

For a clean river Schussen

Water is our most important nutrient. In order to keep it sustainably clean the project Schussenaktivplus started in January 2012. This research project is sponsored by the German Federal Ministry of Education and Research (BMBF) and the state of Baden-Württemberg. To get innovative but practical results, 20 partners from research, free economy, municipalities as well as state agencies and syndicates work together until 2015.

The project focuses on technologies capable to reduce the release of micropollutants and potentially pathogenic bacteria into surface waters via sewage treatment plants of different sizes and via stormwater overflow basins of different types.

The model rivers

The river Schussen is one of the most polluted tributaries of Lake Constance (a main source of drinking water). The 790 square kilometer catchment area is densely populated with 222,000 inhabitants and is heavily industrialized. Large parts of it are used intensively for agriculture, cattle breeding, and fruit-growing.

The significantly cleaner neighboring river Argen is used as a control. Preliminary studies showed the Argen to contain only about half the micropollutants of the Schussen.

For more information, please visit www.schussenaktivplus.de



Joint research

Project partners

Universität Tübingen (R. Triebkorn)

Project management, coordination, limno-chemistry, toxic and hormonal effects

Universität Frankfurt (J. Oehlmann)

Toxic and hormonal effects

KIT Karlsruhe (C. Gallert)

Antibiotic resistance of pathogenic bacteria

Universität Stuttgart (B. Kuch)

Estrogenic effects in sewage, water and sediments

Universität Brno, Tschechien (L. Blaha)

Toxic and hormonal effects

Imbe Institut Mediterranee de Biodiversite et d'Ecologie marine et continentale (M. Rault)

Environmental biomarkers and bioindicators

ISF Langenargen (H. Löffler, H. Güde, H. Hetzenauer)

Retention input, and fate of fecal bacteria

TZW Karlsruhe (M. Scheurer, D. Richter)

Chemical analysis

JuP Stuttgart (K. Jedele)

Engineering, set up and monitoring of test plants

BBW Achberg (M. Weyhmüller)

Responsible for bypass stations

GÖL Starzach (K. Wurm)

Water-ecology investigations

HYDRA Konstanz (P. Rey)

Scientific public relations

Ökonsult Stuttgart (J. Schneider-Rapp)

Communications

Steinbeis-Danube-Center (J. Raizner)

Knowledge transfer into the Danube region

RP Tübingen (H.-J. Vogel)

Co-financing and counselling

Stadt Ravensburg, AZV Mariatal (R. Jung)

Set up of test facilities at Langwiese

Eriskirch, Tettang, AV Unteres Schussental (M. Spieth)

Set up of test facilities at Eriskirch, monitoring of retention soil filter at Tettang

Gemeinde Merklingen (S. Kneipp)

Monitoring of slow sand filters

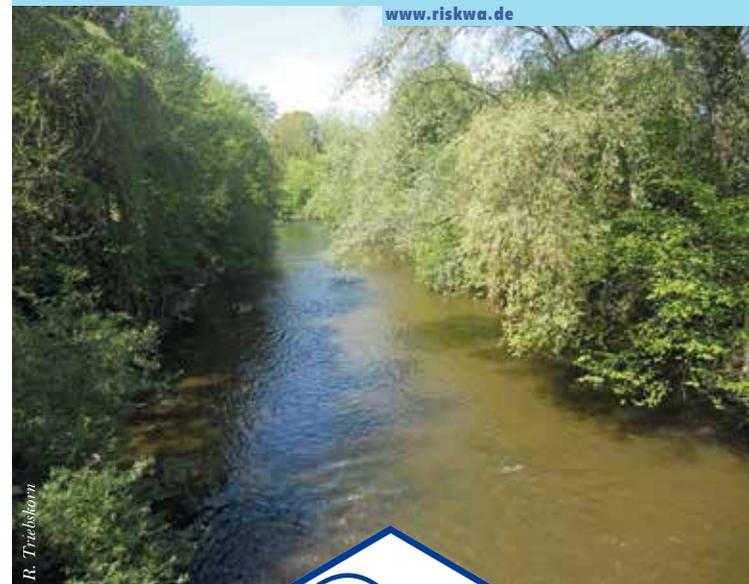
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Aim of the project

The project aims at providing a scientifically sound concept for extended sewage and rainwater treatment in densely populated river catchment areas in view to reduce micropollutants and sanitarially relevant pathogens (including antibiotic-resistant bacteria) in surface waters.

