

# Reuse of treated wastewater and quality-proven sludge in agriculture -The Braunschweig Experience -

Wolfgang Sehrt

Abwasserverband Braunschweig

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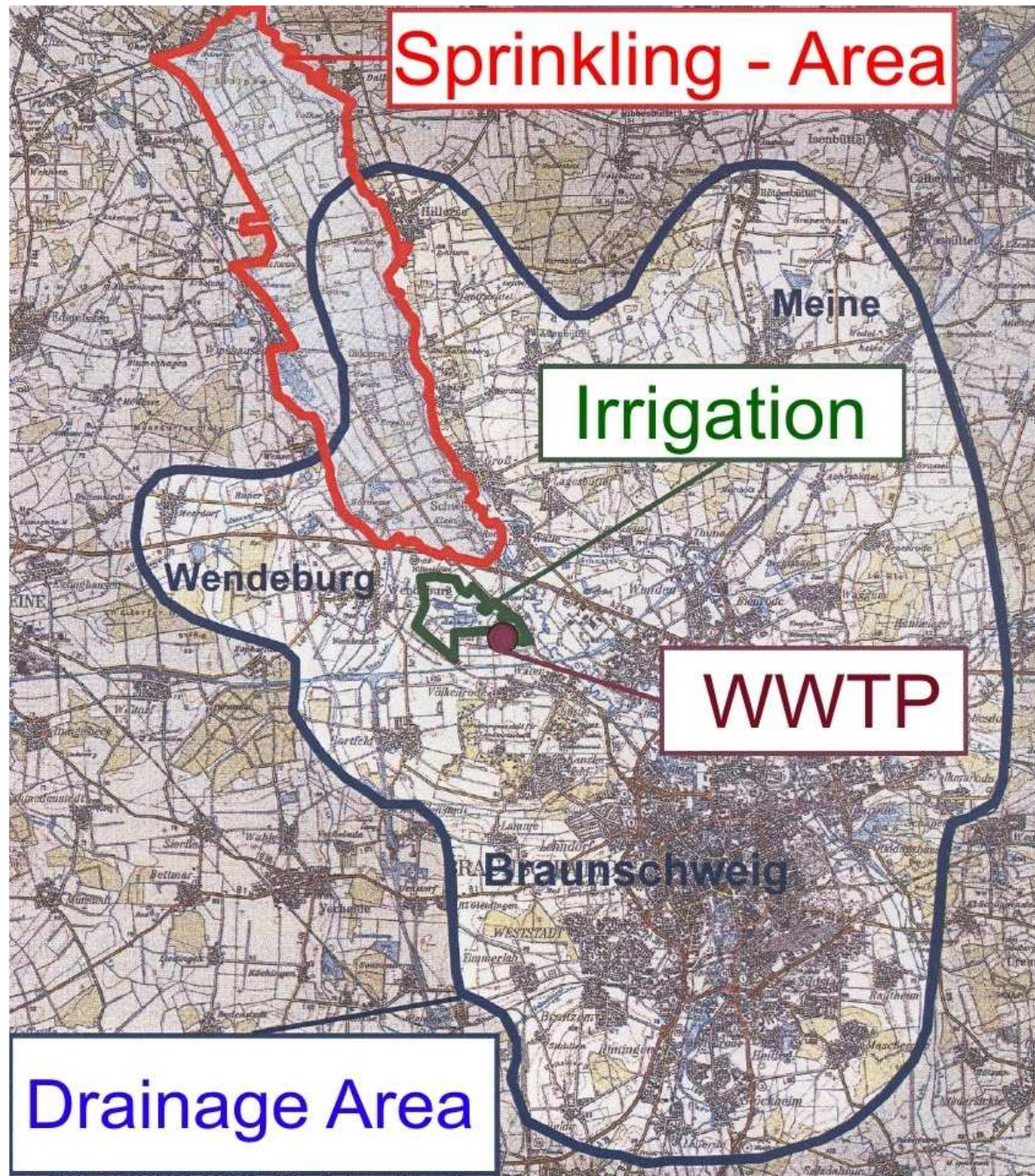
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- Necessity of irrigation and advantage of agricultural reuse
  - Relevance of wastewater reuse and its ingredients for resources conservation
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## General plan

