

**From Monitoring to Measures:  
Historical Contaminated Sediments  
in the Elbe River Basin**

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Day 3: River Basin Management – Aspects of Sediment Quality

# From Monitoring (2006) to Measures (2009)

## WFD Expert Groups on Monitoring & Emission Control June 2004

“Compliance monitoring for sediment is not appropriate because of **lack of definition** of valid Environmental Quality Standards (**EQS**) in a European context” (AMPS 2004)

Screening of generic sources that can result in releases of PS/PHS (WFD Article 16) will include the specific source/- pathway **”historical pollution from sediments”** (EAF 2004)

## Report on the SedNet Round Table Discussion – Venice Nov. 2006

“EQS should only be regarded as **high-level screening values** as a start of diagnostics, using **different lines of evidence**, and linking sediment state to impacts” (SedNet 2007)

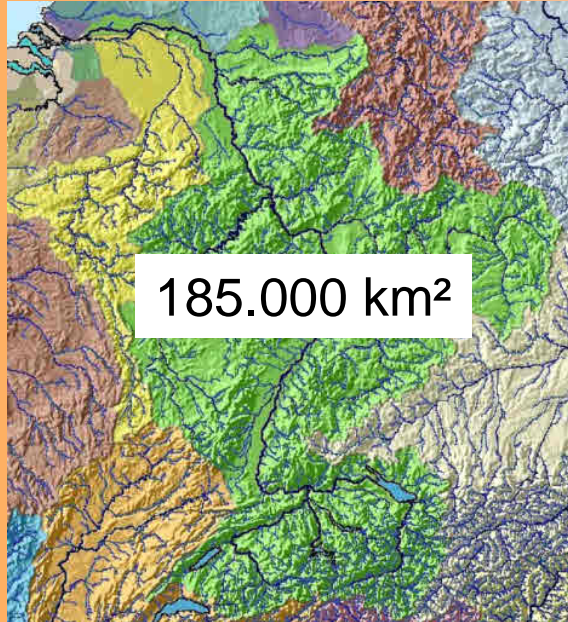
“For certain **measures** (such as source control) **target values** and a good understanding of the system (different in the upstream and downstream parts) are necessary” (SedNet 2007)

# Monitoring Historical Pollution from Sediments

## *The Rhine Basin*

## *The Elbe Basin*

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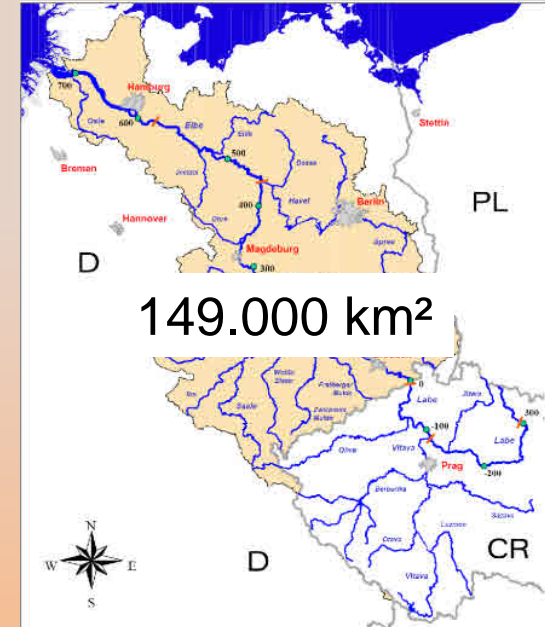


(commissioned by the Port of Rotterdam, 2004)

3-Step Approach  
Heise et al. 2004

- 1) S.o.C.
- 2) A.o.C.
- 3) A.o.R.

