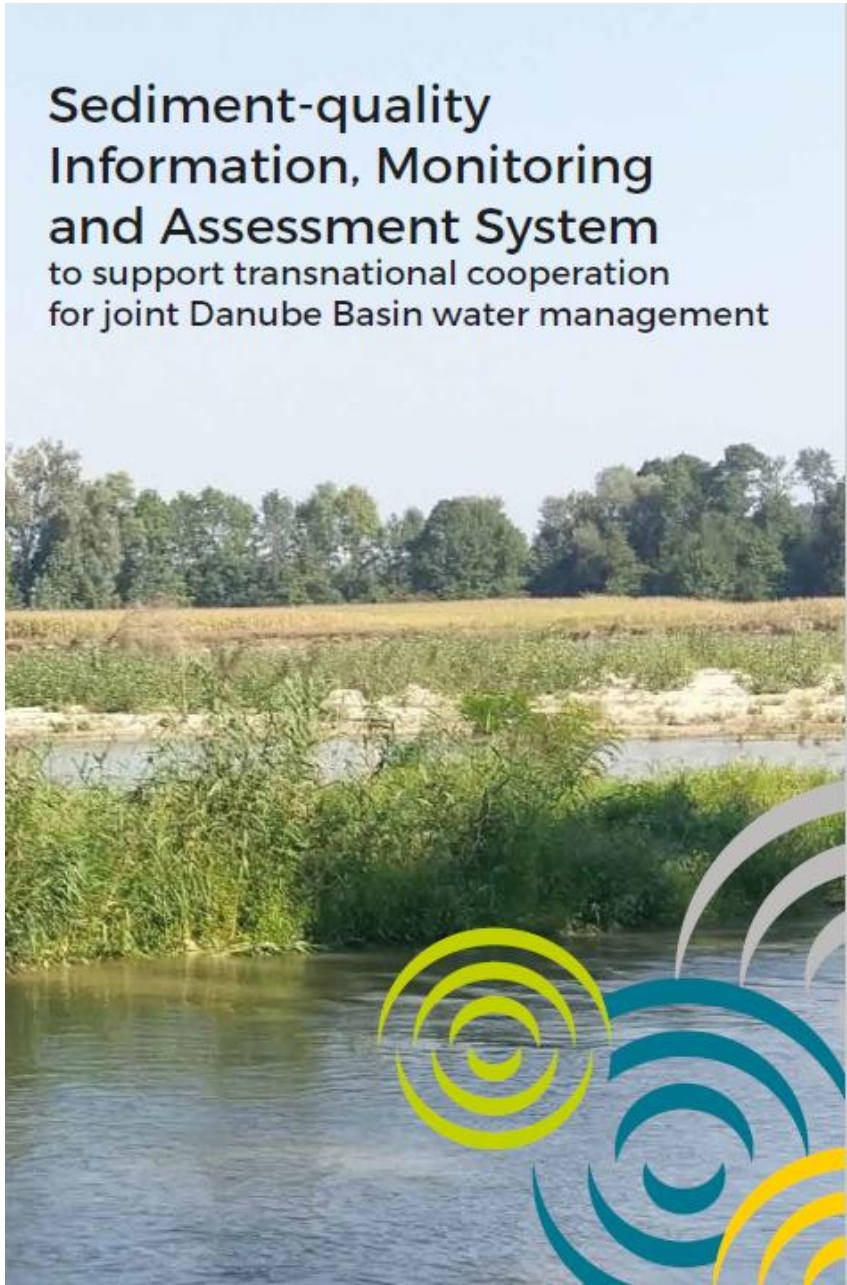
Interreg
Danube Transnational Programme
SIMONA

SIMONA
Sediment-quality Information, Monitoring and Assessment System

to support transnational cooperation for joint Danube Basin water management

Gyozo Jordan and The SIMONA Project Team*
Scientific Coordinator

**http://www.interreg-danube.eu/approved-projects/simona*



THE PROJECT

Background

Environment and culture responsible Danube region (Priority Axis 2.)