The area of the  
Waste Water  
Association



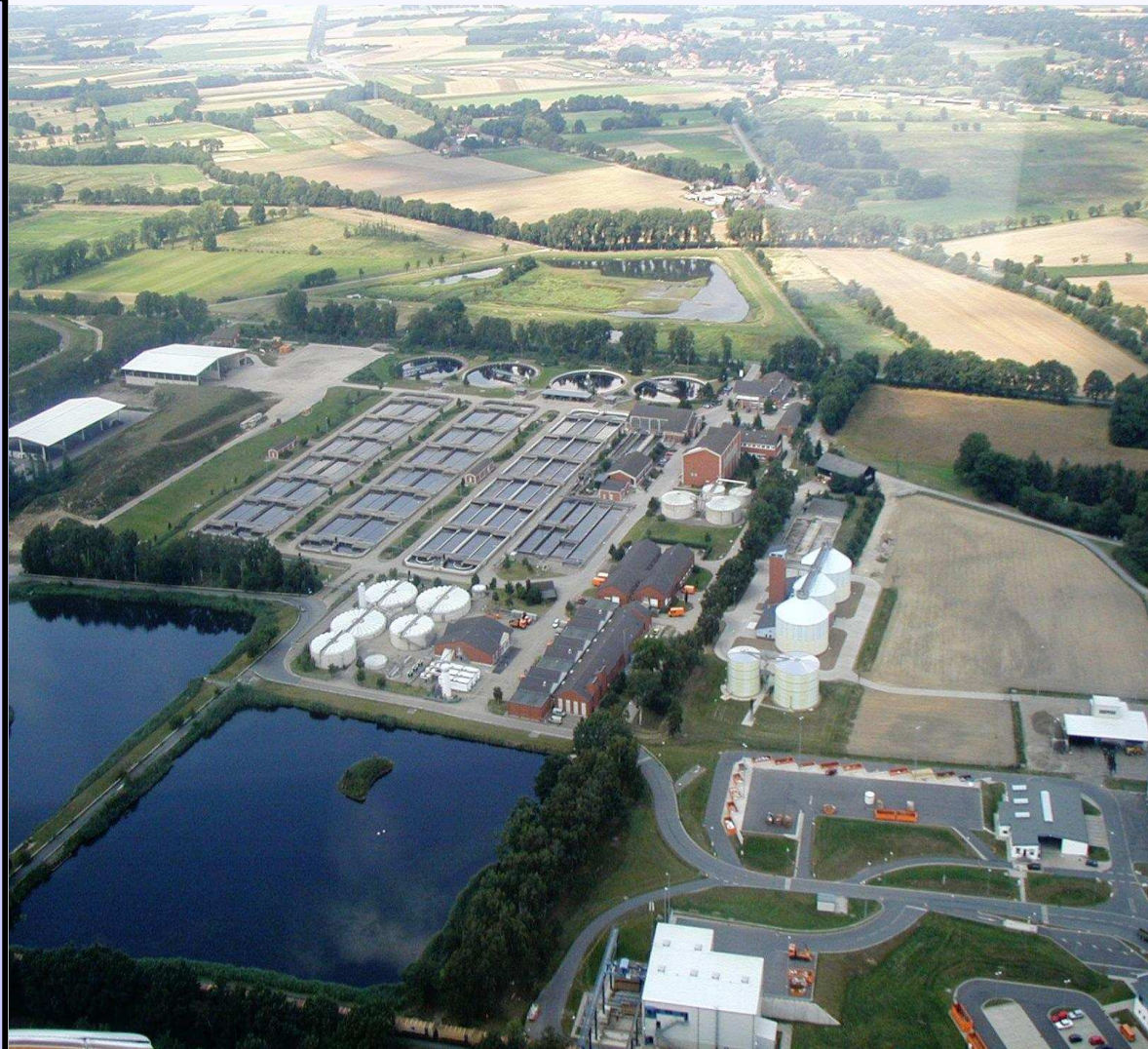
# Treatment plant Steinhof



Population  
equivalents:  
385 000

Treatment process:  
mechanical  
biological  
nutrient removal

Flow:  
60 000 m<sup>3</sup>/d



