

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

Ulrich Förstner (TUHH), Susanne Heise (BIS)
and Peter Heininger (BfG)

5th International SedNet Conference, Oslo 27th-29th May 2008
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)

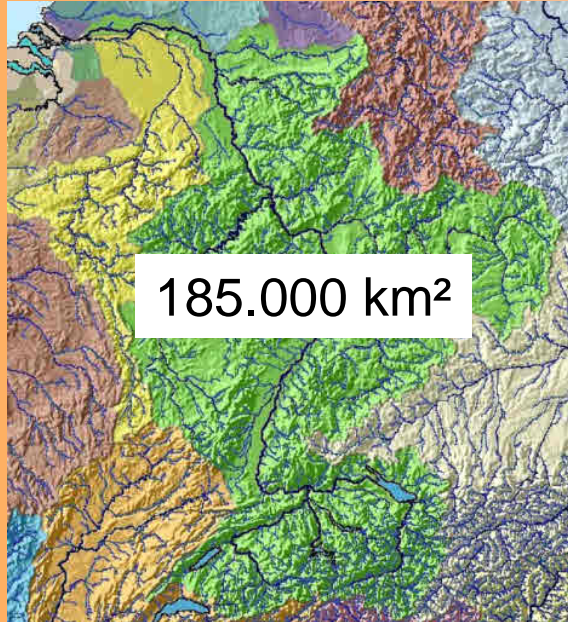
“For certain **measures** (such as source control) **target values** and a good understanding of the system (different in the up-stream and downstream parts) are necessary” (SedNet 2007)

Monitoring Historical Pollution from Sediments

The Rhine Basin

The Elbe Basin

From Monitoring to Measures – Elbe River Basin

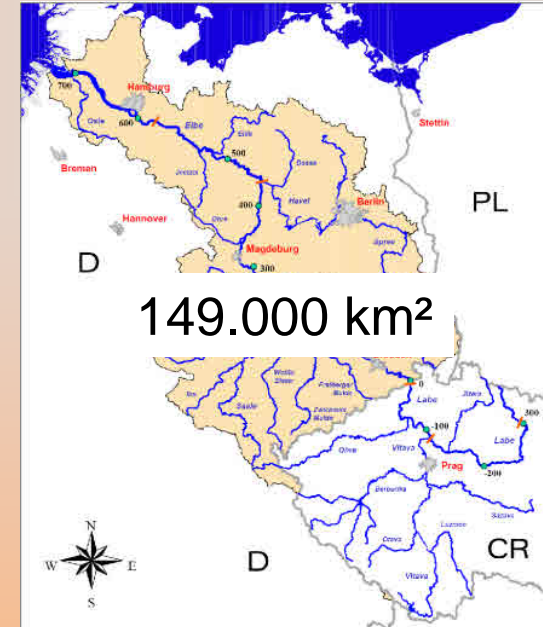


(commissioned by the Port of Rotterdam, 2004)

3-Step Approach
Heise et al. 2004

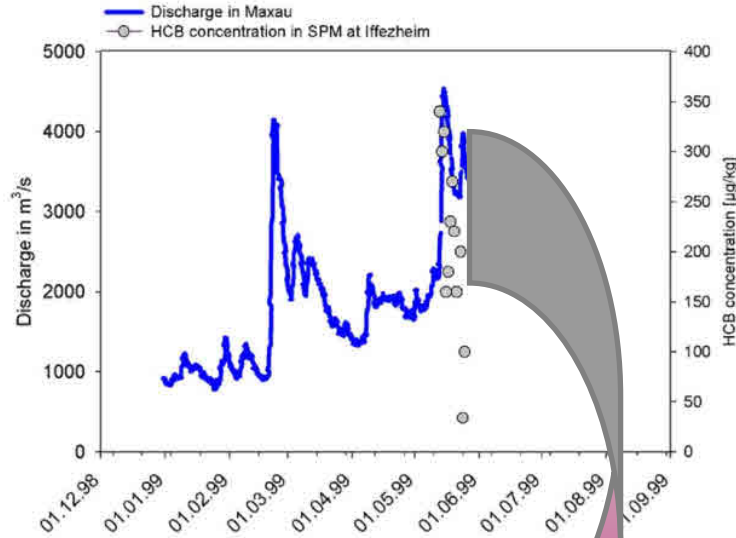
- 1) S.o.C.
- 2) A.o.C.
- 3) A.o.R.

