North East South West
INTERREG IIIC

Southern Moravia Region

WATER AROUND US

Water is an essential requirement for life. Water is an important component of the bodies of plants and animals and it is also the environment for many important processes. Demands on water resources are growing along with increasing human population and agricultural and industrial development. **Therefore, it is important to respect and appreciate water, use it with wisdom and protect it from contamination with waste waters and other adverse impacts.** Each country has its own regulations and authorities taking care of water quality and remedial measures. However, international cooperation is needed to solve all problems of water contamination.

WATER CONTAMINATION

Types of contamination

I. Short term (accidental) and long term contamination

Accident (spills of oil, solvents, chemicals or faecal contamination) has often rapid and disastrous impact (such as death of living organisms ...). On the other hand, it only lasts for a short time.

Long term contamination can be eliminated by self purification of the stream. However, in many cases it might negatively affect the water environment (e.g. extinction of some fish species).

II. Physical, chemical and biological contamination

Physical – mechanical changes in the river basin, changes in water temperature and flow capacity, removal of bank vegetation.

Chemical – petroleum, detergents (mainly for washing machines and dishwashers), fertilizers, pesticides, heavy metals, discharges of waste waters, runoffs and leakage from the fields, farms and landfills.

Biological – unnatural trees on the river banks, too many fish, decaying organic materials (odour, manure).

Radioactive contamination – may rarely occur for example in proximity to uranium processing plants or in the case of accident

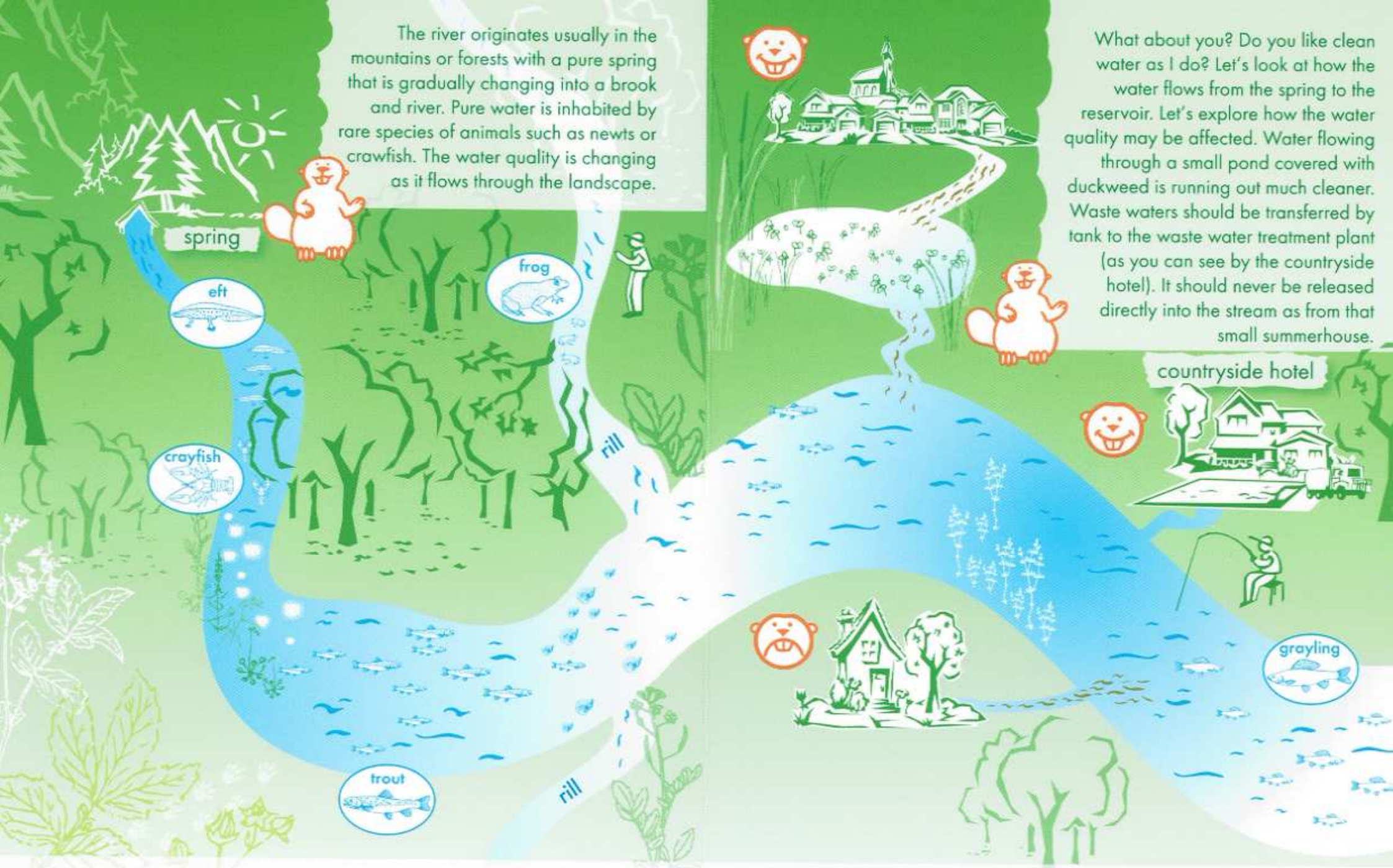
Nutrient contamination – in particular nitrogen and phosphorus.