# Sprinkler irrigation

Sprinklers from 1956 - 1974



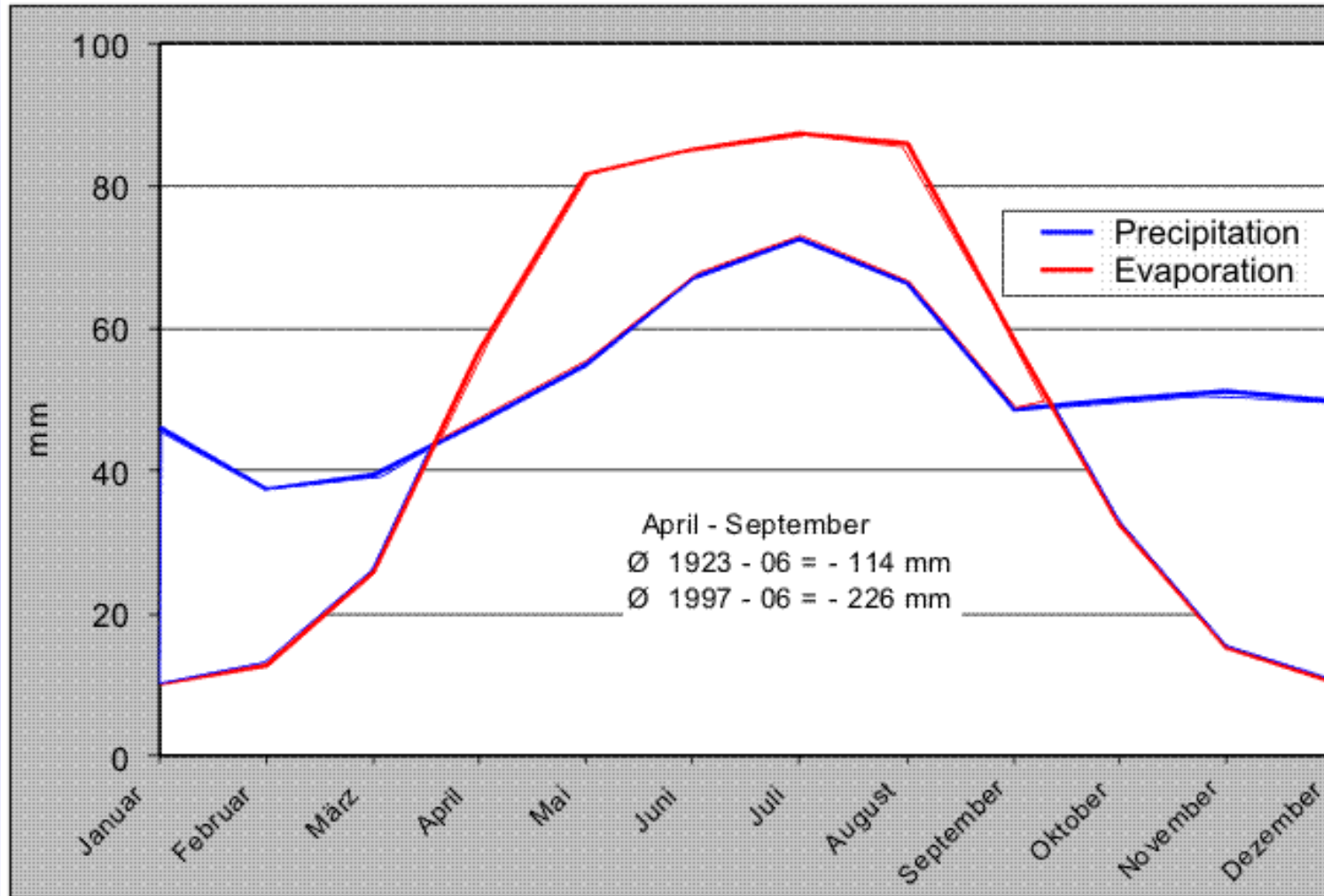
...and since 1974



# Necessity of irrigation and advantages of wastewater reuse in agriculture

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# Average water balance 1923 - 2006

