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Swiss Confederation

Federal Department of the Environment,
Transport, Energy and Communications DETEC

Federal Office for the Environment FOEN
Water Division

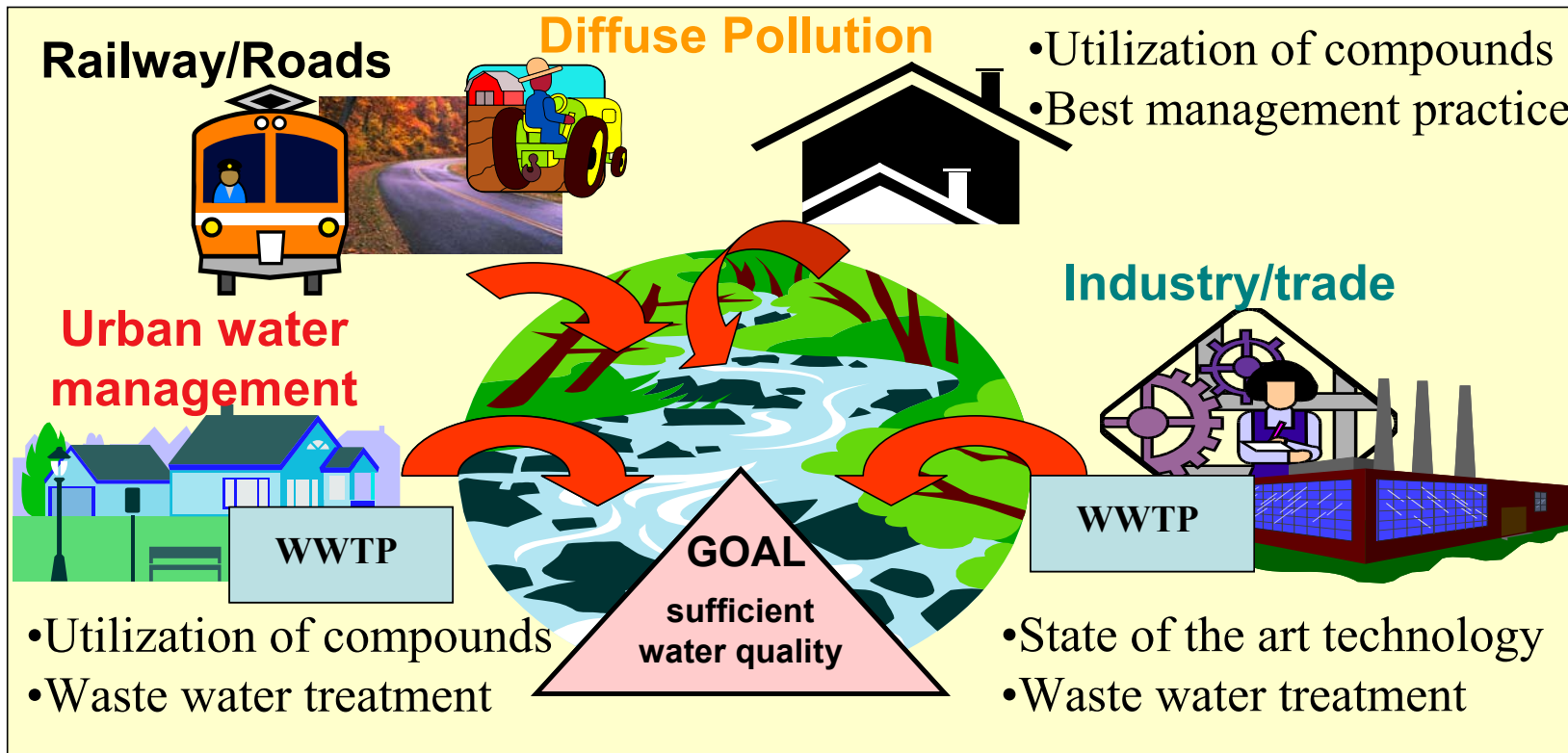
Developing the Swiss strategy to reduce organic micropollutants in surface waters

April 22, 2009

Neptune Workshop Koblenz

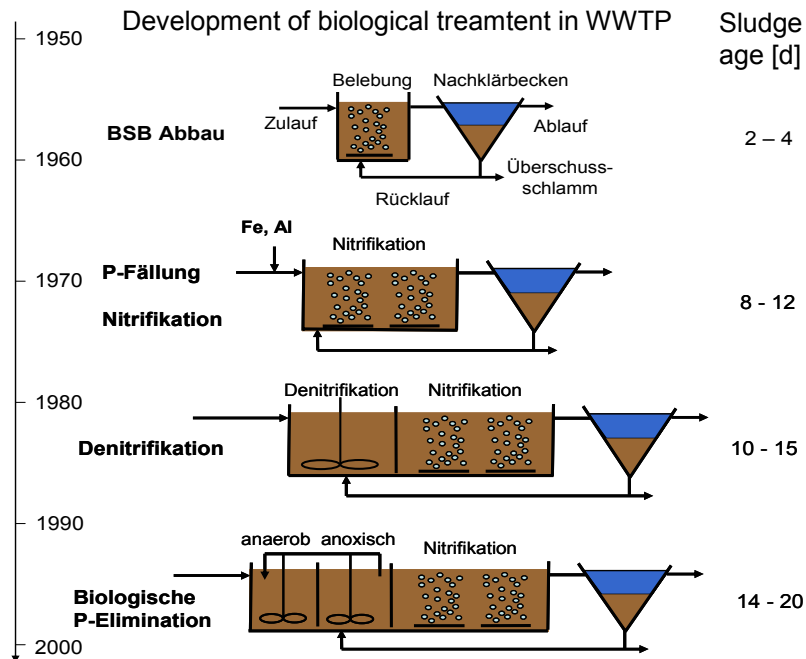


Surface water quality – a constant challenge!