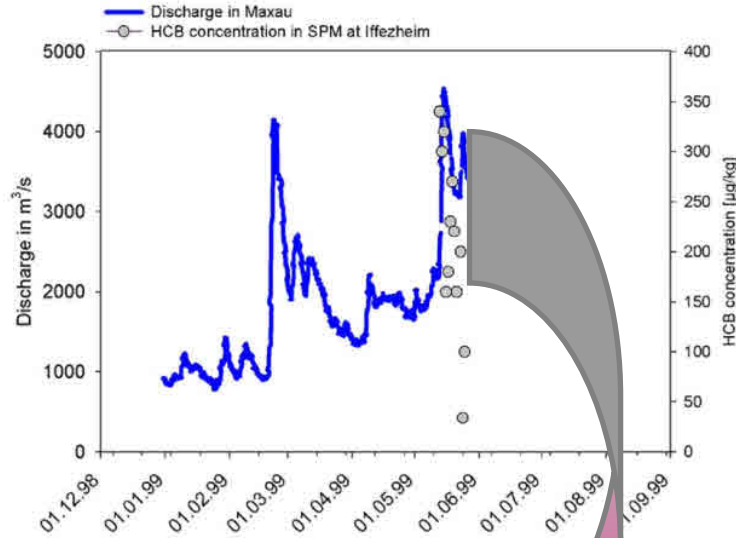
SPM/Pollutant – Full Flood Cycles  
Target Values – CTT Threshold V.  
Critical Pollutant in Main Stream  
Tracers, Models and Experiments



(commissioned by HPA and FGG, 2005, 2008)

# Analysis of Flood Events, e.g. in 1999

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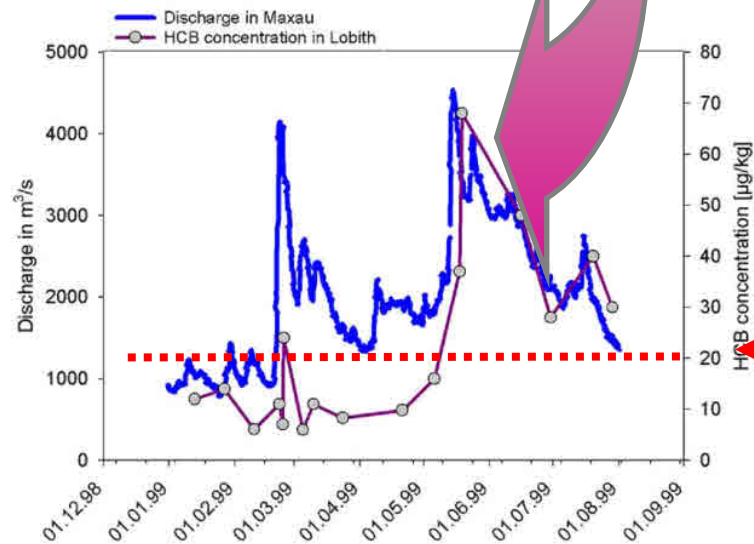