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

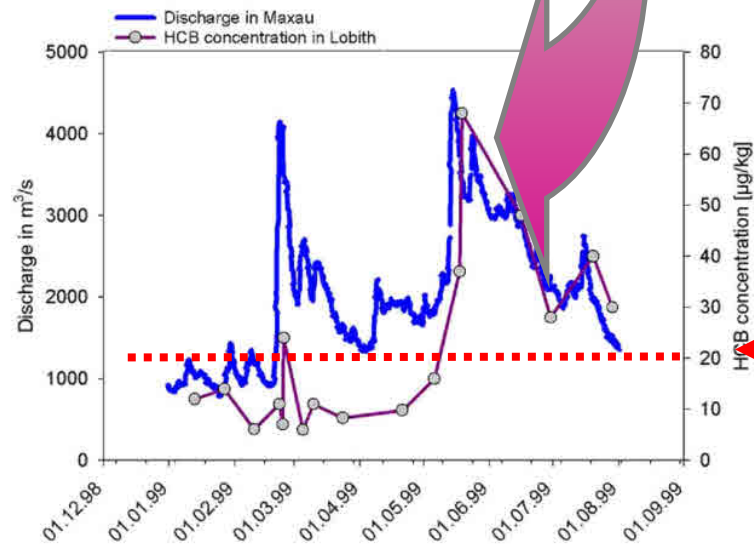


Resuspension of HCB in Iffezheim (Upper Rhine Barrage)

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)

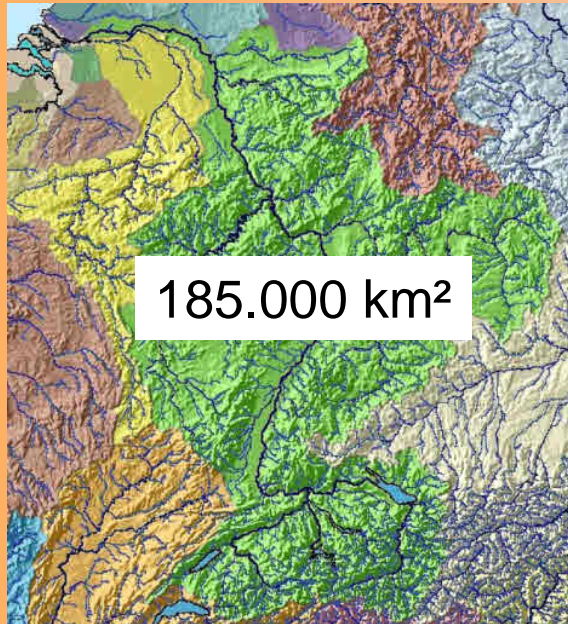
Data: Landesumweltamt Baden-Württemberg

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The Rhine Basin

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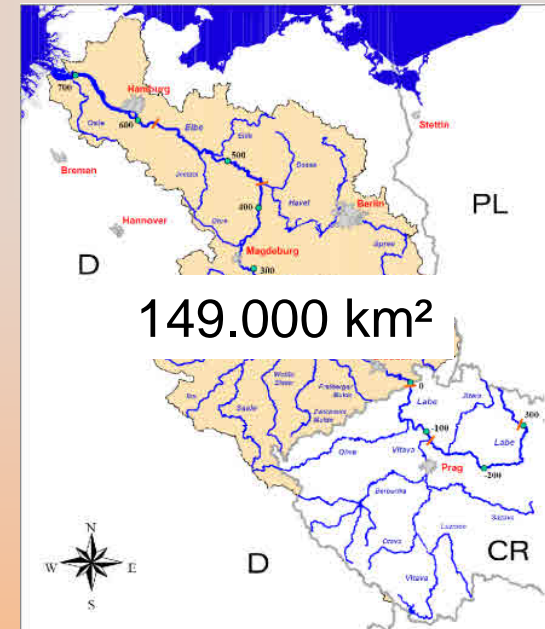