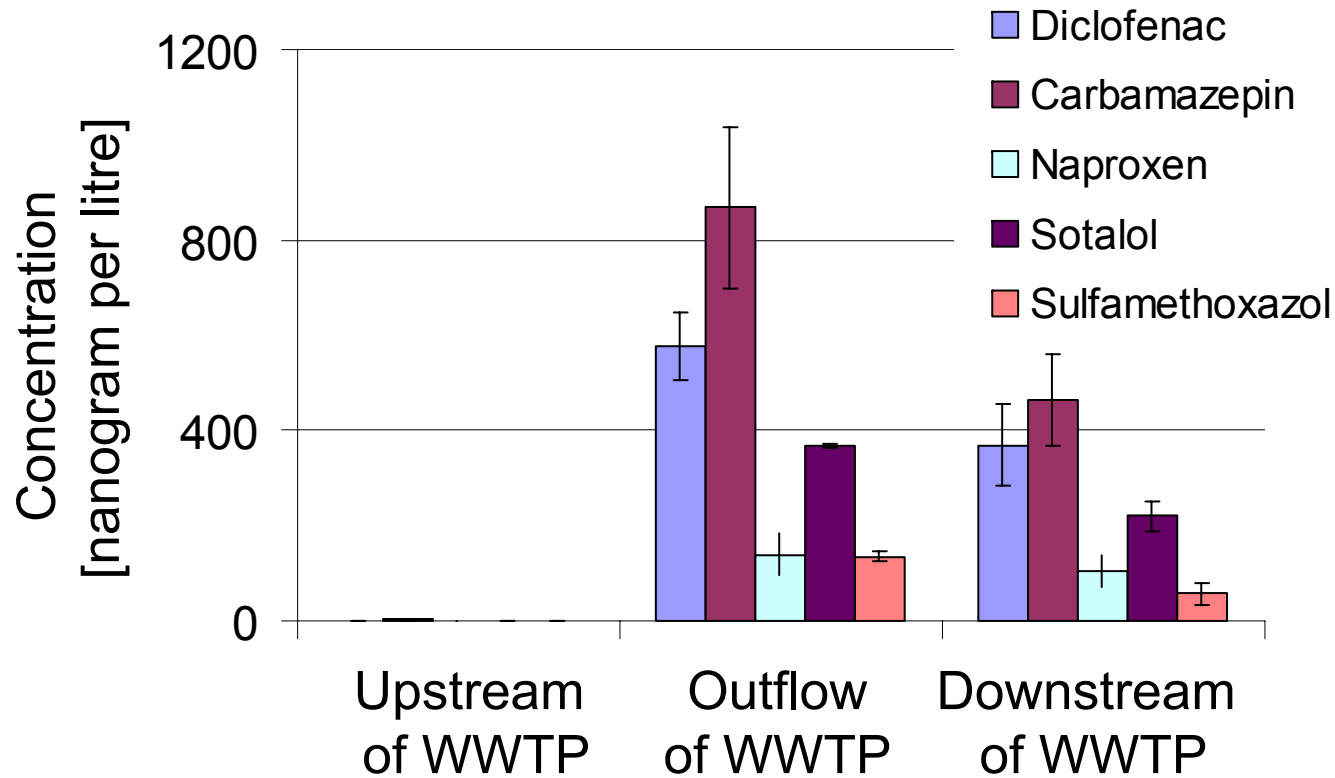
Performance of today's WWTP?



Strong improvement of water quality in last decades



New challenge: emerging pollutants?



Partial or no elimination of many substances in WWTP
→ continuous inputs from WWTP (chronic effects)



Project „Strategy MicroPoll“

Evidence on adverse effects in Swiss surface waters

- **Project Fishnet (finished):**
Decline of fish yields in Switzerland partially due to inputs of chemicals from waste water treatment plants (WWTP)
- **National Research Programme 50 “endocrine disruptors” (finished):**
Inputs of estrogens from WWTP are affecting quality of Swiss surface waters

Increasing knowledge on (technical) measures

- **EU-Project POSEIDON etc.**



Project „Strategy MicroPoll“ (since 2006)

Goal

Development of a strategy with regard to (organic) micropollutants in municipal waste water.

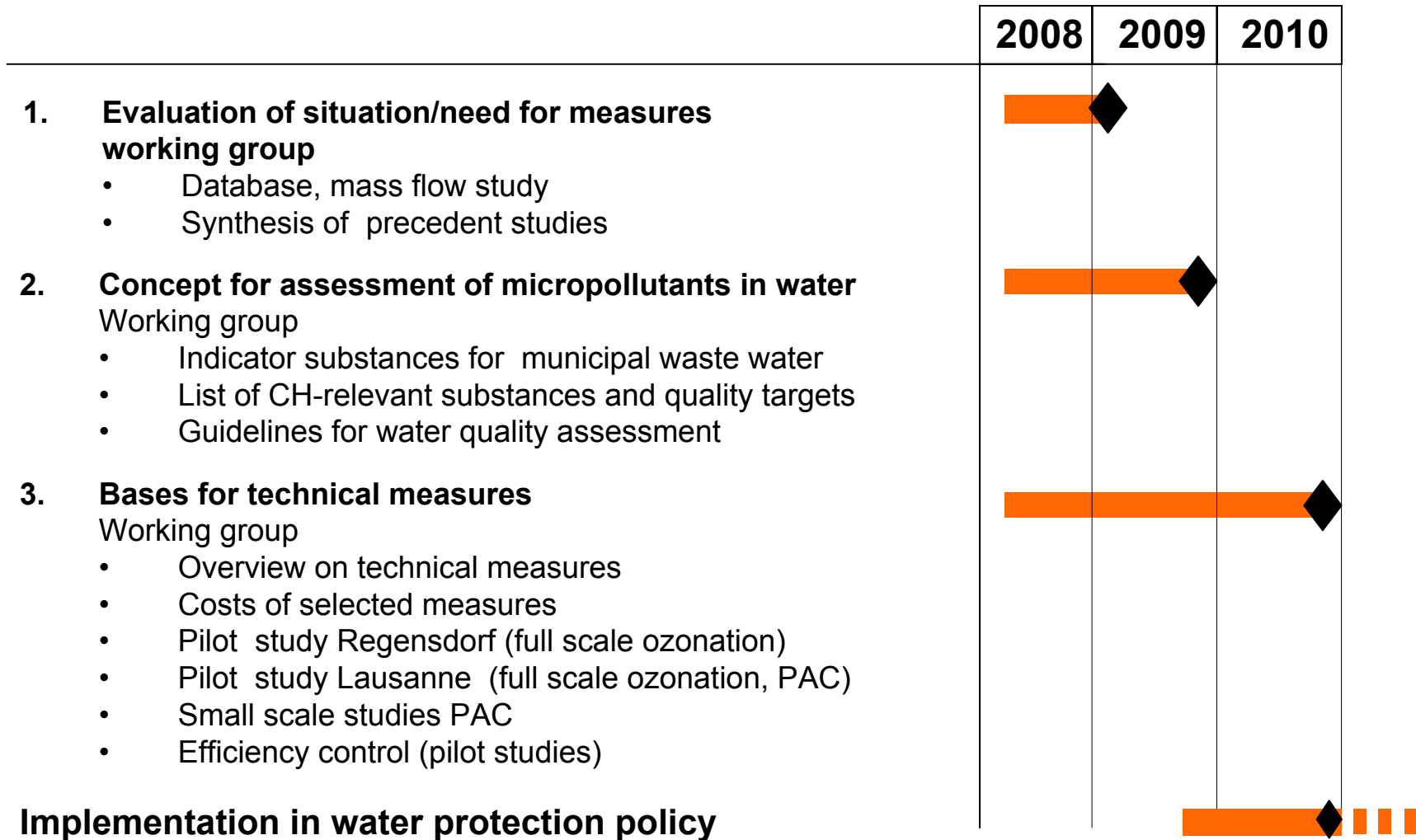
Project lead

Federal Office for the Environment

- **Involvement of different stakeholders in working groups and accompanying group**
- **Close link to research (Eawag, other institutes)**
- **International exchange (D, NL, ...)**