III. Categorization according to sources – natural, anthropogenic.

IV. Categorization based on spatial characteristics of the contamination source – spread or diffuse – runoff from fields, line, point – discharge from waste water treatment plants.

The river originates usually in the mountains or forests with a pure spring that is gradually changing into a brook and river. Pure water is inhabited by rare species of animals such as newts or crawfish. The water quality is changing as it flows through the landscape.

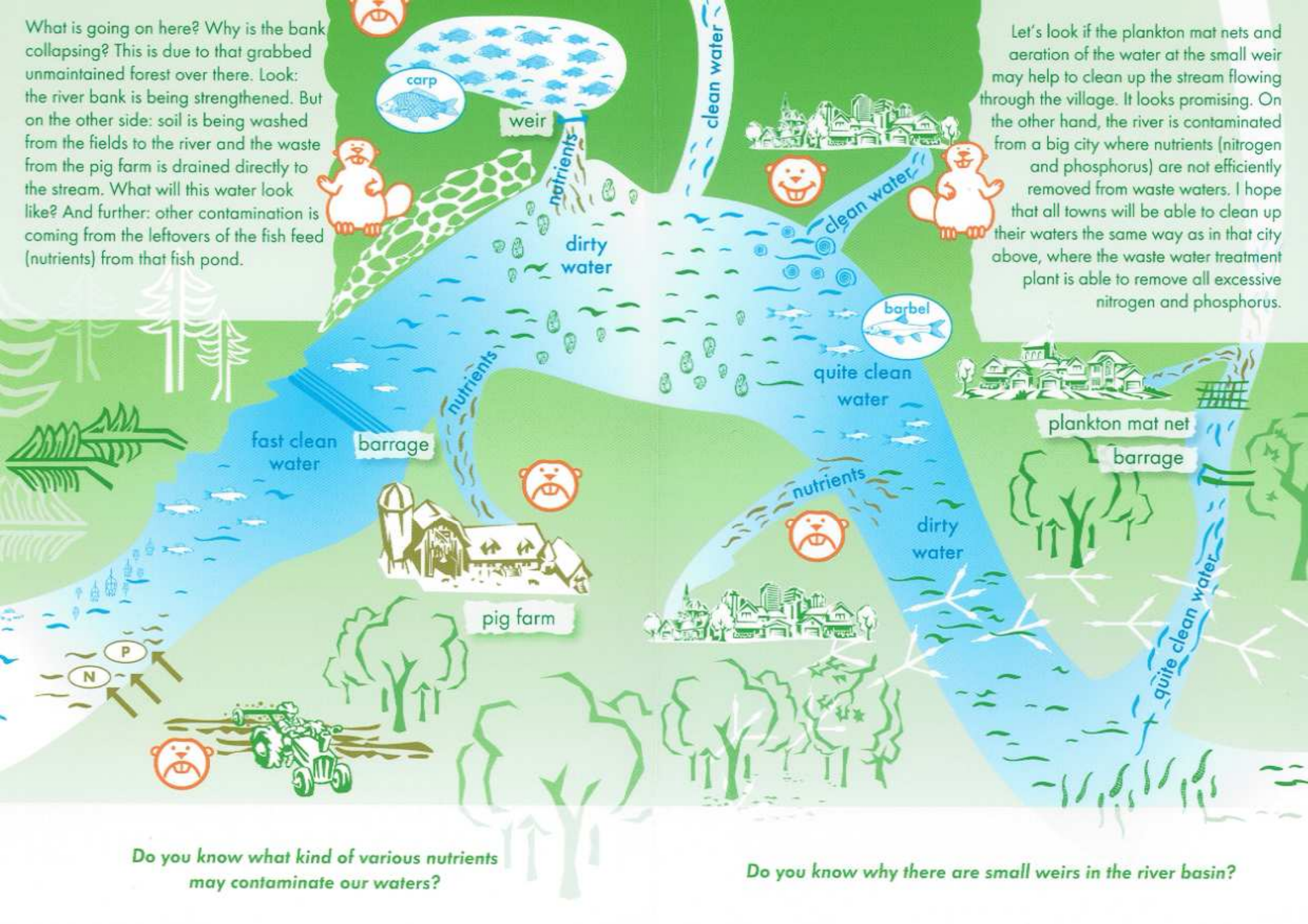
What about you? Do you like clean water as I do? Let's look at how the water flows from the spring to the reservoir. Let's explore how the water quality may be affected. Water flowing through a small pond covered with duckweed is running out much cleaner. Waste waters should be transferred by tank to the waste water treatment plant (as you can see by the countryside hotel). It should never be released directly into the stream as from that small summerhouse.