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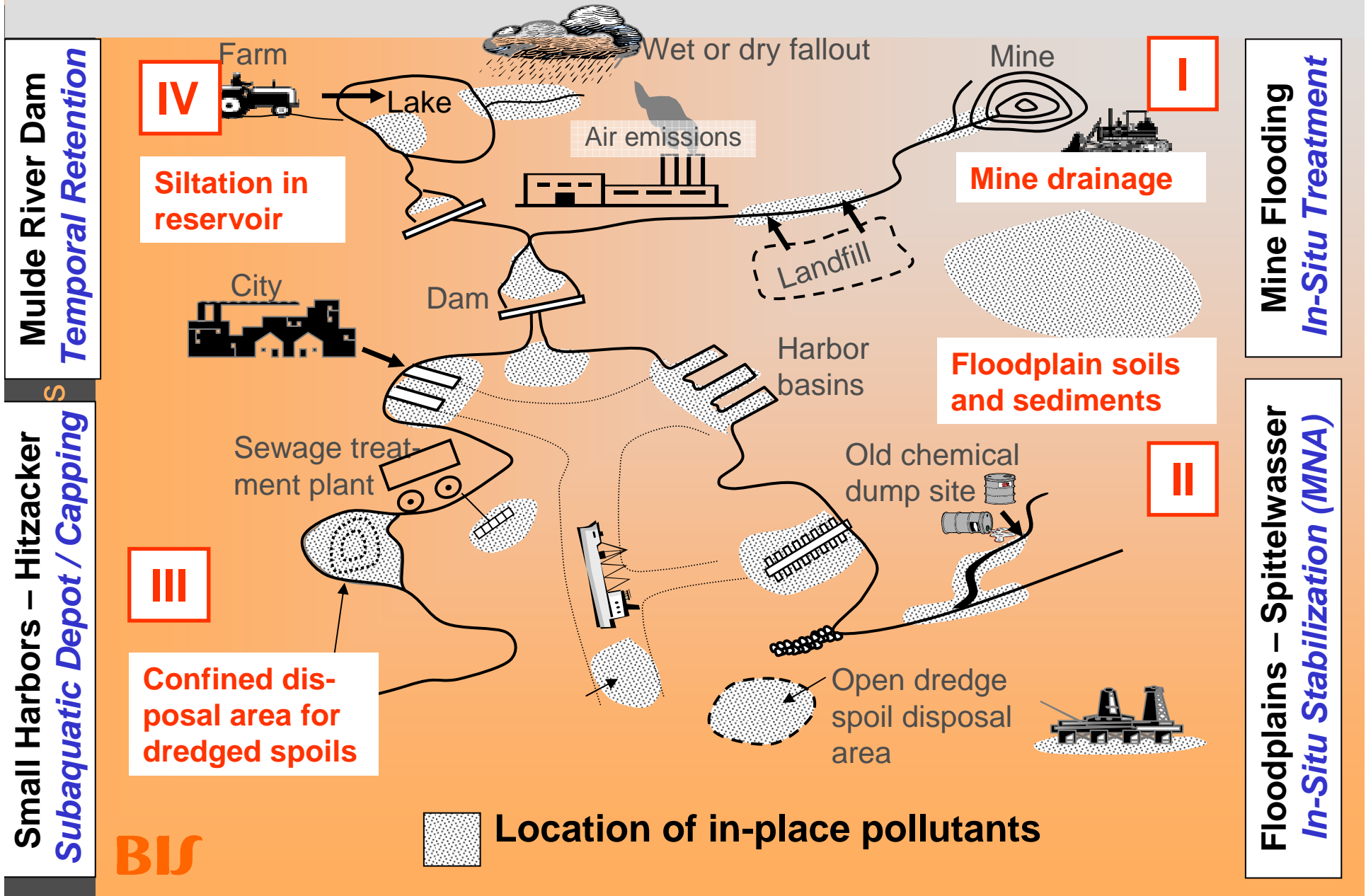
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