Overview „Strategy Micropoll“

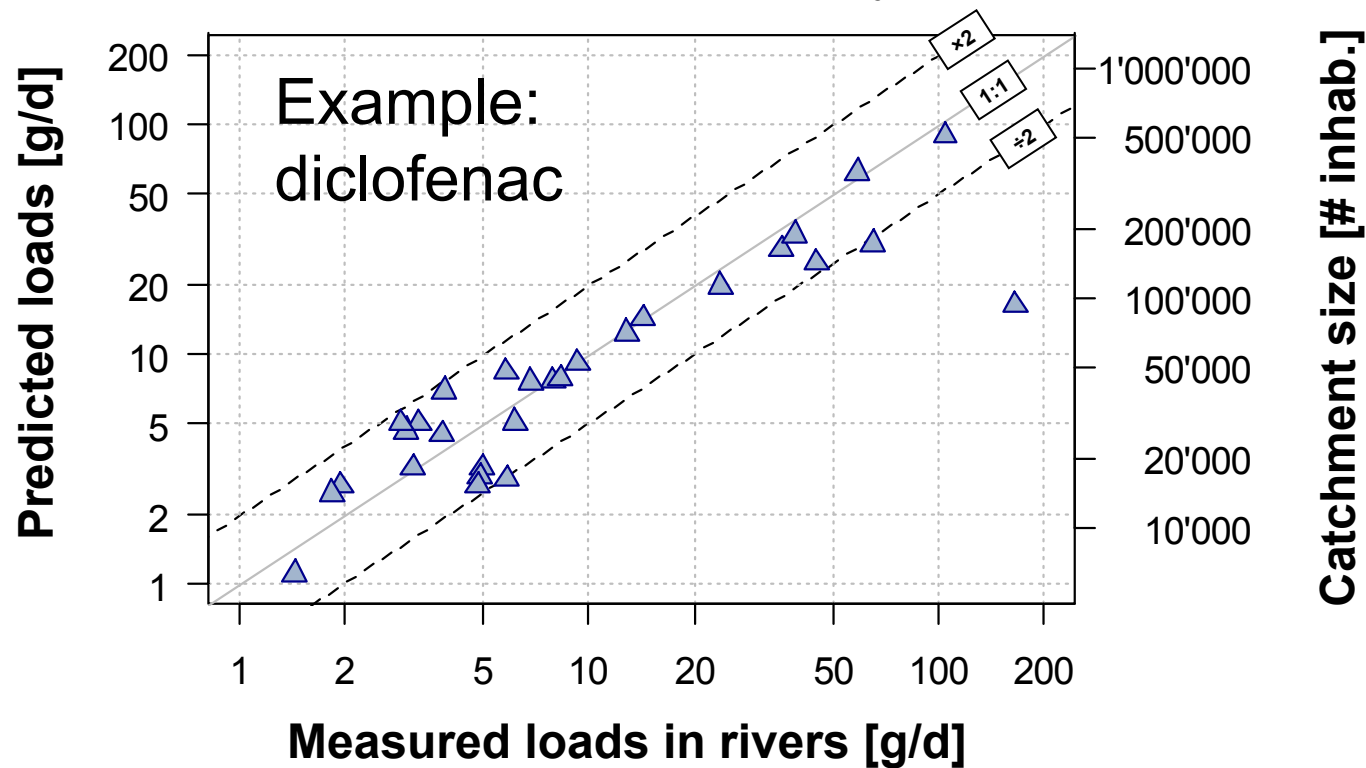


◆ = publication by OFEV



Evaluation of situation: Mass flow study

Model prediction vs. measurements (only parent compound*)