Do you know why the clean water is called "trout water"?

What species of fish can be caught in this water? Can they be eaten?
Do you know that water can remove small amount of contamination by itself? This is called self-purification.
Why do people grow duckweed in their small ponds?

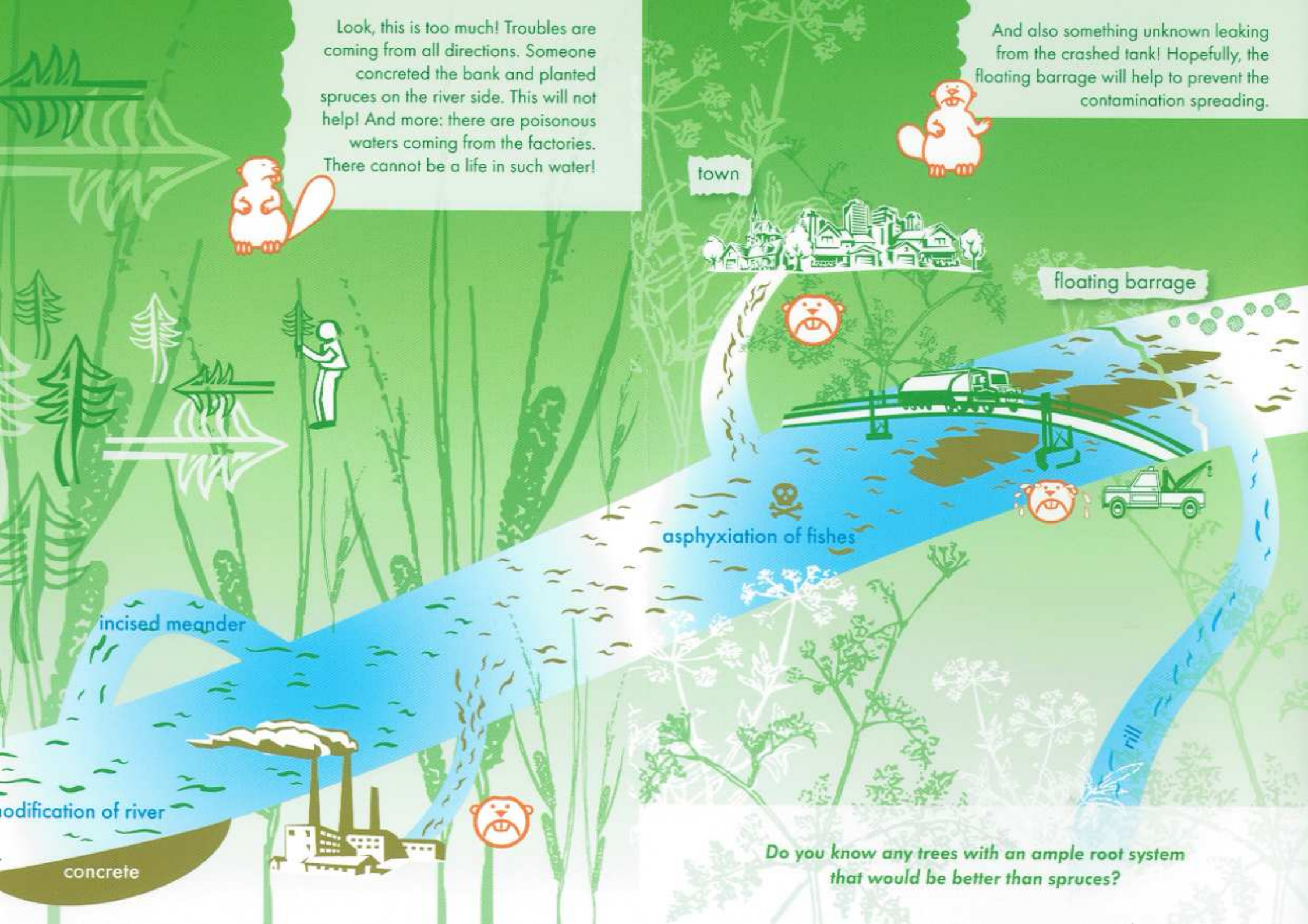
What is going on here? Why is the bank collapsing? This is due to that grabbed unmaintained forest over there. Look: the river bank is being strengthened. But on the other side: soil is being washed from the fields to the river and the waste from the pig farm is drained directly to the stream. What will this water look like? And further: other contamination is coming from the leftovers of the fish feed (nutrients) from that fish pond.