## Resuspension of HCB in Iffezheim (Upper Rhine Barrage)

Distance: ca. 500 km

Time delay: ca. 5 days

Decrease (HCB): 350 µg/kg → ca. 70 µg/kg



## HCB-concentrations in Lobith (Dutch-German-Border)

**20 µg/kg limit value for POR for relocation at sea (CTT-Value)**

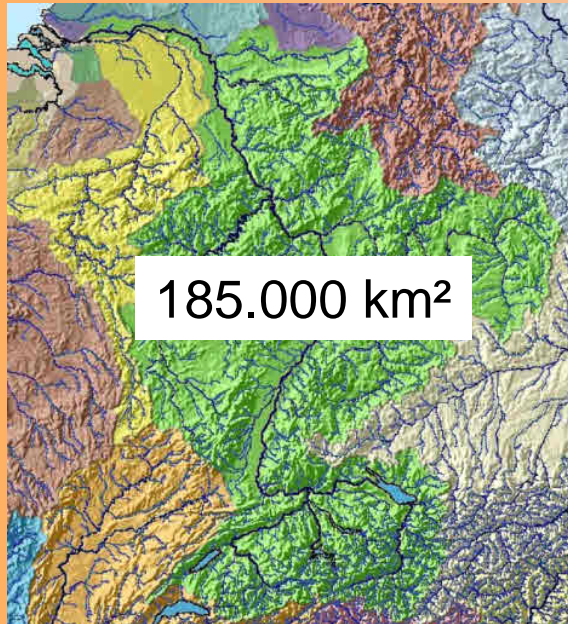
Data: Landesumweltamt Baden-Württemberg

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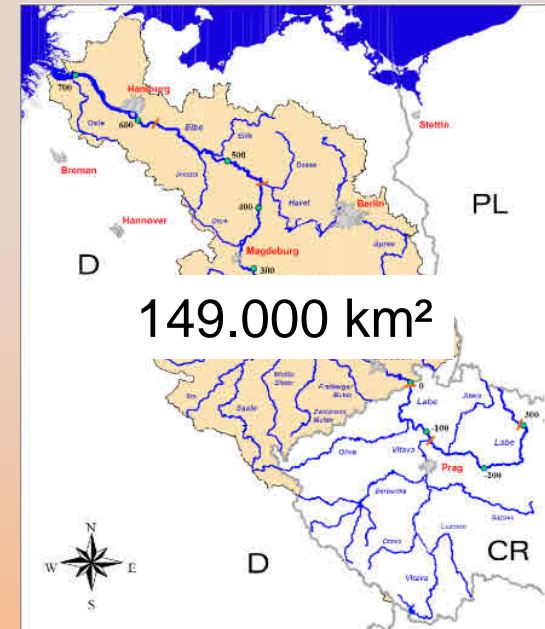