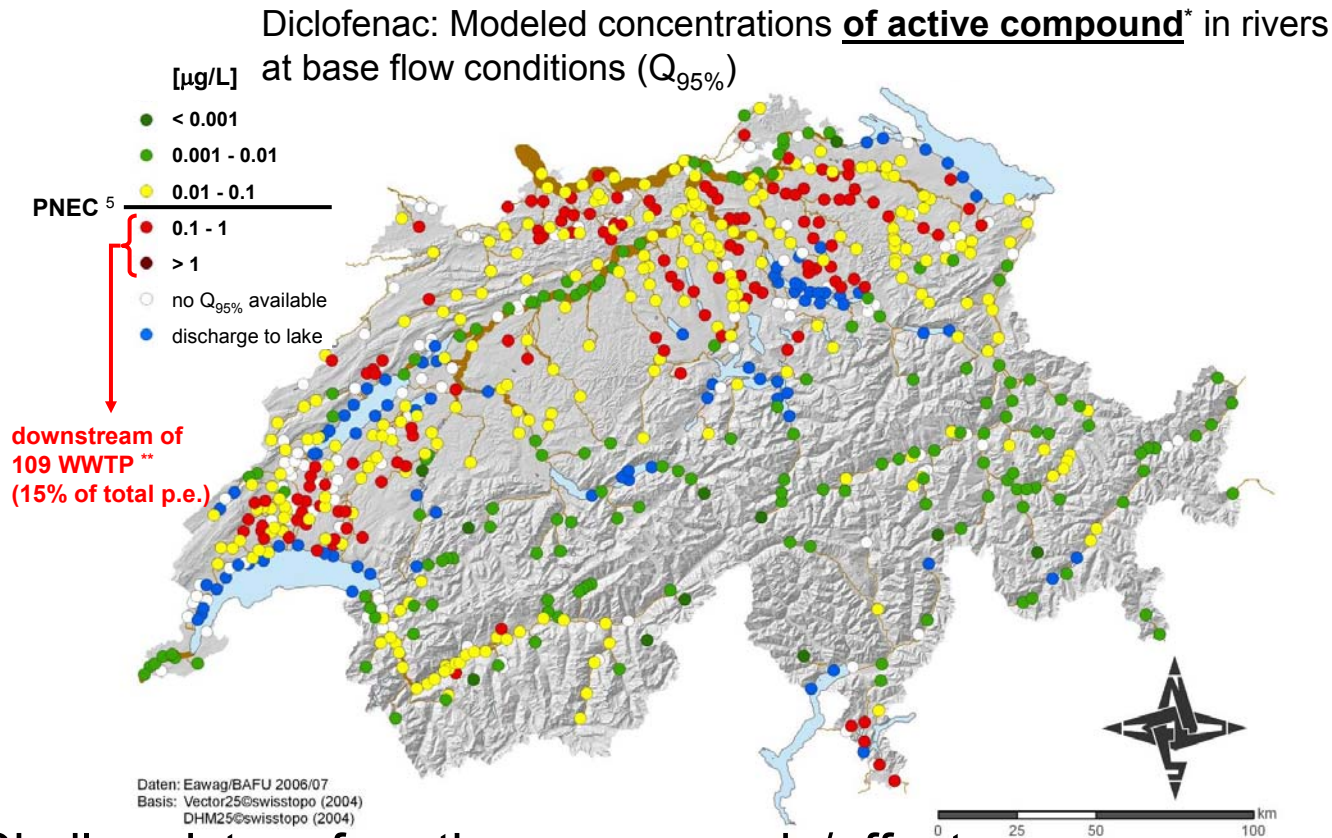


For details on mass flow study: see Ort et al. (2009) ES&T (in press)



Evaluation of situation:

1. Problem: concentration (I)



Similar picture for other compounds/effects:

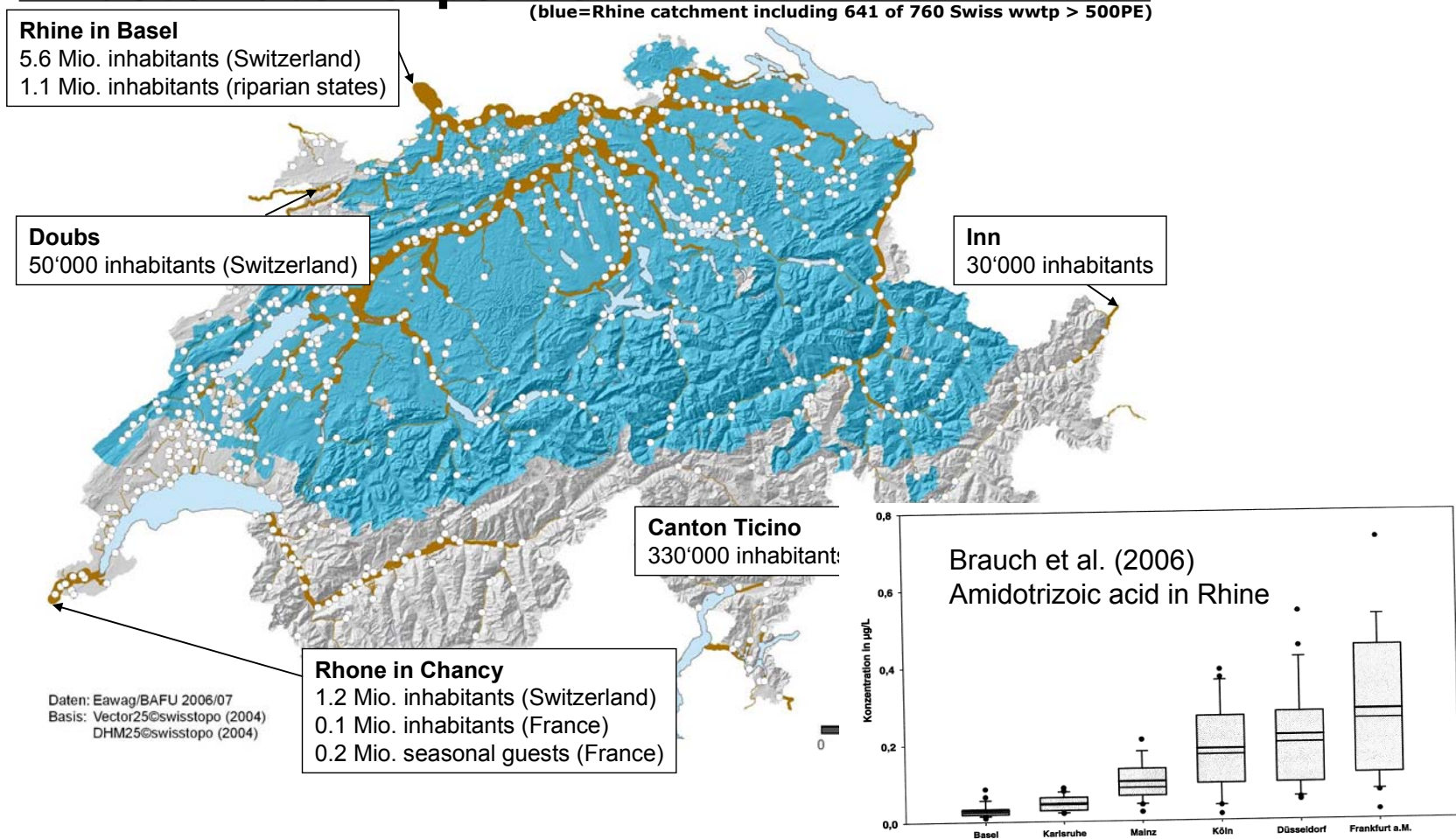
Carbamazepin, Sulfamethoxazole, Diazinon, estrogenic activity, ...