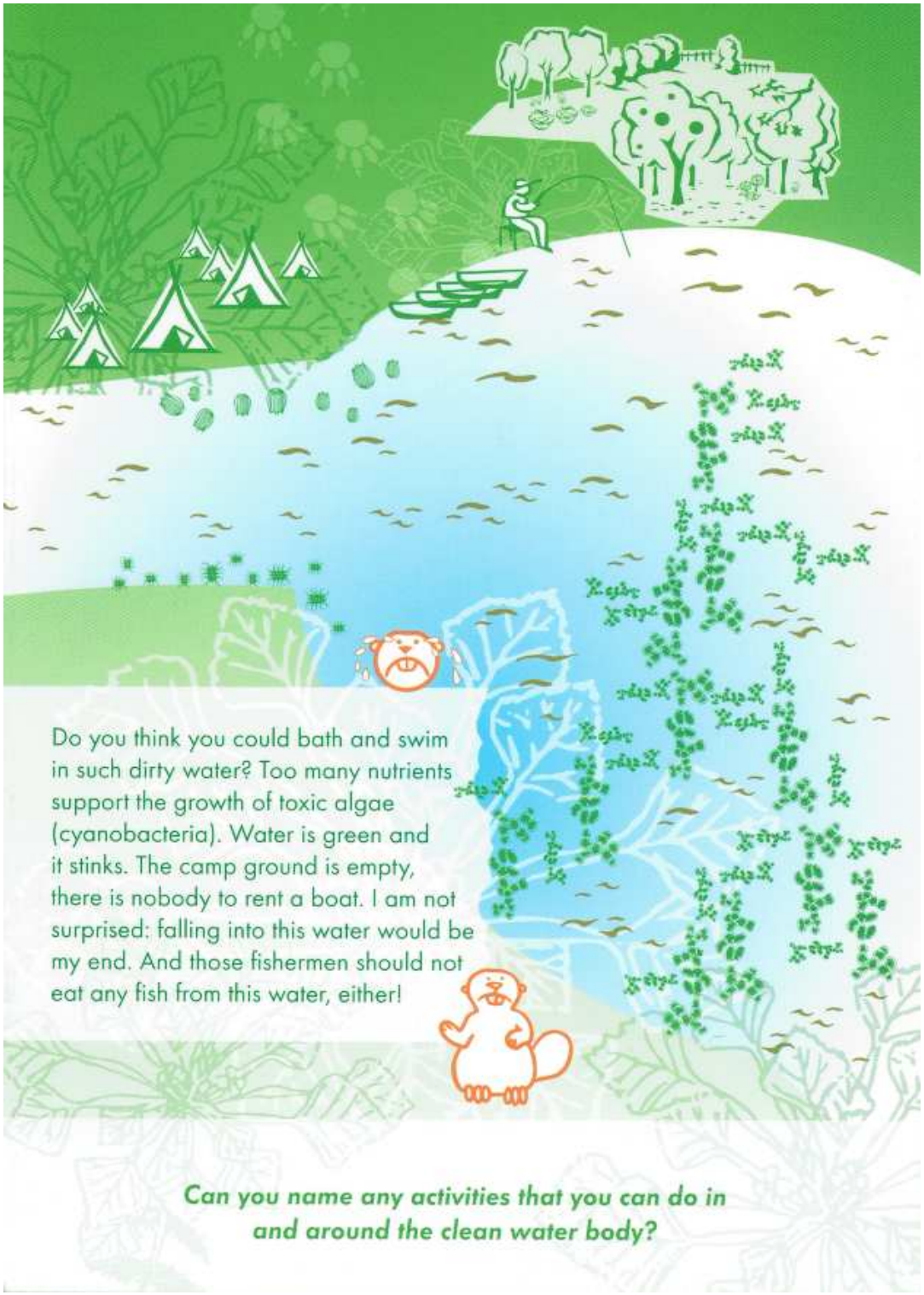


Let's look if the plankton mat nets and aeration of the water at the small weir may help to clean up the stream flowing through the village. It looks promising. On the other hand, the river is contaminated from a big city where nutrients (nitrogen and phosphorus) are not efficiently removed from waste waters. I hope that all towns will be able to clean up their waters the same way as in that city above, where the waste water treatment plant is able to remove all excessive nitrogen and phosphorus.

Do you know what kind of various nutrients may contaminate our waters?

Do you know why there are small weirs in the river basin?


Look, this is too much! Troubles are coming from all directions. Someone concreted the bank and planted spruces on the river side. This will not help! And more: there are poisonous waters coming from the factories. There cannot be a life in such water!
And also something unknown leaking from the crashed tank! Hopefully, the floating barrage will help to prevent the contamination spreading.
town
floating barrage
asphyxiation of fishes
incised meander
odification of river
concrete
rill
Do you know any trees with an ample root system that would be better than spruces?



Do you think you could bath and swim in such dirty water? Too many nutrients support the growth of toxic algae (cyanobacteria). Water is green and it stinks. The camp ground is empty, there is nobody to rent a boat. I am not surprised: falling into this water would be my end. And those fishermen should not eat any fish from this water, either!