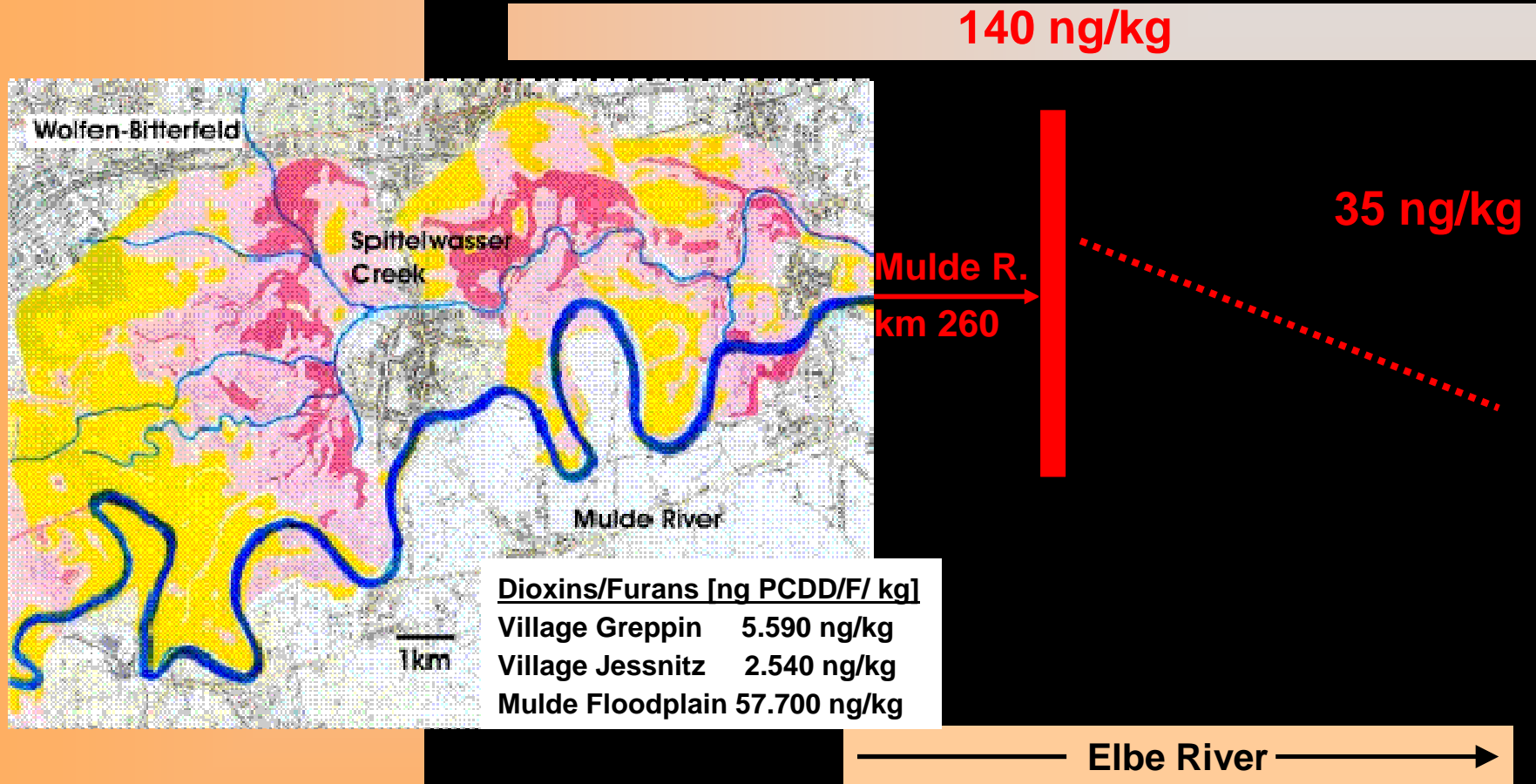
Heterogenous Data: BfG, IKSE, ...
Lack of Target Values for Dioxin
Floodplains as Intermediate Sinks
Proposals for Measures (2008)