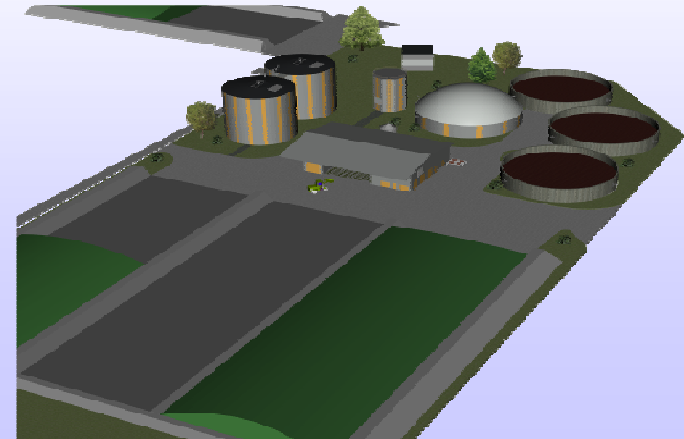


# Cultivation in the irrigation area

Crops	1950	1970	1990	2007
	%	%	%	%
Cereals	42	39	60	30
Potatoes	26	20	6	6
Sugar-beets	6	16	25	19
Maize	0	2	2	38
Other	26	23	7	7

# Cultivation of renewable resources

On approx. 38 % of the total “Waste-Water-Association-area” renewable resources for the generation of biogas are cultivated.



## Features of the biogas plant Hillerse

- total capacity  $2.5 \text{ MW}_{el}$
  - 2 x  $1 \text{ MW}_{el}$  at Ölper (BS Energy)
  - 20 km gas pipeline from Hillerse to Ölper powerplant
  - 1 x  $0.5 \text{ MW}_{el}$  at Hillerse
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# Relevance of wastewater reuse and its ingredients for resource conservation

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# Wastewater flow



Annual amount of treated water 21 Mill.m<sup>3</sup>/a

Hereof: reused by sprinkler irrigation 15 Mill.m<sup>3</sup>/a

artificial groundwater recharge 6 Mill.m<sup>3</sup>/a

Additional water demand for irrigation

approx. 100 mm on 3000 ha 3 Mill.m<sup>3</sup>/a

Total amount of water for artificial  
groundwater recharge

12 Mill.m<sup>3</sup>/a

This corresponds to the drinking water demand in the area of  
the sewage board!

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# Amount of sludge generated

Primary sludge and activated sludge	6,800 t TS/a (total solids/year)
Reduction by 30 % by digestion anaerobic digested sludge	2,050 t TS/a 4,750 t TS/a
hereof: ~ 60 % sprinkler irrigation in the „Waste-Water-Association-area“	2,750 t TS/a
~ 40 % elsewhere reused in agriculture	2,000 t TS/a

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# Ø Nutrient loads and nutrient demand (kg/ha)



	Load	Demand
• Ammonium, nitrate	50	140
• Phosphate $P_2O_5$	69	70
• Sodium $K_2O$	78	130
• Sulphur S	105	25
• Magnesium MgO	38	45
• Calcium CaO	318	380

Organic Substance 640 kg/ha

This corresponds to about 2.3 t/ha compost.