Due to high percentage of waste water in watercourse



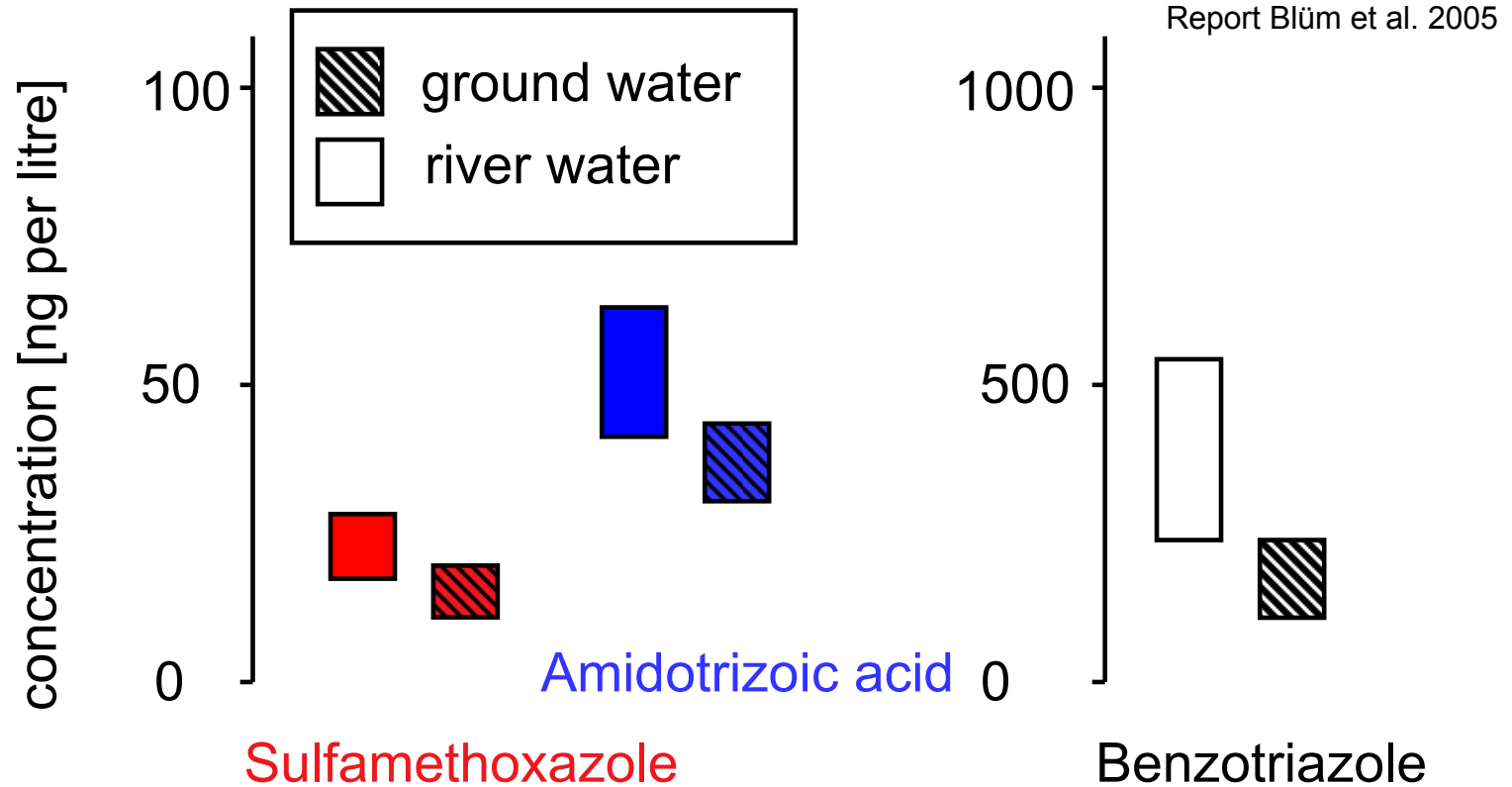
Evaluation of situation: 2. Problem: loads (I)

“Wastewater export CH”





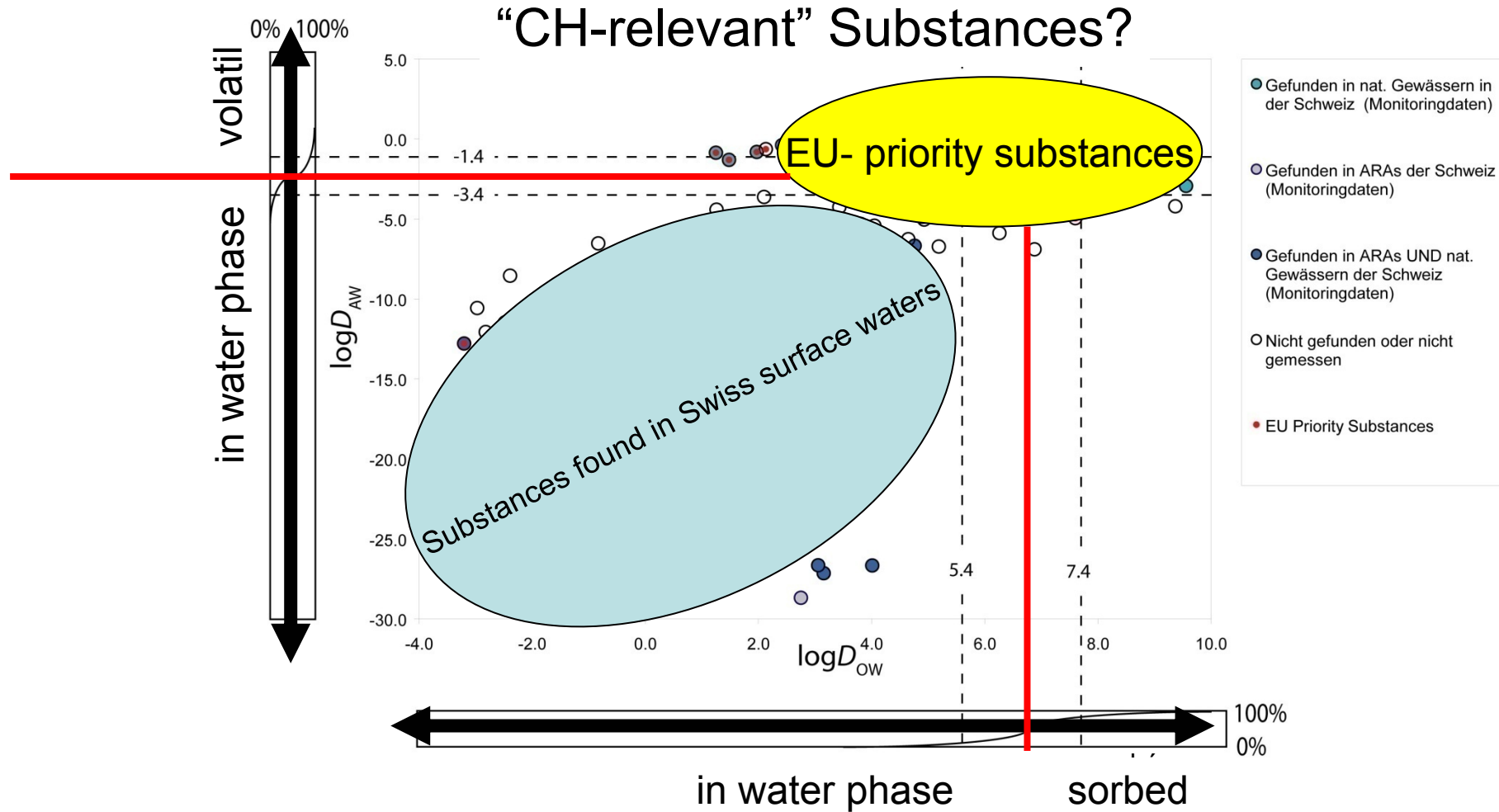
2. Problem: loads (II)