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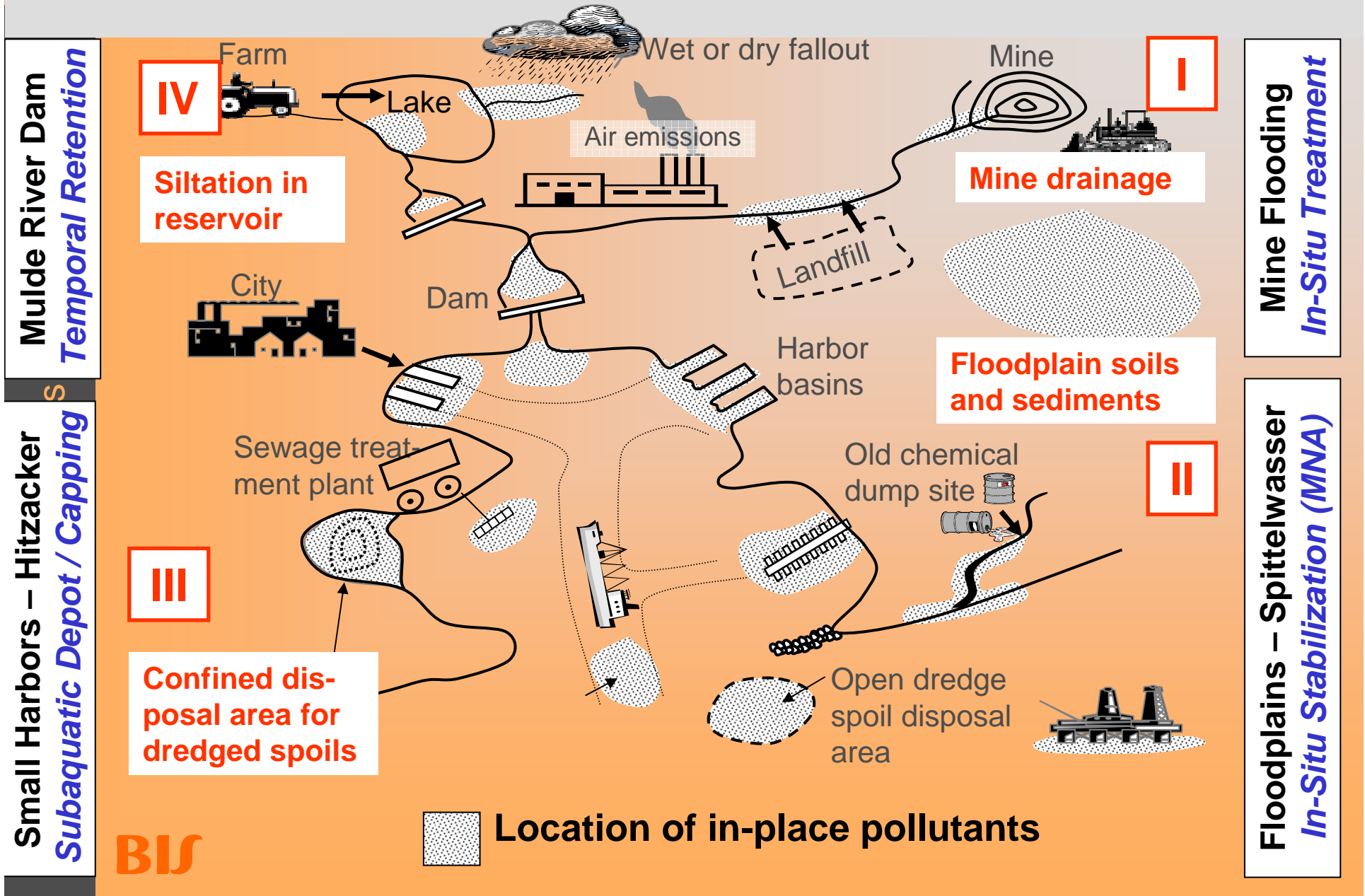
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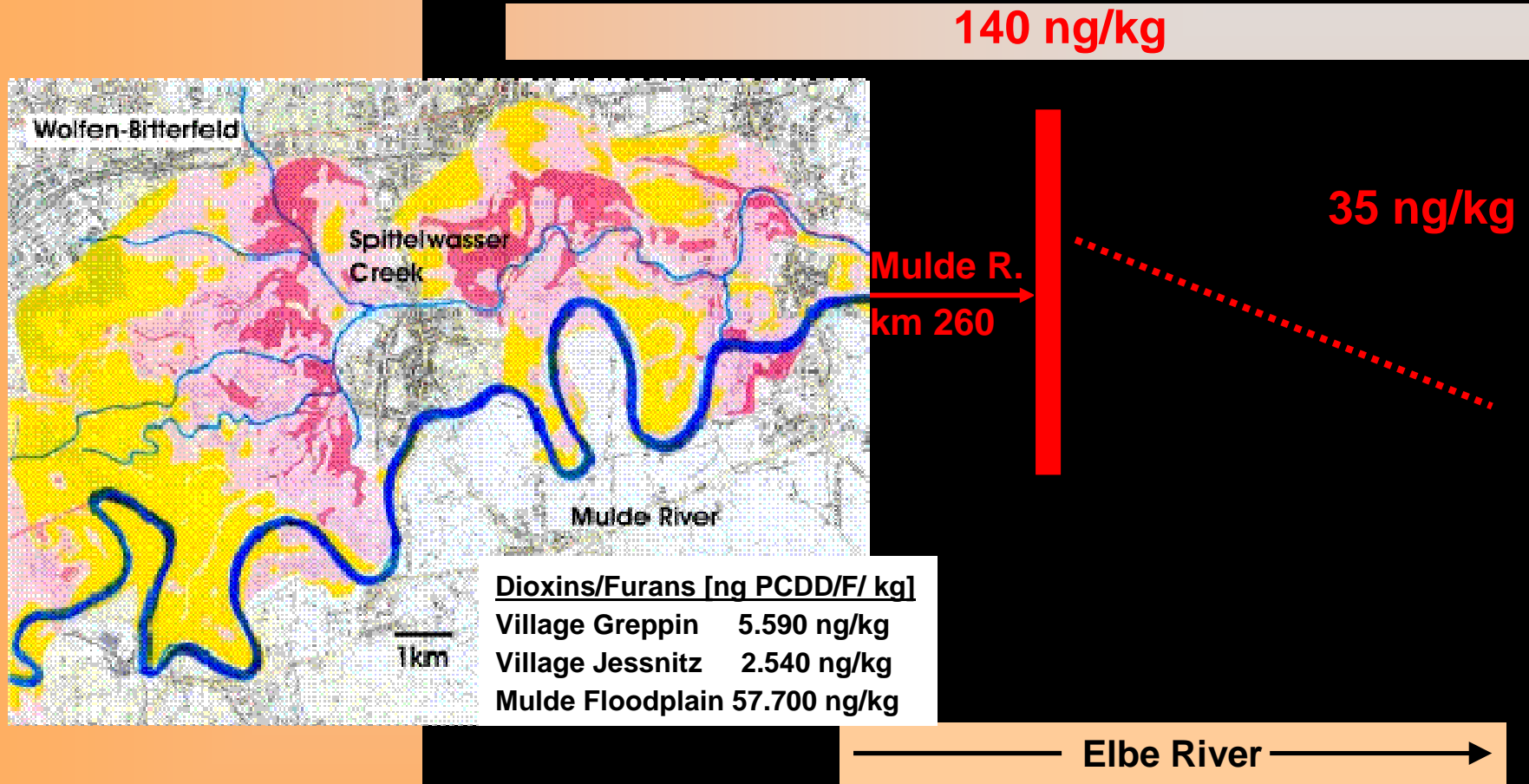
Heterogenous Data: BfG, IKSE, ...  
Lack of Target Values for Dioxin  
Floodplains as Intermediate Sinks  
**Proposals for Measures (2008)**