Strengthen transnational water management (Specific Objective 2.1)

Fund: 1,749,152 €

Duration: June 2018 – November 2021

Partnership: 13 Countries

17 Partners, 13 ASPs

http://www.interreg-danube.eu/about-dtp/participating-countries

Project web site: https://www.interreg-danube.eu/approved-projects/simona
Project video: https://www.interreg-danube.eu/approved-projects/simona/section/simona-promotional-video

Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona

Danube River Basin – PROBLEMS

Origin

Nitrogen pollution current status

ICPDR

Governments - ASPs

Geochemistry Expert Group

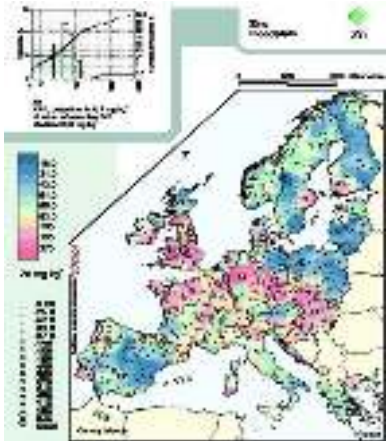
Geological Surveys - PPs

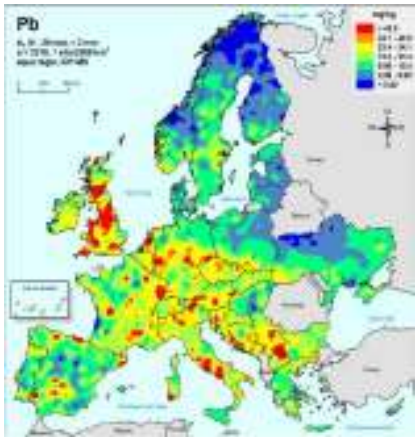
DEMAND: hazardous substances

- *where are the contaminated areas (water, sediment, soil)?*
- *harmonised data and methods*
- *Water Framework Directive*

SUPPLY: geochemical maps

- ***FOREGS*** *EU Geochemical Atlas (stream water, stream sediment, floodplain sediment, soil)*
- ***GEMAS*** *EU Chemistry of Soils (REACH Regulation)*





ASP: Associated Strategic Partner, PP: Project Partner

Objective

DEMAND Effective use of sediment quality **ASSESSMENT** (status, trend) for the next RBMPs due in 2021

STATUS DTP Countries: lack of institutional supply

SUPPLY Ready-to-deploy Sediment-quality Information, Monitoring and Assessment System (**SIMONA SYSTEM**)

aid Danube Transnational Programme (DTP) Countries' daily operational work

Water Framework Directive

Approach

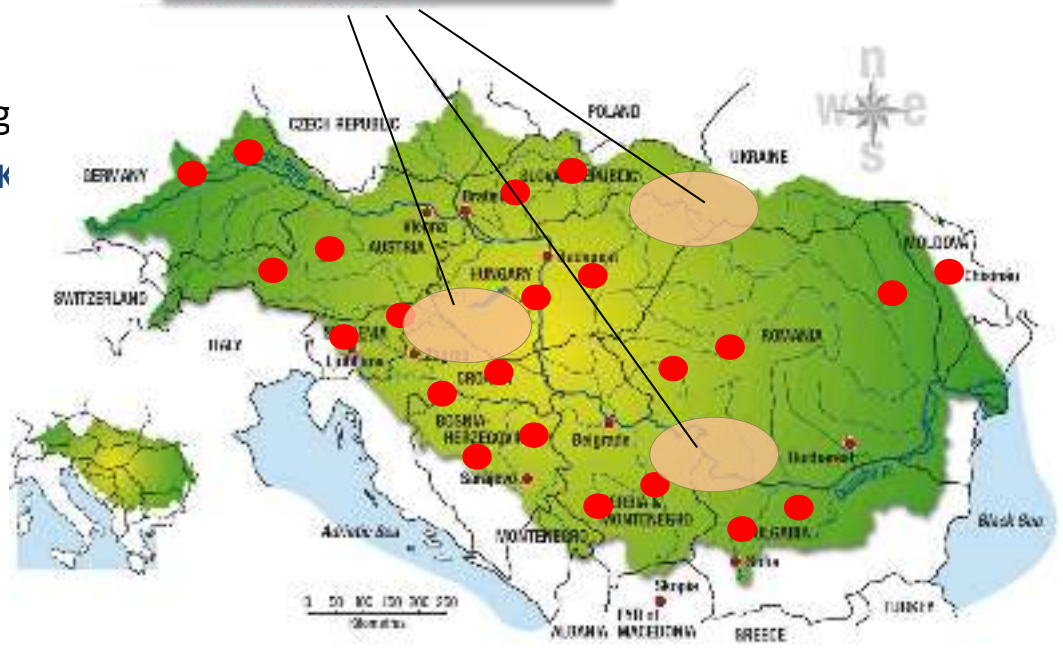
- ✓ **INVENTORY** – status of Sediment Quality monitoring in Danube River Basin (DRB)

