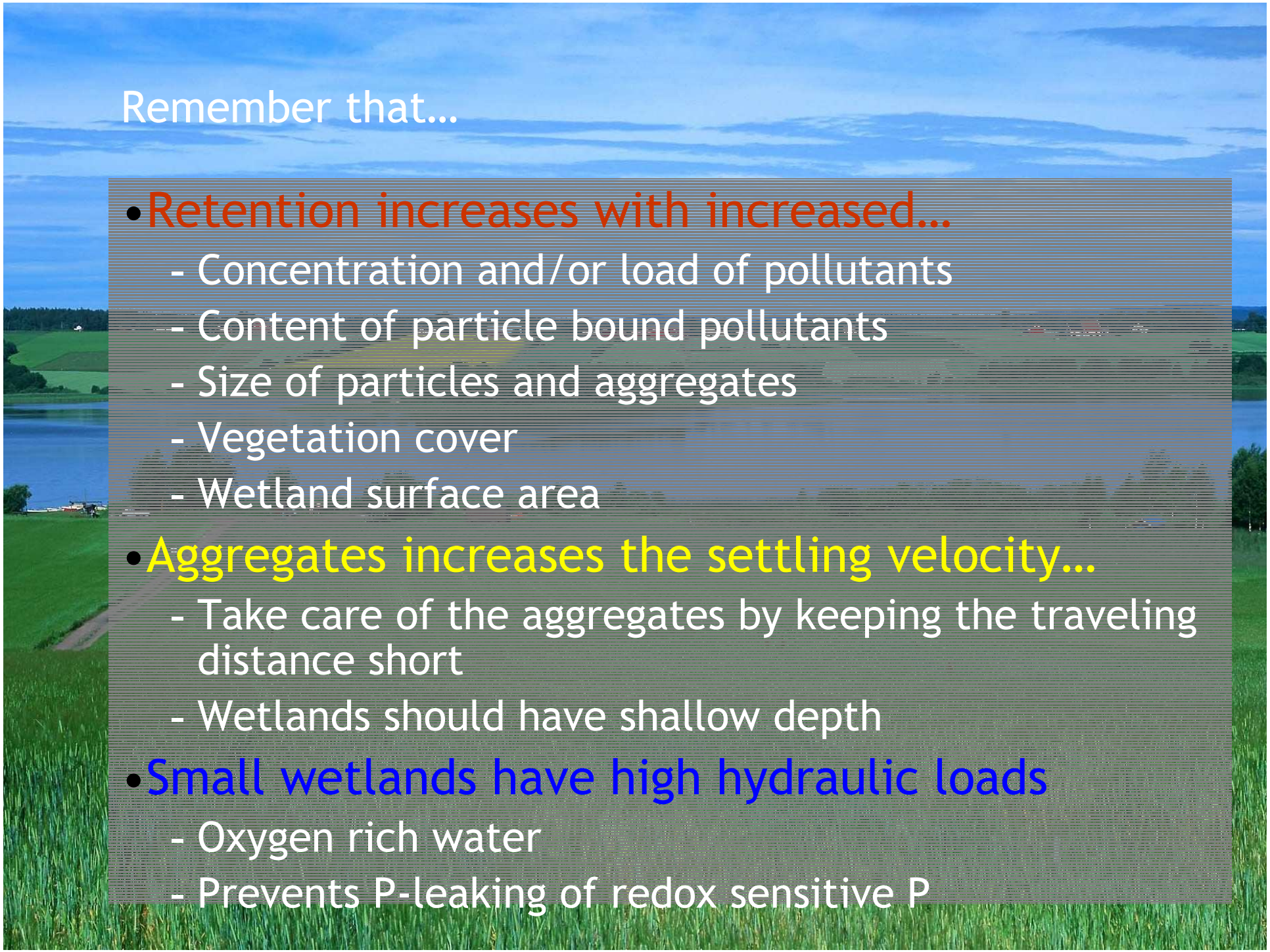
Pond or wetland?





Vegetation stops resuspension





Remember that…

- Retention increases with increased…
  - Concentration and/or load of pollutants
  - Content of particle bound pollutants
  - Size of particles and aggregates
  - Vegetation cover
  - Wetland surface area
- Aggregates increases the settling velocity…
  - Take care of the aggregates by keeping the traveling distance short
  - Wetlands should have shallow depth
- Small wetlands have high hydraulic loads
  - Oxygen rich water
  - Prevents P-leaking of redox sensitive P

Possibilities of constructed wetlands use in natural technologies of waste water treatment (vegetation root filters)

There is a trend to use natural ways in waste water treatment technology, namely for isolated buildings and small settlement. Natural WWTP (wetland vegetation) are succesfully used also for part or all villages up to 500-1000 inhabitants in localities, where they bring ecological and economical benefits in comparison with construction and use of common technology WWTP (mechanical and biological waste water treatment).

Natural processes

- In natural technologies are successfully used natural biochemical processes known from water and wetland environment, improved for better retention of pollutants from waste waters.
- Physical and chemical processes
- Micro-organisms
- Plants and Animals

These natural cleaning processes are stimulated and controlled by designing natural like ecosystems.