# Sediment Remediation – River Basin Scale



# Dioxin: from Spittelwasser to the Elbe River

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Monitoring of PCDD/F in Sediments of the Elbe River Basin:  
++ Congeneric Patterns, - - No Target Values for Relocation

# Remedial Option A: Monitored Natural Recovery

## **The Role of Natural Recovery in Sediment Remediation**

- (1) Contaminant burial – vertical contaminant profiles
- (2) Mechanical/chemical stabilisation – erosion/elution data
- (3) Chemical/biological transformation – prognosis/evidence
- (4) Dilution by dispersion – increase risk to downstream areas

*Magar & Wenning, IEAM 2006*

## **Spittelwasser floodplain (60 km<sup>2</sup>, fluvisols + sediments):**

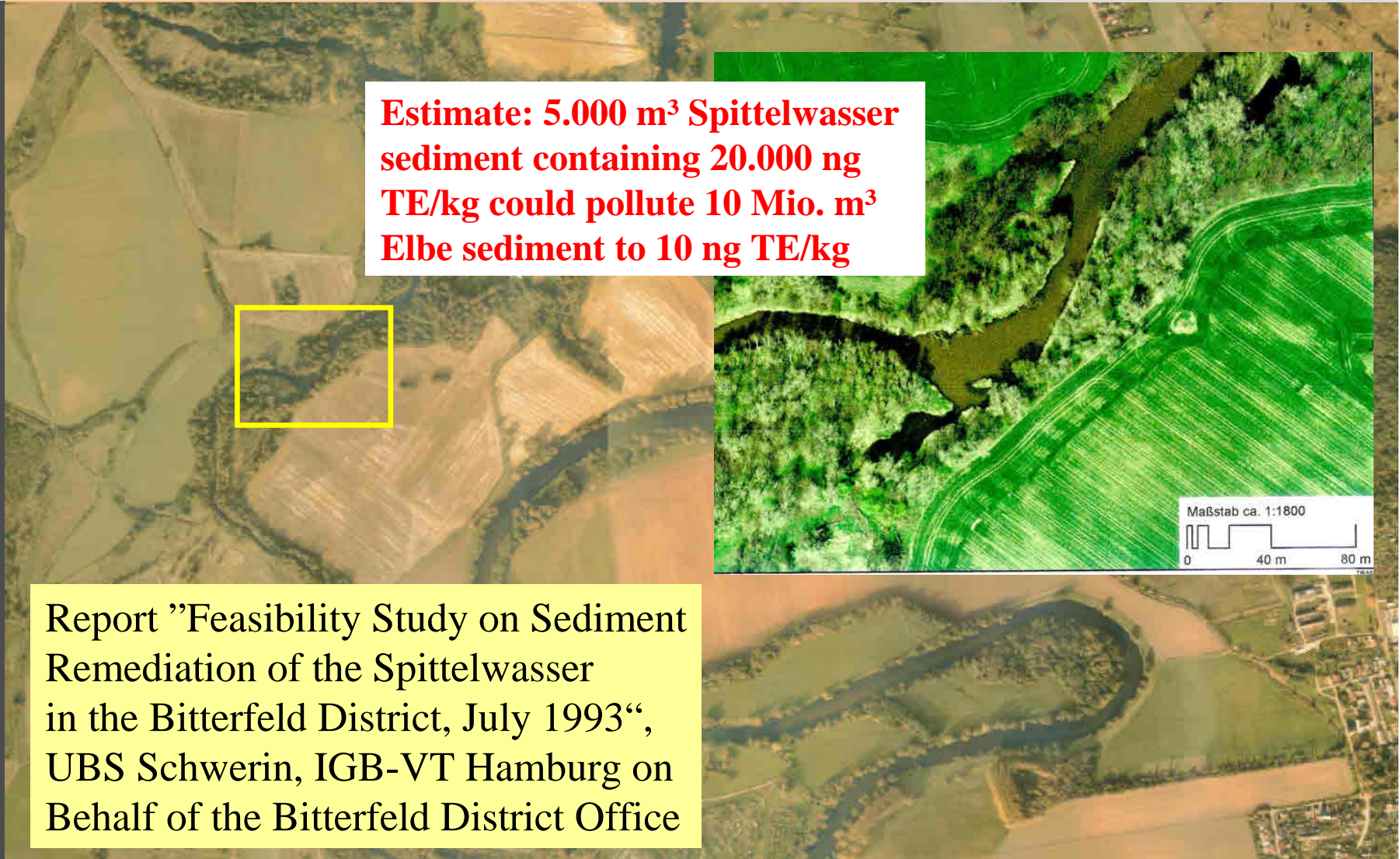
- (1) No clean sediment cover;
- (2) easily erodible old sediment (0.5 Pa in the upper 15 cm);
- (3) degradation of critical Bitterfeld chemicals – HCH, DDT, PCDD/F – is low, due to toxic effects (Bunge et al., 2007)