Influence of micropollutants from waste water on ground-/drinking water over river bank infiltration



Substances in Swiss surface waters: «emerging» or «new» substances





Possible measures

Source control:

- Registration and regulation of products
- Behavior of consumers
- Waste disposal

But:

- “long-term options”
- Thousands of substances can hardly be regulated
- Replacement of some problematic substances is very difficult (pharmaceuticals, ...) or impossible (natural estrogens).

see as well ICPR-Workshop Micropollutants in May 2007 (www.iksr.org)



Possible measures (II)

Technical measures

1. Global solution not possible without technical measures.
2. Sewer system, treatment of concentrated waste water (source separation), optimization of municipal waste water treatment etc.
3. End of pipe measures at municipal WWTP are probably the most effective

ICPR-Workshop Micropollutants in May 2007 (www.iksr.org)



Possible measures (III)

Drivers: public health, hygiene, convenience products, daily life



Use of (thousands of) substances with specific properties



Waste water / WWTP



Impact: effects on surface water ecosystems (estrogens, biocides, pharmaceuticals, drinking water)

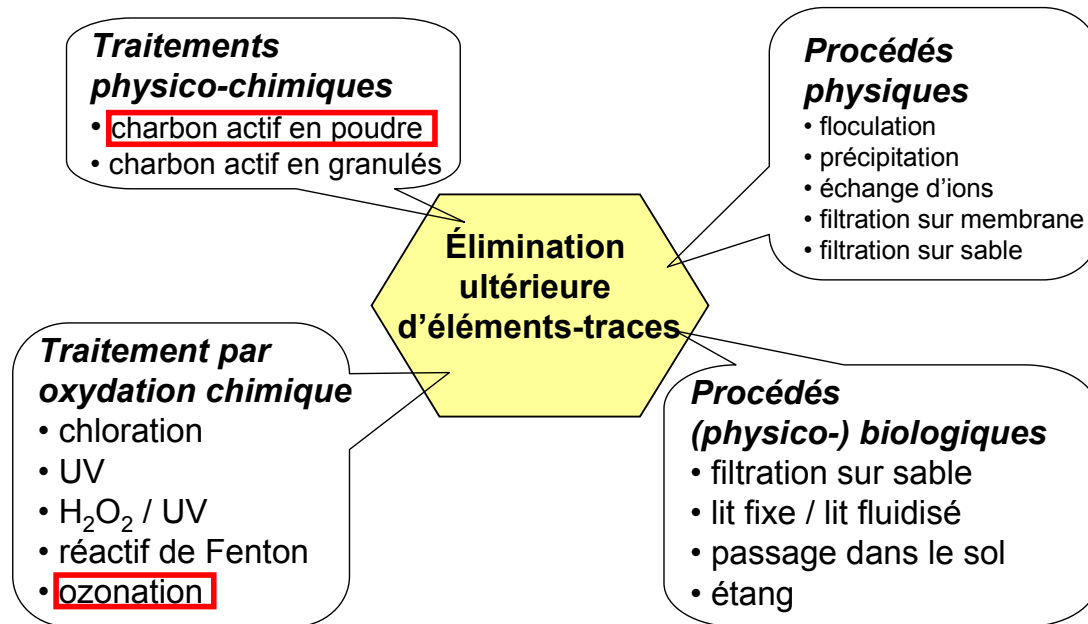


Response: technical measures to reduce impact (political decision, “tip of iceberg” contains sufficient information to decide!)



Evaluation of technical measures

1. Energy consumption, costs
2. Efficiency of treatment to reduce micropollutants / effects and influence on effluent quality
3. Technology and operation

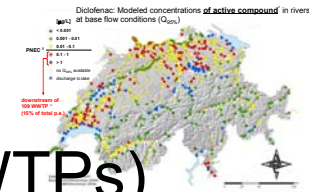




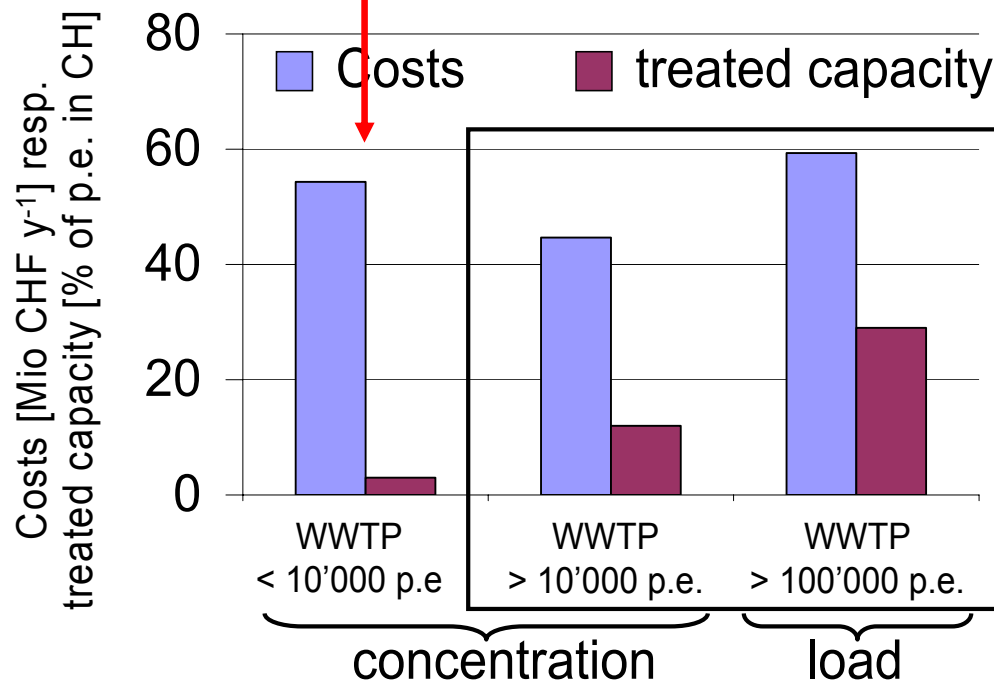
Evaluation of technical measures: costs

Goals: 1. Concentration (Diclofenac) \ll PNEC

2. significant reduction of loads (large WWTPs)