- ✓ **METHODS** – **SIMONA System**
  - Sampling Protocol / Methods
  - Laboratory Protocol / Methods
  - Evaluation Protocol / Methods
  - IT Tool

- ✓ **TESTING & VERIFICATION**
  - 3 Test Areas (TAs) (30 sampling sites)
  - National Sites (2 per country -26 sampling sites): **DRB BASELINE MONITORING NETWORK**

- ✓ **TRAINING & CAPACITY BUILDING**
  - Sampling – Drava TA
  - Laboratory – South Danube TA
  - Evaluation & IT Tool – Upper Tisa TA
  - **PARTNER COUNTRY PREMISSES**

3 TEST AREAS:
- Drava River
- Upper Tisa
- South Danube



Approach

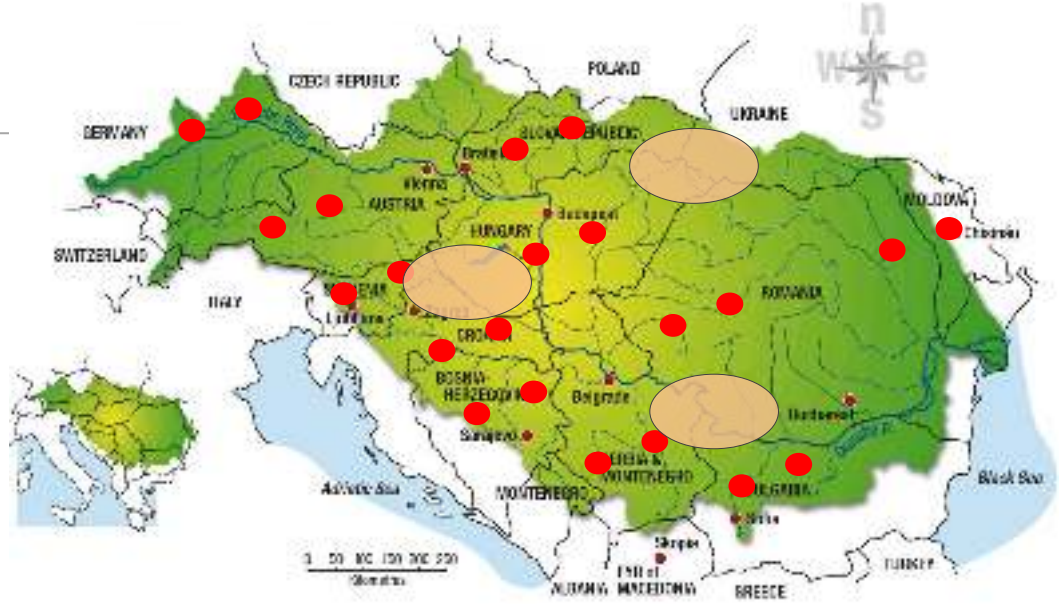
SIMONA System – DEVELOP

- Sampling Method / *Protocol*
- Laboratory Method / *Protocol*
- Evaluation Method / *Protocol*
- IT Tool