# Option B: Environmental Dredging/Excavation ...

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**Estimate: 5.000 m<sup>3</sup> Spittelwasser sediment containing 20.000 ng TE/kg could pollute 10 Mio. m<sup>3</sup> Elbe sediment to 10 ng TE/kg**

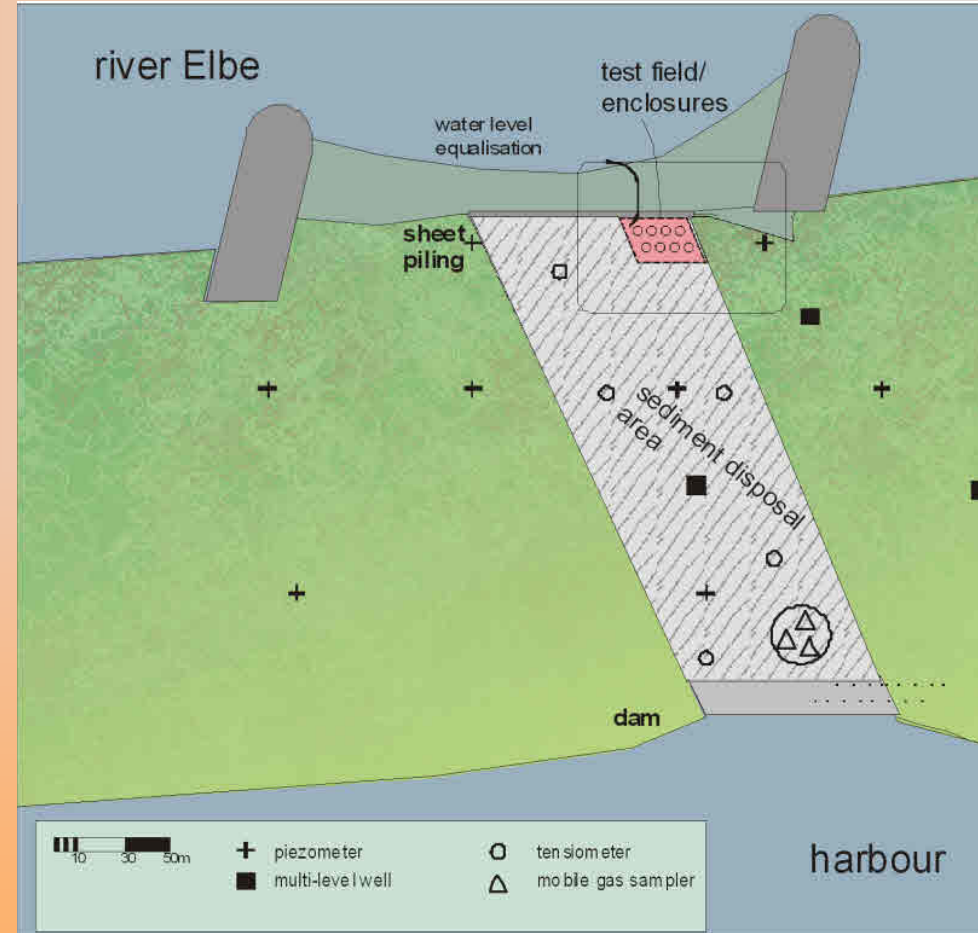
Report "Feasibility Study on Sediment Remediation of the Spittelwasser in the Bitterfeld District, July 1993", UBS Schwerin, IGB-VT Hamburg on Behalf of the Bitterfeld District Office