Sediment Remediation – River Basin Scale



Dioxin: from Spittelwasser to the Elbe River

From Monitoring to Measures – Elbe River Basin



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 km², fluvisols + sediments):

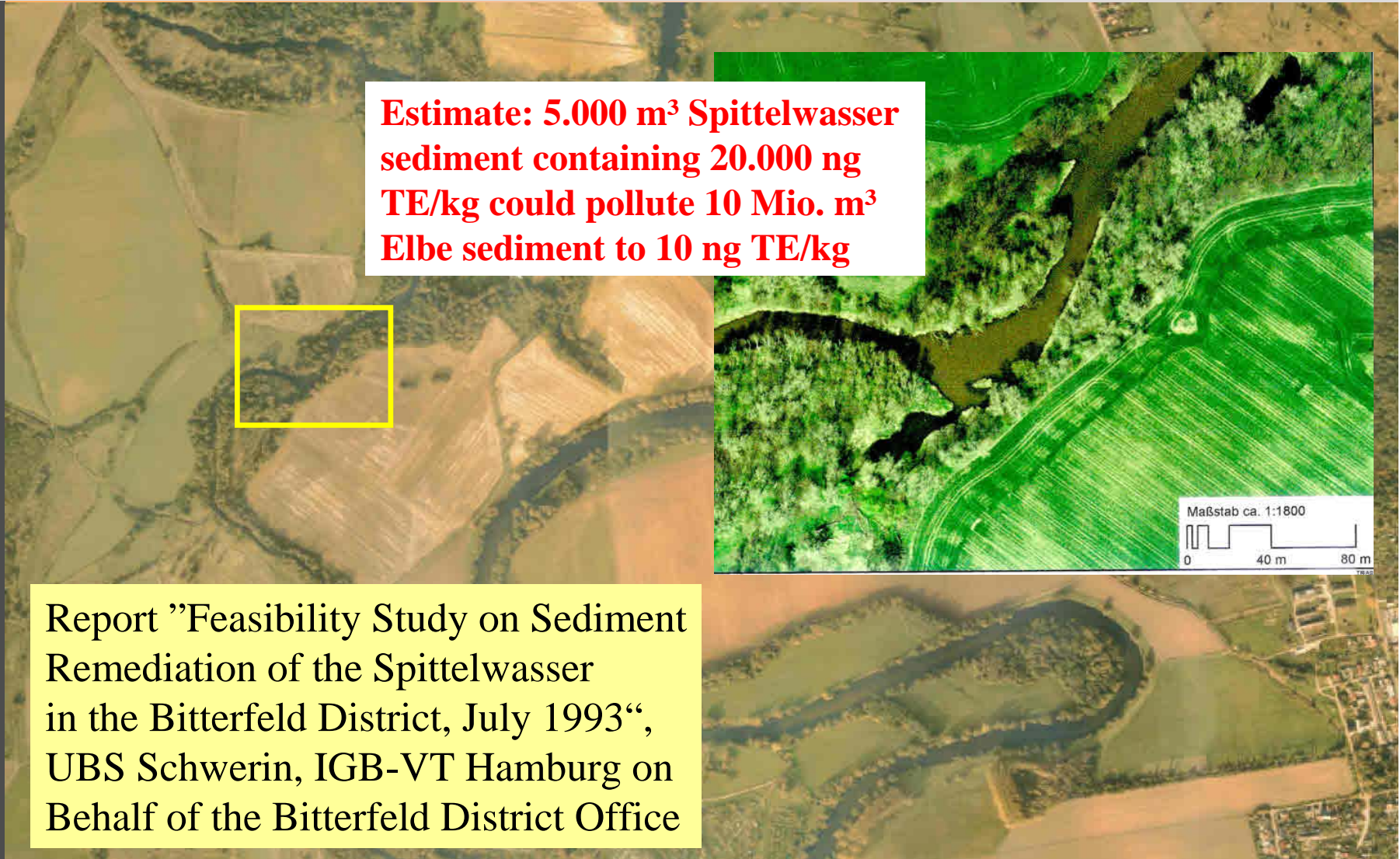
- (1) No clean sediment cover;
- (2) easily erodible old sediment (0.5 Pa in the upper 15 cm);
- (3) degradation of critical Bitterfeld chemicals – HCH, DDT, PCDD/F – is low, due to toxic effects (Bunge et al., 2007)

Option B: Environmental Dredging/Excavation ...

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Estimate: 5.000 m³ Spittelwasser sediment containing 20.000 ng TE/kg could pollute 10 Mio. m³ Elbe sediment to 10 ng TE/kg