Can you name any activities that you can do in and around the clean water body?

polluted, stunk, green water

What a great idea! Let's look at how to clean up the pond. The dredging boat sucks the mud loaded with nutrients brought by the river. Finally, toxic algae will not grow here anymore. Without cleaning, nutrients and algae would continue to be released from sediments into the water. Aeration of waters by bubbling will also improve life of fish in the pond.

Water can also be cleaned up using special remedies that eliminate the toxic cyanobacteria or limit their growth. **However, the most important thing is to reduce sources of contamination of the river.** Because even after this special treatment, cyanobacteria can grow back very fast if they still have enough nutrients.

Do you know how to recognize toxic blue-green algae (cyanobacteria)? Fill the plastic bottle with water from the pond and let it settle for about 15 minutes. It is cyanobacteria if there is a green ring near the water level. On the other hand, greenish colour distributed throughout the entire water volume indicates green algae that are not so hazardous.

Do you remember what were the main sources contaminating the river?

small reservoir

I am so happy I could also help! I have built a dam on the river inflow and contaminated mud cannot get into the main reservoir with cleaned up water. Bank reeds also help to keep the water clean.

clean water

carp

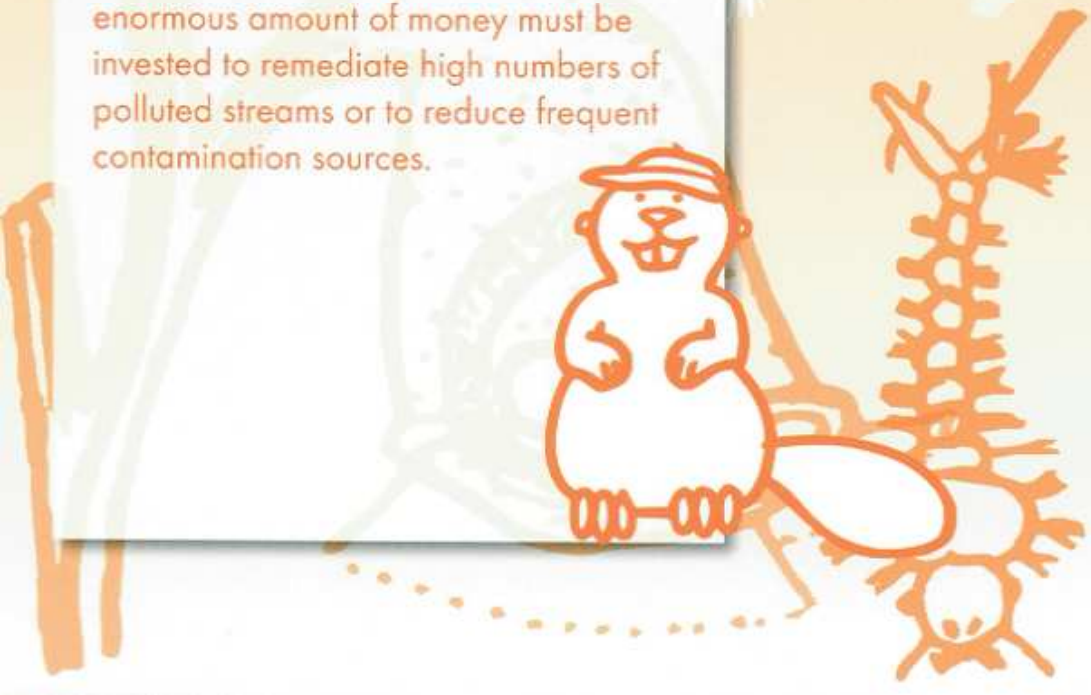
Do you know how reeds and bank vegetation can help to clean the water?