Technical measures for small WWTP (< 10'000 p.e.) not cost effective



40% of total capacity
100 Mio CHF y⁻¹
(including filtration)
= 6 % of annual costs
of public WW-
infrastructure



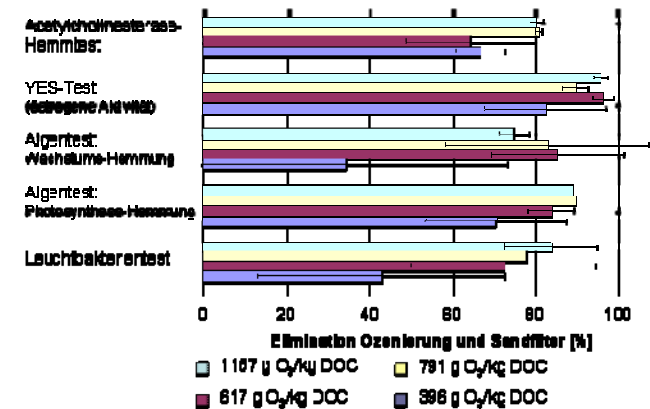
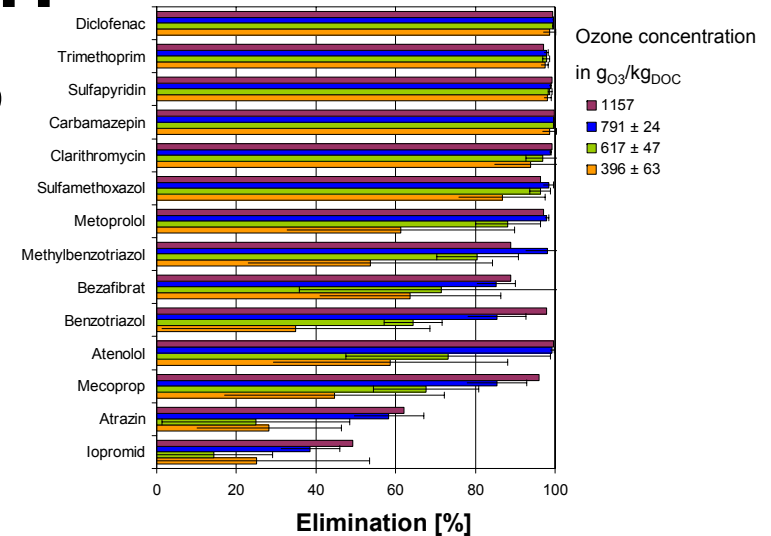
Evaluation of technical measures: pilot studies

- Pilot study Regensdorf (full scale ozonation) 2007 to 2008
- Pilot study Lausanne (full scale ozonation, PAC) 2009 to 2010
- Small scale studies PAC at Eawag 2008 to 2010
- Efficiency control (broad set of methods evaluated and applied)
- International collaboration and exchange (ICPR, NRW, pilot study Ulm/D,



Evaluation of technical measures: pilot study Regensdorf

- Ozonation is an efficient technology to reduce micropollutants in WWTP
- Ozonation reduces ecotoxic effects. Especially the estrogenic activity is strongly reduced.
- No significant production of toxic by-products
- Sand-filter is recommended for degradation of reactive compounds
- Economically feasible: energy increase 0.06 – 0.15 kWh/m³ (+30%), cost increase 0.1 CHF/m³ (+ 10%)
- Manageable for WWTP-personnel





General remarks (I): Multiple pressures on water quality

Guiding principles for Swiss Watercourses - Development goals for improvement of ecological status:

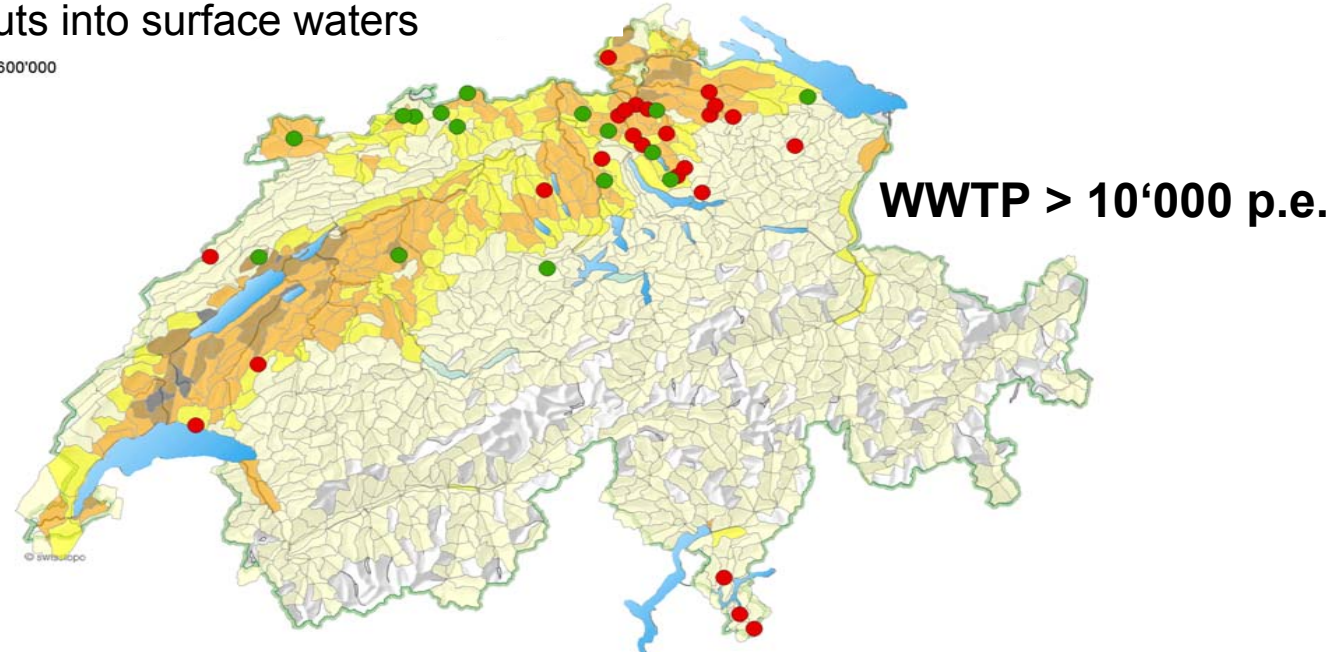
1. Adequate Space for watercourses (flood run-off, ecomorphology, land-use at sufficient distance etc.)
2. Adequate water flows (appropriate residual water levels, hydropeaking etc.)
3. Water quality
 1. Waste water: (nutrients, trace metals) organic micropollutants
 2. Agriculture: nutrients, organic micropollutants (product registration of pesticides, risk reduction measures through buffer strips etc.)