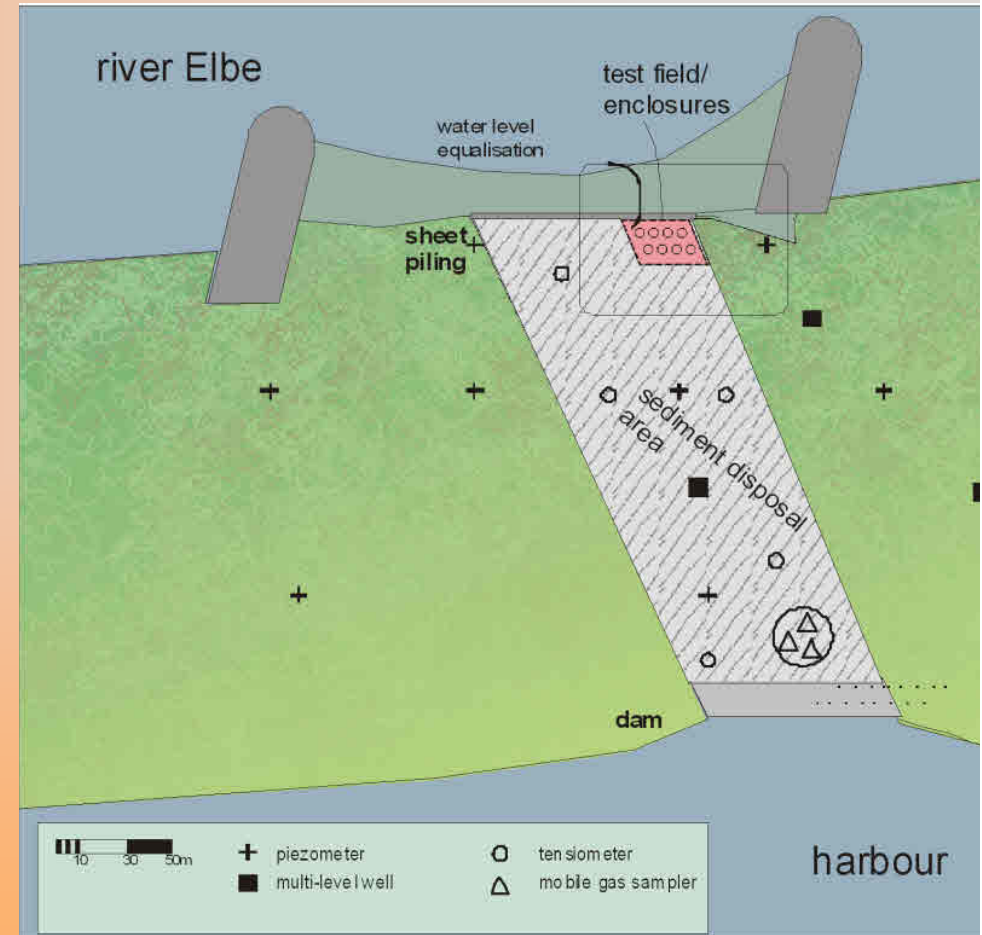
Report "Feasibility Study on Sediment Remediation of the Spittelwasser in the Bitterfeld District, July 1993", UBS Schwerin, IGB-VT Hamburg on Behalf of the Bitterfeld District Office



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

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Example: Möbius Press and Hauling System (MPF)