Well, everything turned out fine: we can swim again! **We must care not only about the reservoir but also about the river.** As you could see: cleaning of the water is demanding and not always successful. **That's why it is much better not to pollute the water in the first place!**

CYANOBACTERIAL (BLUE-GREEN ALGAL) WATER BLOOMS

Cyanobacteria (blue-green algae) affect the water quality in many reservoirs throughout the world. One of the major factors is water pollution with nutrients (so called „eutrophication" or „hypertrophication").

Prevention is considered the most efficient solution to the problem. An enormous amount of money must be invested to remediate high numbers of polluted streams or to reduce frequent contamination sources.



BANK VEGETATION

Importance of natural water and the bank vegetation

Natural water has a great importance in the landscape.
Diversion of water from the landscape, ameliorations, stream regulations and straightening, or draining of water from meadows leads to drying out of the landscape.

However! Seemingly excessive water has a great role.

Water used to be retained in natural reservoirs (wetlands, flood plains, forests).

After the stream regulations, water runs away faster than it may be evaporated, and it takes away soil leading to irrecoverable losses.

Cultivation of the bank vegetation should be based on careful maintenance. Newly planted trees and bushes should be close to natural composition without improper species such as poplars. Functional riverside vegetation eliminates soil erosion and draining of nutrients from the fields.

1. **Microclimatic function** – buffering of the temperature differences during the day, reduction of wind speed, increase of relative air humidity due to evaporation, have a positive impact on the surrounding area.
2. **Protection of soil from erosion** – stabilization of the banks by roots (namely alders, elms, ashes, willows and oaks), protection from soil and bank erosion and wash-out by running water.
3. **Filtration effect** – capture of the runoff material (soil particles, unused nutrients, residues of pesticides) from the surrounding area, namely agricultural land. Grass vegetation greatly improves the filtration ability of the streamside stand.
4. **Landscape-forming, aesthetic and recreational function** – vegetation with species and spatial richness unifies the water stream with surrounding area and leads to creation of aesthetically valuable sceneries.
5. **Homeostatic function** – water stream surrounded by stable vegetation increases the ecological stability and biodiversity in the landscape.

REMEDIAL ACTIONS

There are two classes of the remedial actions:

- methods and techniques applied in the river catchment area (above the reservoir)
- methods applied in the reservoir

Remediations in the river catchment area are the most efficient in preventing diffuse pollution. Such actions aim to retain water and nutrients in the landscape, thus eliminating the inflow of nutrients into the reservoir. Furthermore, rational farming and management of the landscape help to limit contamination.

REMEDIAL METHODS APPLIED IN RESERVOIR

Main methods used for nutrients removal from sediments:

- dredging operations (with lowered water level)
- suction dredging (normal water level)
- precipitation of phosphorus e.g. Al, Fe compounds
- changes of water flow through the reservoirs

Main methods used for the treatment of water in a reservoir with cyanobacterial water blooms:

- chemicals reducing or inhibiting growth of cyanobacteria
- chemicals precipitating cyanobacterial cells and colonies
- biological agents or water aeration

SUMMARY

To make water clean... the most important thing is to reduce sources of contamination of the river and reduce inputs of nutrients and algae from sediments into the water.

Water belongs to all of us; thus we all protect it together!

If the water in a reservoir is polluted, there are lots of methods available for reduction of cyanobacterial water blooms. The decision about which method is suitable for particular reservoir should be made by experts.

Methods must be combined, because some chemicals destroy cyanobacteria immediately, but only for a short time.

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