General remarks (II): multiple pressures

- 1. Ecomorphology** (refers to the physical characteristics of a waterbody and its riparian zone): Degree of modification by engineering works and other activities
- 2. Agriculture:** Percentage of arable land as indicator for pesticide inputs into surface waters

1:1'600'000



● good ecomorphology

● poor ecomorphology

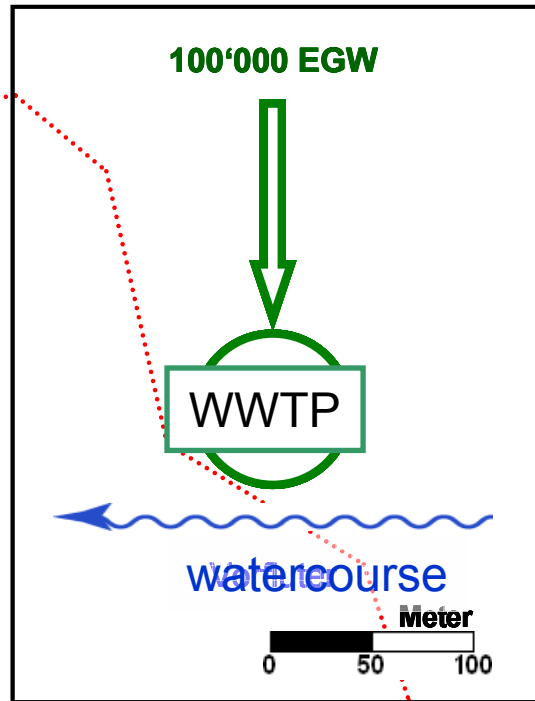
■ 10 – 20 % arable land

■ > 60 % arable land



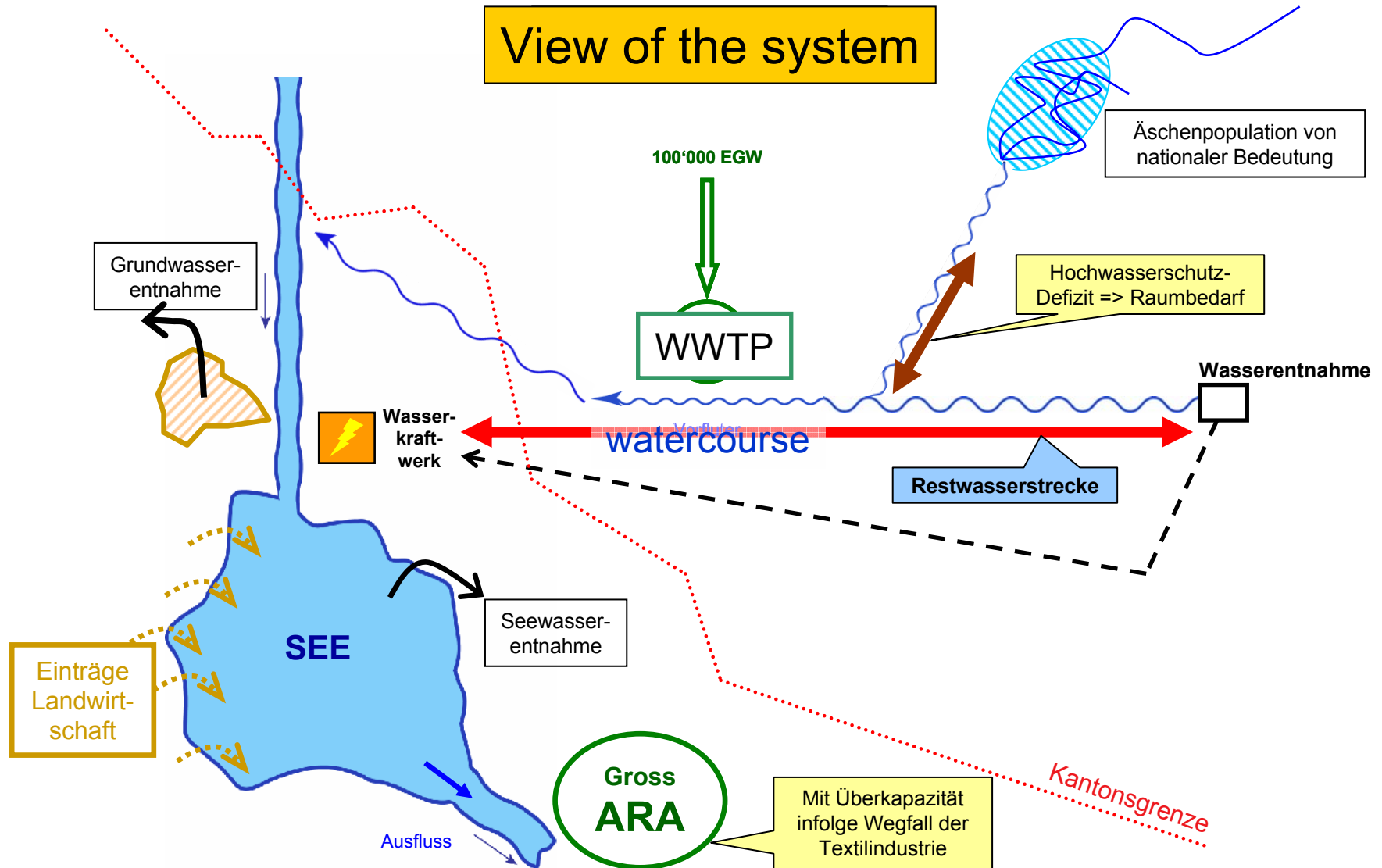
Focus on single WWTP adequate?

Betrachtungsweise: lokal-sektoral





Integral Watershed Management





Summary

- Increasing application of chemicals (Pharmaceutical etc.)
- **Negative Effect in surface waters and accumulation of substances along flow paths** (responsibility of upstream countries of international rivers)
- **Technological measures** (Ozonation, PAC) **available and applicable**
- **Implementation within natural renewal of infrastructure** (timeframe up to 10-20 years)
- Water quality can be improved by optimizing waste water treatment
- International context: activities of ICPR (PG MIKRO),



....more to come!

Thank you for your attention!

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www.bafu.admin.ch/micropoll