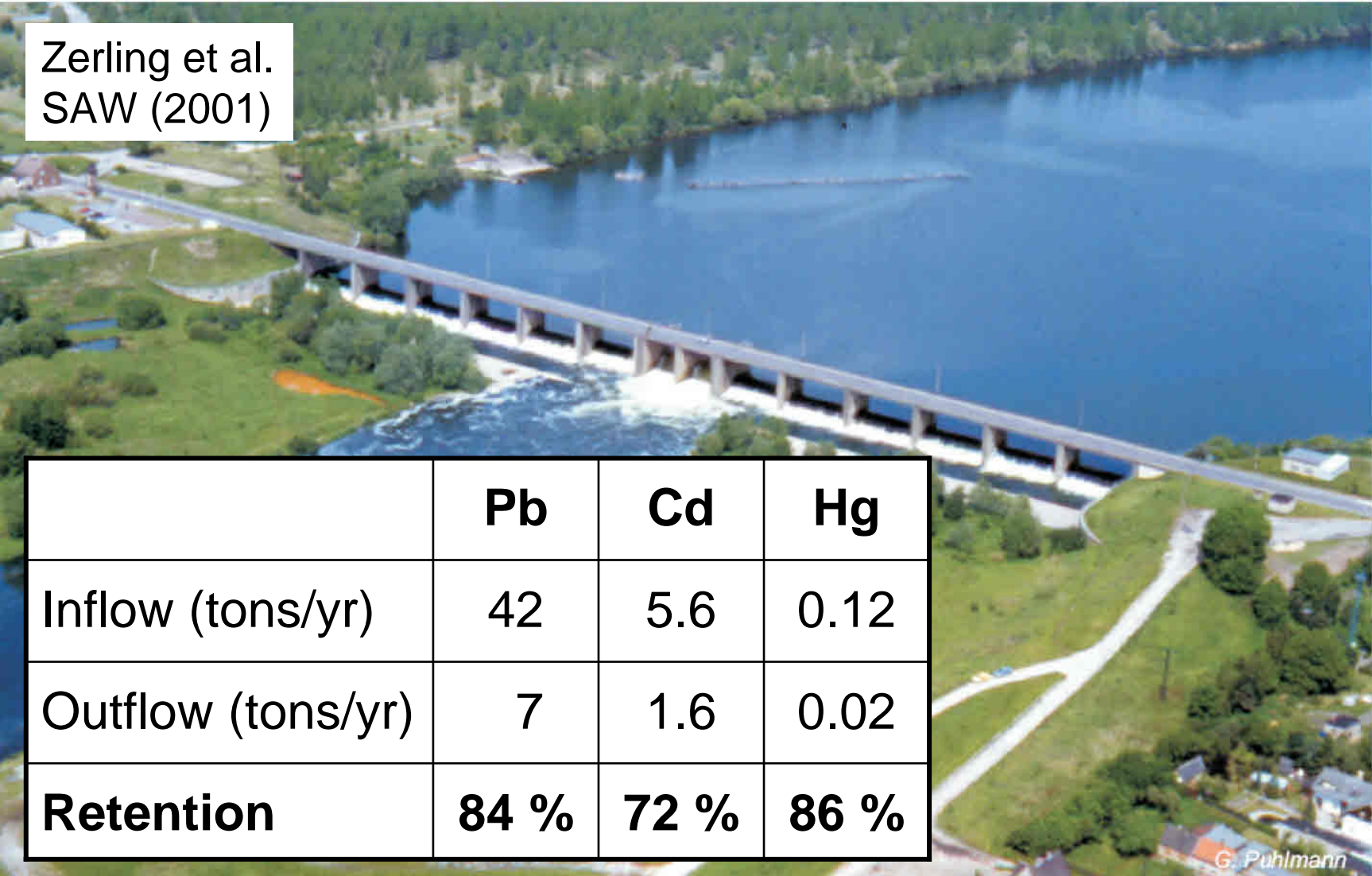


Planning of a Pilot Study on Sediment Excavation/Capping at Hitzacker (Elbe)

Bitterfeld Mulde Reservoir as a Sink for Metals

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Zerling et al.
SAW (2001)



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

G. Puhlmann

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

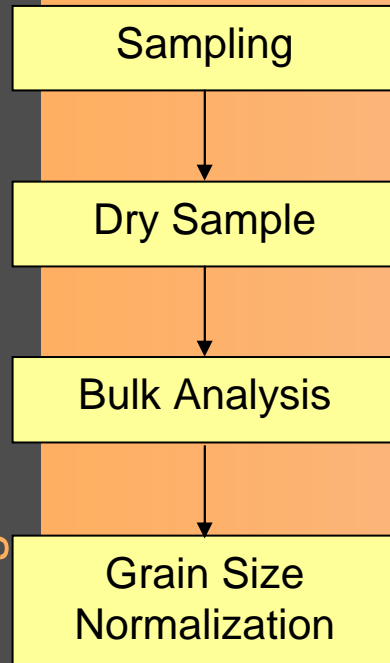
RBM requires different levels of sediment monitoring

Measures on Contaminated Sediments in River Basins

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

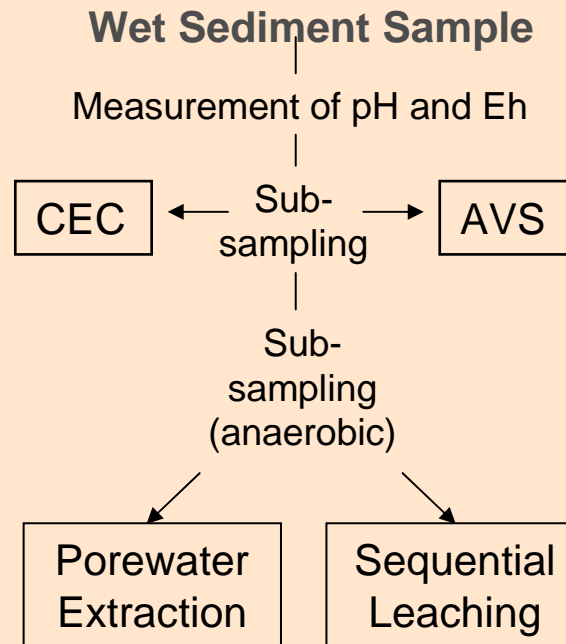
Monitoring to Measures – Elbe River Basin

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

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