# Provisions for the protection of soil and groundwater

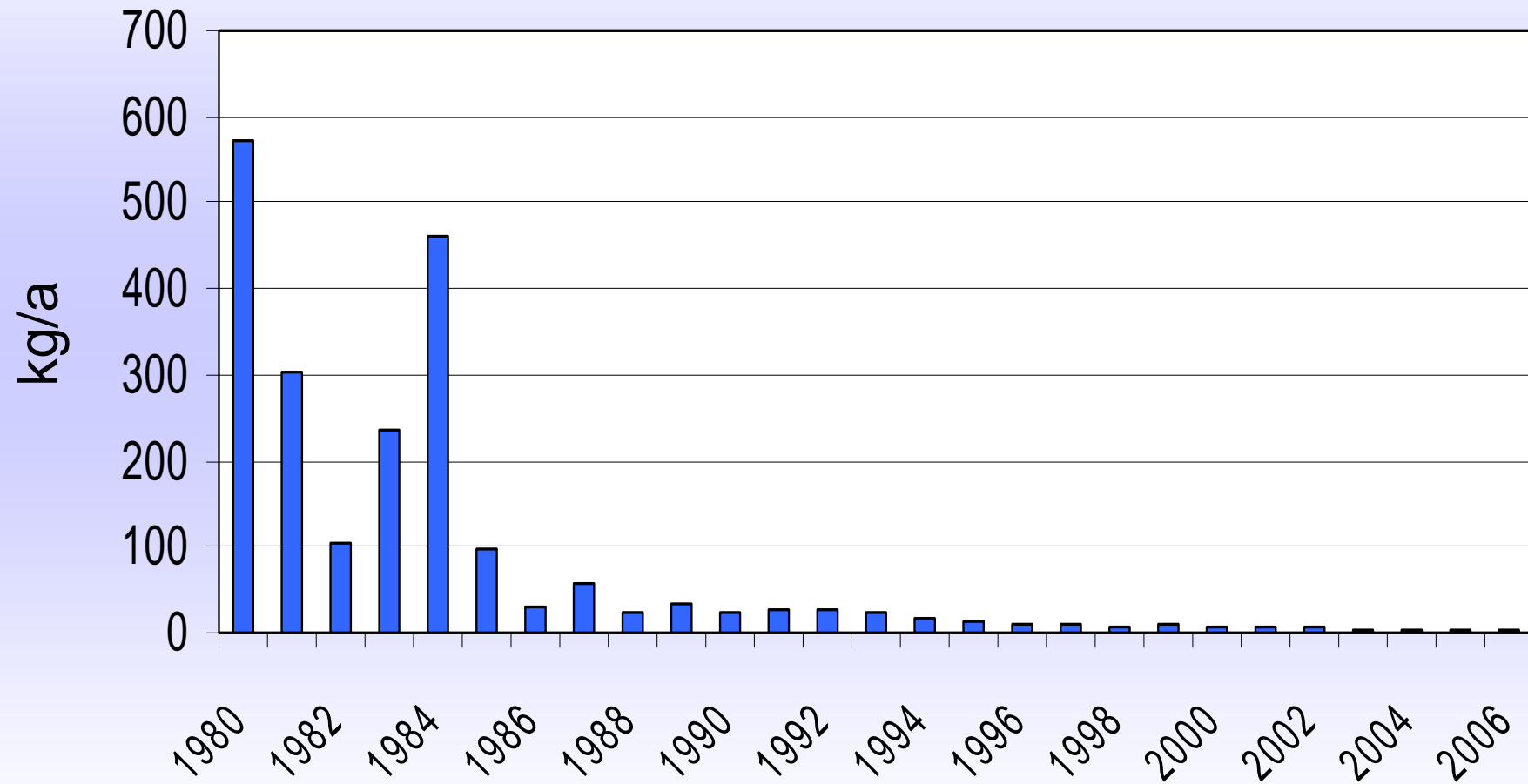
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# Indirect discharger monitoring in Braunschweig for 25 years

• Dry-cleaner	2
• Glass processing	6
• Breweries	1
• Chemical Companies	1
• Print shops	16
• Food industry	6
• Institutes and Laboratories	26
• Metal industry	10
• Garages, petrol stations etc.	262
• Hospitals	7
• Waste disposal sites	3
• Water treatment plants	20
• Varnish production	6
• Other	35
• <b>Sum Discharger</b>	<b>401</b>

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# Cadmium-load in digested sludge



# Consultancy for farmers



- Support of cultivation of intertillage to hold nutrients in the soil during groundwater recharge
  - Fertilisation tests of sugar-beets, winter wheat, winter rapeseed und maize
  - $N_{\min}$ -analysis to determine the subsequent supply of nitrogen of the soil
  - Extensive information on the fertilisation-effect of the sprinkler-water in the „WWA-area“ due to weekly analyses
  - Balance of total amount of sprinkler-water and allocation of the nutrient load (approx. 12,000 checks/a)
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# Water-monitoring



For 45 years:

Testing of 6 discharge points from 500 ha drained area and groundwater testing of 3 of 33 observation wells by the water authority (analysis of 4 samples / year)

Parameters: pH, electrical conductivity, dissolved oxygen, total-P, nitrite-N, nitrate-N, ammonium-N, organic bound nitrogen, TOC, COD, BOD5

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# Receipt of QLA-certificate (quality assurance) for agricultural sludge utilisation 5.02.2007



# Summary and outlook

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# Advantages of water reuse

## **For inhabitants**

- high treatment efficiency
- no filtration necessary
- solution for sludge disposal

