Data Base of the Sullied Sediments Project

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on behalf of the Sullied Sediment Partners in Work Package 3

Sullied Sediments

Sediment Assessment and Clean Up Pilots in Inland Waterways in the North Sea Region

Many of the inland waterways in Europe are under threat due to the introduction of Watch List chemicals that are not currently regulated under the European Water Framework Directive. These chemicals enter our waterways as a result of our day-to-day activities and through industry, and many have been shown to be harmful to wildlife and the wider aquatic environment. Regardless of their source, these pollutants accumulate in the sediments in our rivers and canals over time.

Water regulators and managing authorities do not always know the levels, locations or impacts of these pollutants. Nor do they have the tools to assess sediments confidently and make informed environmental management decisions. To address these issues, the Sullied Sediment project partnership of scientific experts, regulators and water managers is developing and testing new tools that will enable stakeholders to better assess, treat and prevent contamination from these chemicals. This work is being carried out at selected sites in the Elbe, Humber and Scheldt river catchments.

The intention of the Sullied Sediments project is therefore to help regulators and water managers make better decisions with regard to the management, removal and disposal of sediments, thereby reducing economic costs to private and public sector organisations, and the impact of these pollutants on the environment.

The partnership is also working to reduce the extent of chemicals entering the water system by raising awareness about what we, as consumers, are releasing into the environment through the use of common drugs and household products. This includes the involvement of volunteers in a sediment sampling initiative across the North Sea Region, which will inform and empower them as water champions in their local communities.

The Sullied Sediments project has been co-funded by the European Regional Development Fund through the Interreg VB North Sea Region Programme with match funding from the 13 partners involved. The project partnership includes public, private, community and voluntary sector organisations based in the United Kingdom, Germany, Belgium and the Netherlands.

The project has been supported under the Interreg VB North Sea Region Programme's third priority, which is focused on a Sustainable North Sea Region, and is led by the University of Hull (UK).

Website: northsearegion.eu/sullied-sediments

Blog: sulliedsediments.wordpress.com

Twitter:@SulliedSediment

The incentives for WP3

Sediment is of high ecological value due to its diversity of infauna and epifauna, its function as a habitat, providing food and shelter, and its role in the recycling of nutrients. But it is also of economic concern. Sediment that accumulates in navigational channels is usually dredged out of the system. Disposal options for dredged material are fiercely debated among environmentalists and stakeholders such as port authorities or waterway or shipping administrations, when the material is contaminated and the release of hazardous chemicals needs to be prevented but is costly.

Within the focus of Sullied Sediments were 3 watersheds that each has its own issue with sediments:

The Humber Catchment, where 100 000 tons silt per tide is carried in and out of the Humber estuary, delivering enormous volumes of sediment also to the attached water bodies.

The Elbe Estuary, where the Port of Hamburg spends up to 100 mio € to manage and remove 3 to 9 mio m^3 of accumulated, contaminated sediment each year.

The Scheldt River Basin District, where Antwerp has recently spent about 500 mio € on a treatment facility for contaminated sediment.

Figure 1: Impressions from the Humber Estuary (below and right) and sediment accumulation on the banks of the river Hull (Fotos: Heise)

The objective to set up a database

The Sullied Sediments project aims to improve sediment and dredged material assessment in order to improve the environmental safety without increasing the costs substantially.

“Environmental safety” means the probability that current or prospective hazardous effects are overlooked will decrease.

Our hypothesis was, that this would be possible by integrating biotest data into a sediment and DM assessment framework as one line of evidence next to chemical sediment quality criteria (and possibly biological community data). Following the citation of Peter Drucker below, data on ecotoxicity, chemical contaminants, sediment properties and biological community status were gathered during 18 sampling surveys in 3 watershed of different characteristics over the course of 2.5 years, and provided to the partners in form of a data base for further use and framework development.

Peter Drucker (1909-2005):
IF YOU CAN’T MEASURE IT,
YOU CAN’T IMPROVE IT.