Key activities

- Prior and after application of different sewage and rainwater treatment technologies (including e.g. combinations of ozonization and charcoal filters) the release of micropollutants and bacteria (including antibiotic-resistant bacteria) will be characterized.
- In addition, the resulting reduction of toxic and endocrine potentials in effluents, stream water, and sediments, as well as the possible decrease of harmful effects in freshwater species will be recorded by various biological *in vitro* and *in vivo* tests.
- Concomitantly, the effects of the innovative cleaning technologies on the ecosystem will be traced by effect analyses in different indigenous species, including fish species and benthic invertebrates being relevant as food sources for fish.
- Finally, scientific studies will be accompanied by public relation and communication of the results to relevant authorities.

What about RiSKWa?

The Federal Ministry of Education and Research (BMBF) initiated the funding programme "Risk Management of Emerging Compounds and Pathogens in the Water Cycle (RiSKWa)". Aim of the programme is to develop innovative technologies and concepts for the risk management of these compounds. For three years, 12 joint research project groups are working on "Risk characterisation and management", "Technologies for emission and immission management" and "Measures for communication and education".

SchussenAktivplus

Reduction of micropollutants and bacteria in the Schussen river, a tributary of Lake Constance

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The big wastewater treatment plant **Langwiese** of the "Abwasserzweckverband" (association for sewage treatment) Mariatal, Ravensburg with a total treatment capacity of 184.000 residents was upgraded with an additional cleaning step of powdered active charcoal in fall 2013. The charcoal is expected to bind micropollutants and thus to reduce chemical release into the environment.

1

Retention soil filter (RSF)

Tettwang: RSFs purify contaminated rainwater by using the filter function of the soil body and the decomposition activity of the existent fauna and flora. At the RSF in Tettwang, we investigate how many micropollutants and bacteria are removed by this filter.



2



Field sites: At five sites along the rivers Schussen and Argen, surface water and sediment samples are analyzed with respect to micropollutants and microbes including multi-resistant bacteria. In addition, micropollutants in fish (chub and spirlin) and resulting effects (biomarkers) are under investigation.



Bypass: In two river bypass-systems, river water is pumped through five aquaria each. In these, trout eggs, adult trout, gammarids, and snails are actively exposed to the water of the Schussen and Argen rivers under controlled conditions.

Locations

In the wastewater treatment plant **Merklingen**, the oxidative effect of ozone in combination with an existing slow sand filter is investigated exemplarily for small wastewater treatment plants.



3

Storm water overflow basin (SOB) Mariatal: For economic reasons, wastewater treatment plants are designed for a specific amount of water. During heavy rain events, the sewers are filled up and the wastewater is temporarily stored in SOBs. In case of an overflow, the spillover ends up directly in the receiving water. At the SOB Mariatal of the city of Ravensburg, a part of the spillover is experimentally channeled through a lamellae separator to improve the retention of solid matter.



4

The wastewater treatment plant **Eriskirch** of the "Abwasser-verbund Unteres Schussental (AUS)" (association for sewage treatment of the lower Schussen valley) is experimentally upgraded with an ozone treatment previous to a sand filter and a subsequent purification with granulated active charcoal. This combination allows the removal of bacteria and micropollutants.



Microbiological examinations reveal which bacteria are present in wastewater and which ones show resistances.



- drainage area Schussen
- drainage area Argen
- field site, bypass
- location test facilities



Animals and plants under investigation

The particular characteristic of SchussenAktivplus is not only the large number of analyzed micropollutants, but also the wide variety of different examination methods for biological effects.

Laboratory tests with wastewater, water, and sediment samples

By using a wide spectrum of organisms and test systems (duckweed, snails, worms, fish eggs, breast cancer cells, and several cell culture systems) the toxic and endocrine potentials of the samples are examined in the laboratory.

Passive monitoring in the field

Organisms in the field are used as bioindicators, because they reveal the biological consequences of new wastewater treatment techniques.

For this purpose, scientists catch typical regional fish species like chub and spirlin via electrical fishing and examine the health status of their livers, kidneys, gills, and gonads. Small organisms, like gammarids, are also targeted during these studies.

Active monitoring in bypass systems

Other test animals are actively exposed to the water of the Schussen and Argen (active monitoring) in bypass systems of the two rivers. For these studies, brown trout, their eggs, and their hatchlings as well as invertebrates are used as test organisms. This allows observing the effects of micropollutants under controlled conditions.

Who is living in and around the river?

The scientists investigate how the improved water quality is reflected in the ecological community: for example, how does the species composition change?

Cells as alarm systems

For *in-vitro* tests (in a plate or test tube) cells are cultured in water samples taken from the Schussen, Argen, or experimental systems. The reaction of the cells allows to make inferences in assessing the toxic potential and the endocrine activity of the river water.