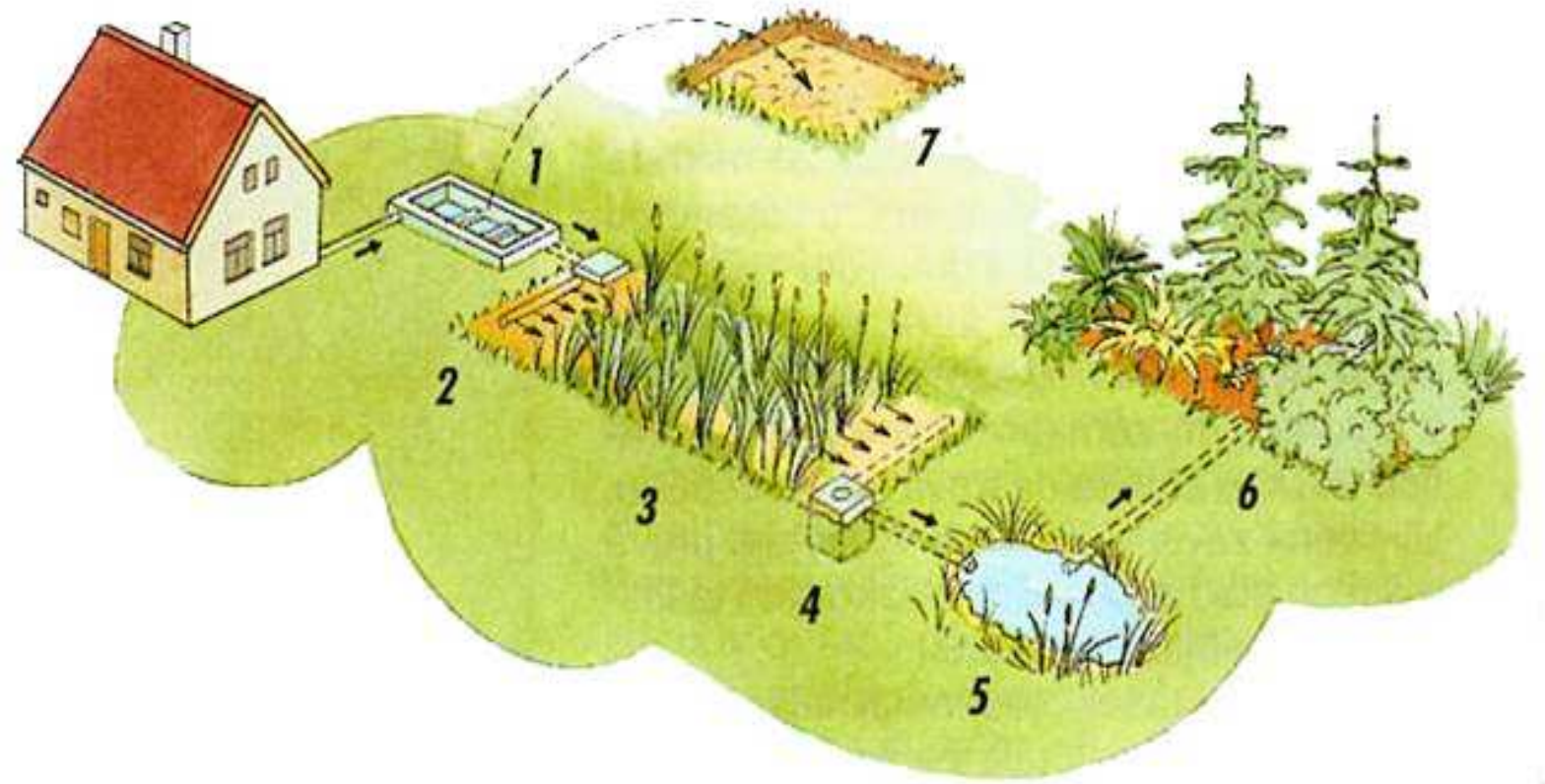
- Micro- organisms are playing main role in these natural cleaning processes similarly to soil filters. Wetland ecosystems use additional nutrient uptake directly by wetland plants.
- Finalising of cleaning processes is designed to plant uptake by wood species and other plants, flowered by precleaned water from wetland. Very important part of these natural technology is composting of sludge or its direct disposal for fertilised plants.

Construction of small natural waste water treatment plant benefits

- Treatment of waste waters from isolated buildings, recreational and seasonally used buildings (cottage houses, pensions, hotels, restaurants, summer camps), where it is complicated to connect sewerage drain to public sewer system and use central WWPT,
- Treatment of not heavily organically polluted waste waters from farms, farmhouses, keeper houses etc.
- Final treatment of wastewaters behind mechanical and biological cleaning technology of common WWPT.
- Natural WWTP without outlet is possibility not to deteriorate water quality in upper parts of watercourses which are very vulnerable to any waste water discharges.

Required Perfect status of small pollution sources – Natural WWTP without outlet by

to seasonally inhabited building



Legend to the previous picture

1/ three cellular septic tank

2/ distributing system

3/ constructed wetland with appropriate swampy vegetation

4/outlet control shaft

5/final cleaning in decorative little pond

6/watered area with wood plants and bushes

7/composting place or area for sewer application fertilising plants

Preferences of natural ways of waste water treatment

- Natural aesthetically acceptable look in the landscape, ecologically increasing biodiversity
- Construction could not so much cost–demanding and time consuming, nearly maintenance free
- Silent, reliable operating, allows cleaning process interruptions, low loads, concentrations
- Retention of water in the land, increased evapotranspiration
- Retention results are good,also good is retention of nutrients by plant in-take
- Long operation durability

Deficiencies of natural ways of waste water treatment

- Bigger area requirement (EU directive - Cooper 1991 – average 5 m2 per 1 EO)
- Some dependence of cleaning efficiency depending on weather and climate
- Possibility of colmatage of filtering environment due to insufficient mechanical pre-cleaning of waters
- Natural waste water treatment plant technology for particular place should be designed or considered by expert or experienced designer to eliminate project deficiencies

Thank you for your attention