Methodological approach

Within work package 3, 3 watersheds with 3 sites each

in 6 sampling surveys

so 54 sediment samples were collected and the various parameters analyzed to quantify:

- Biological diversity
- Ecotoxicological effects
- Chemical contamination

Available data

The data are compiled in an MS Access database.

Data comprise

- Description of sediments and samples

Sample location	**coordinates**
Sampling specifics	Sampling gear, time, depth, temperature etc
Sediment after sampling	Oxygen concentration, Eh, pH
Grain size analysis	From <20 µm to > 2 mm
Bioavailable sulfide	AVS/SEM
Nutrients	Exchangable Ammonium, Nitrate, Nitrite as N, Phosphate (available)
Organic matter content	
Dry matter	
Total moisture (105 °C)	

- Whole organism biotests:

Organism group	Species	Tested matrix
Algae*	*Desmodesmus subspicatus*	Elutriate*, PW*
Algae	*Raphidocelis subcapitata*	elutriate
Bacteria	*Aliivibrio fischeri*	elutriate, extract, PW*
Crustacea	*Daphnia magna*	elutriate, PW*
Crustacea	*Thamnocephalus platyurus*	PW
Bacteria	*Arthrobacter globiformes,*	sediment
Nematodes	*Caenorhabditis elegans*	sediment
Oligochaete	*Lumbriculus variegatus*	sediment
Crustacea	*Heterocypris incongruens*	sediment
Crustacea	*Hyalella azteca*	sediment
Aquatic plant	*Myriophyllum aquaticum*	sediment

PW – porewater; * only measured for German samples

- Quality assessment of the biological community

Target group	Index	
Meiobenthic community	No calculated Index	Original distribution of species
Nematode-diversity	NemaSpEAR	
Macrozoobenthos community	Belgian Sediment Index	Original distribution of species

- Results of chemical analyses of more than 130 substances including watch list chemicals

Alkanes (→ mineral oil)	nC10 - nC37
Dioxins and furans	15 homologues
Organotins	8 compounds
PAHs	16 US EPA PAHs
PCBs	7 compounds
HCHs	Alpha, beta, gamma HCH-isomers
DDX	DDT and metabolites
Chlorobenzenes	Tri- to hexachlorobenzenes
Further pesticides	Aldrine
PFC	PFOA, PFOS
Brominated cyclododecane	Hexabromocyclo-dedecane and isomers (alpha, beta, gamma)

Ag	**Cr**	**Li**	**Se**
Al	**Cu**	**Mg**	**U**
As	**Fe**	**Mo**	**V**
Ba	**Gd**	**Na**	**Zn**
Ca	**Hg**	**Ni**	
Cd	**K**	**Pb**	
Co	**La**	**Rb**	

WL - Compounds	Matrix
Triclosan, diclofenac, estradiol	extracts

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Partners

The Sullied Sediments project partnership comprises 13 project beneficiaries:

Canal and River Trust (UK)

East Riding of Yorkshire Council (UK)

Ecossa (Germany)

Hamburg Port Authority (Germany)

Hamburg University of Applied Sciences (Germany)

Institut Dr Nowak (Germany)

Openbare Vlaamse Afvalstoffenmaatschappij (Belgium)

Radboud University (The Netherlands)

Socotec UK Ltd (UK)

University of Antwerp (Belgium)

University of Hull (UK)

University of Leeds (UK)

Vlaamse Milieumaatschappij (Belgium)

The partnership also receives expert advice from 12 strategic partners who form our Advisory Group:

East and North Yorkshire Waterways Partnership (UK)

Elbe Habitat Foundation (Germany)

Environment Agency (UK)

Federal Institute of Hydrology (Germany)

Foundation for Applied Water Research (Europe)

Hamburg Ministry of the Environment and Energy (Germany)

Northumbrian Water (UK)

River Hull Board (UK)

Sediment European Network Steering Group (European)

Thames Water (UK)

Vlakwa (water research consultancy) (Belgium)

Yorkshire Water (UK)

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