# ..... Excavation, Structural Isolation, and Capping

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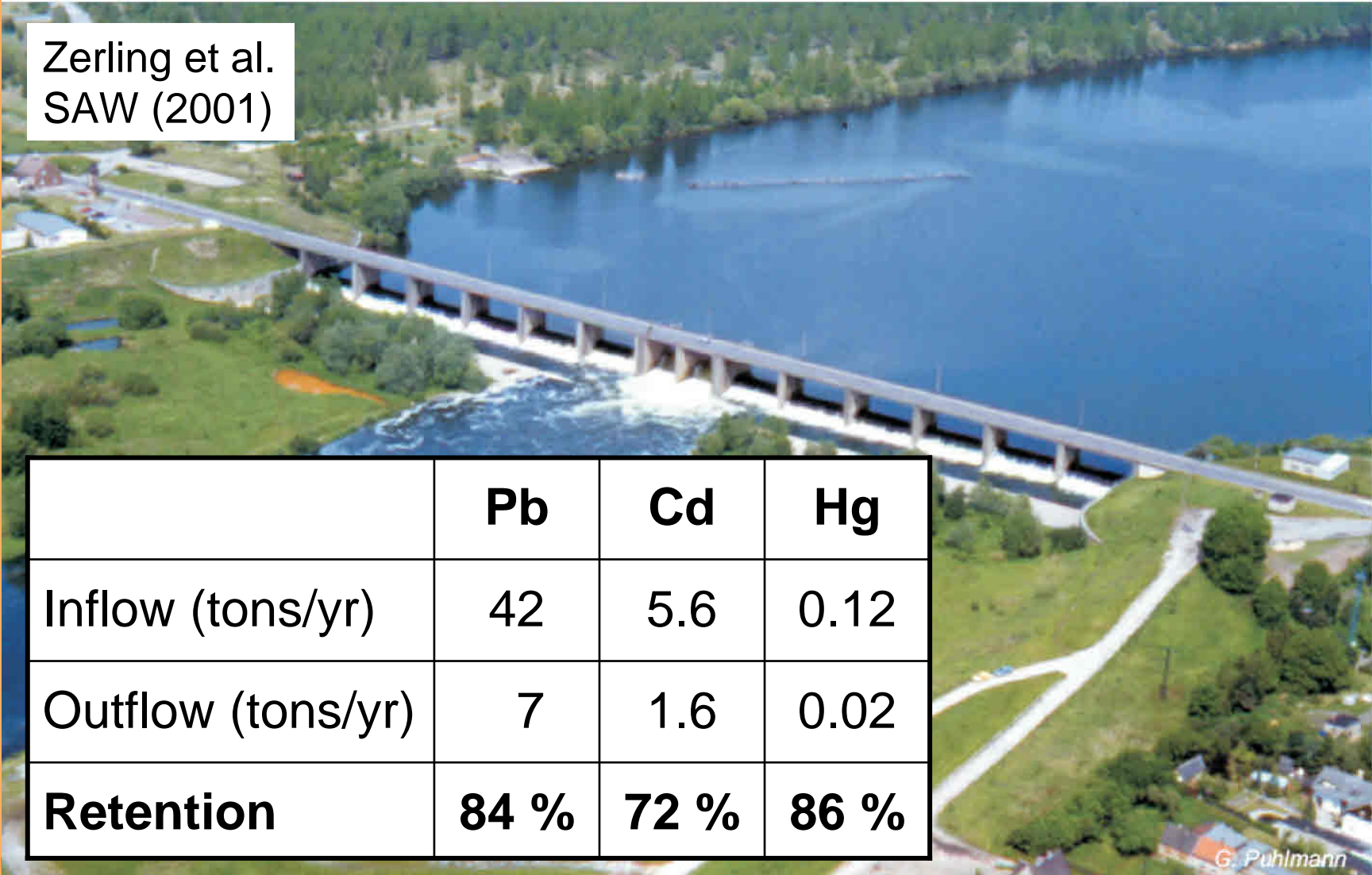
Example: Möbius Press and Hauling System (MPF)