## **For water re-users (farmers)**

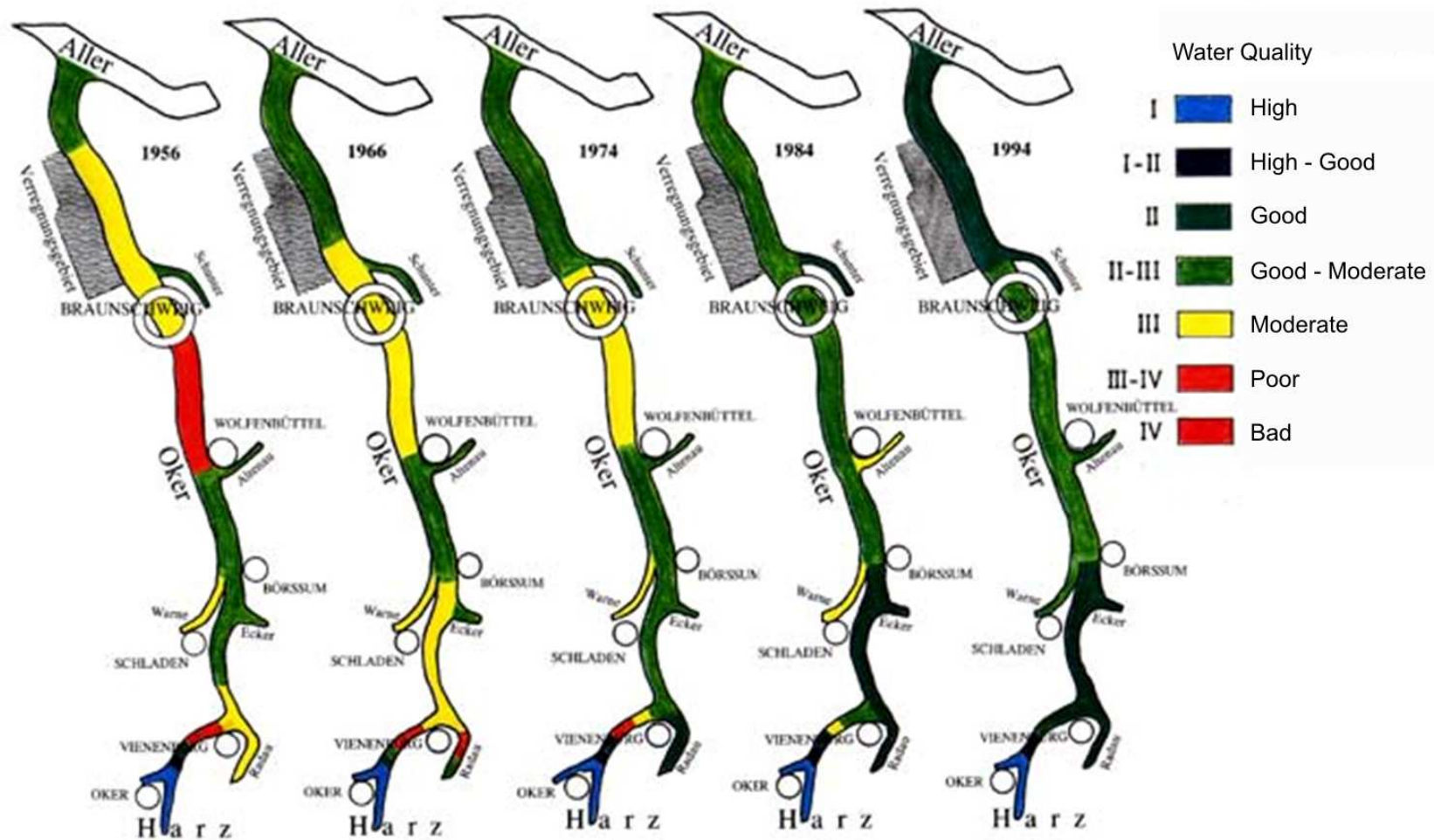
- supply and application of sprinkler water
  - use of nutrients
  - use of organic ingredients
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# Advantages of water reuse

## **For the environment**

- Ecology / water resources
    - Resources conservation
    - Prevention of contamination of rivers
    - No groundwater extraction
    - Promotion of groundwater recharge
  - Closed loop recycling management
    - Dual use of water
    - Reclamation of ingredients
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# Water quality of the Oker river



Thank you for your attention!

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