Planning of a Pilot Study on Sediment Excavation/Capping at Hitzacker (Elbe)

# Bitterfeld Mulde Reservoir as a Sink for Metals

Zerling et al.  
SAW (2001)



	<b>Pb</b>	<b>Cd</b>	<b>Hg</b>
Inflow (tons/yr)	42	5.6	0.12
Outflow (tons/yr)	7	1.6	0.02
<b>Retention</b>	<b>84 %</b>	<b>72 %</b>	<b>86 %</b>

# From Monitoring to Measures - Conclusions

## **Monitoring Risks from Downstream Propagation .....**

- SPM/pollutant concentrations and loads in flood cycles
- Target values in a well-defined decision-making process
- Propagation concept: Hydrology and erosion potential

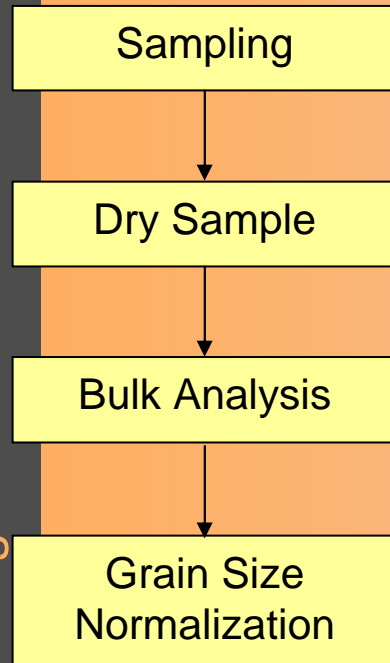
***RBM requires different levels of sediment monitoring***

## **Measures on Contaminated Sediments in River Basins**

# Sediment Monitoring Schemes (*JEM* 2007 p. 947)

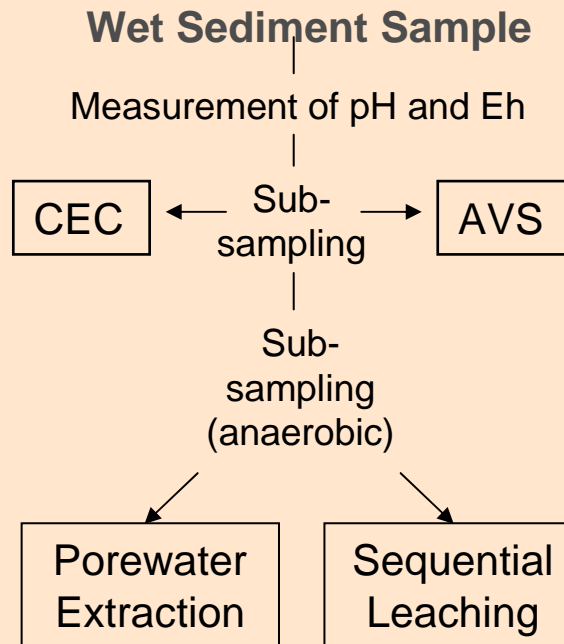
Monitoring to Measures – Elbe River Basin

## Screening Monitoring



**”Standard”**

## In-Situ Sediment Chemistry



**Basic  
Characterization**

## Predicting Propagation

**Chemical  
Stability**

Redox  
Processes

Buffer  
Capacity

Ageing  
Effects

**Hydraulic  
Stability**

Erosion  
Processes

Transport  
Models

Physical  
Effects

**”Dynamics”**

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***RBM requires different levels of sediment monitoring***

## **Measures on Contaminated Sediments in River Basins**

- Understanding the system – difference up-/downstream
- Diffuse contamination, e.g., in floodplains: "soft" options
- One-approach for monitoring, measures and aftercare

***Basin-wide cooperation based on technical expertise***

# Acknowledgements



## **Hamburg Port Authority**

Thanks for (co-)funding BIS-Elbe-studies;  
problems with dioxin and Ch. 6 "Measures"



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Council asked for removal of the FGG-Logo:

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*"Too much science, little practical statements"*.  
from: *k. & k. Central Office of Hydrology, Prague (1907)*

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Rainer Götz, Frank Krüger, Burkhard Stachel and Fred Walkow