3 CASE Studies – TEST

26 Nat. Baseline Sites – VERIFY

deliverables



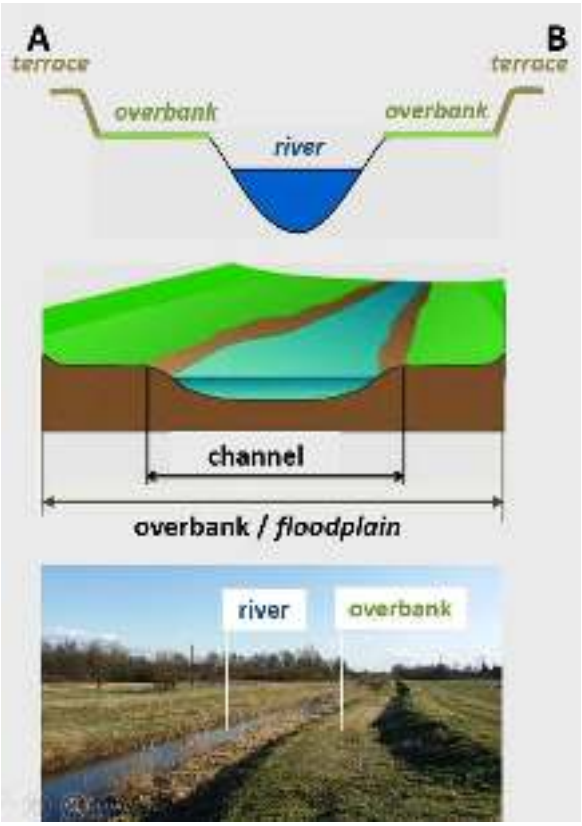
Scope

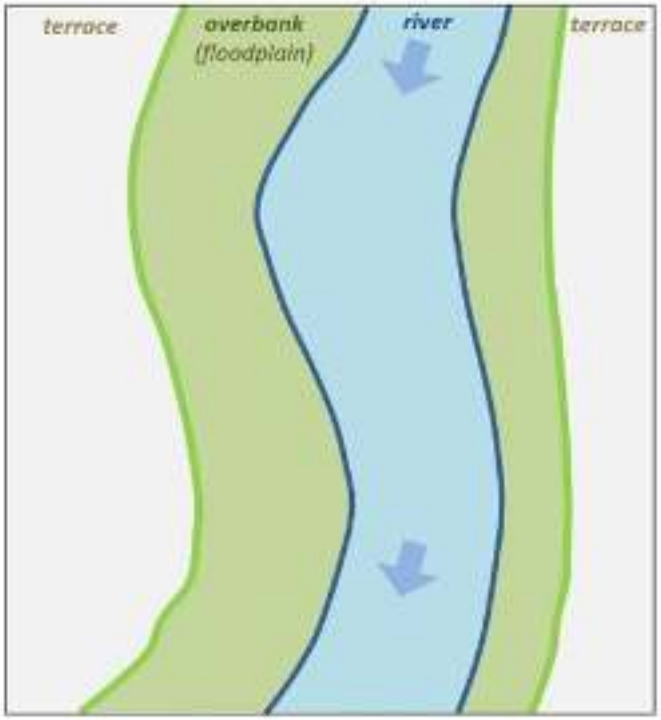
Danube River Basin

The most international river basin in the world

- ✓ 10% of Europe
- ✓ 800.000 km ^{2}
- ✓ **19 countries**
- ✓ **85 million inhabitants**
- ✓ 6500 m^3/s

Scope

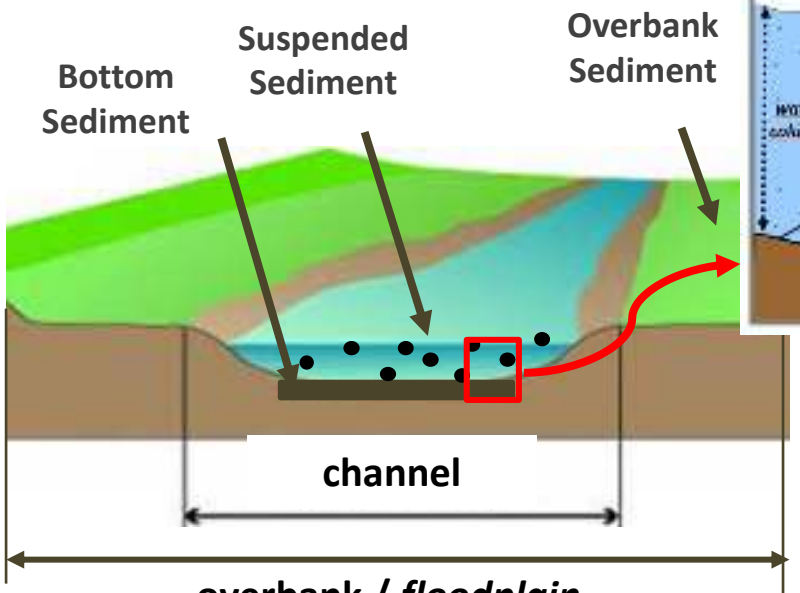


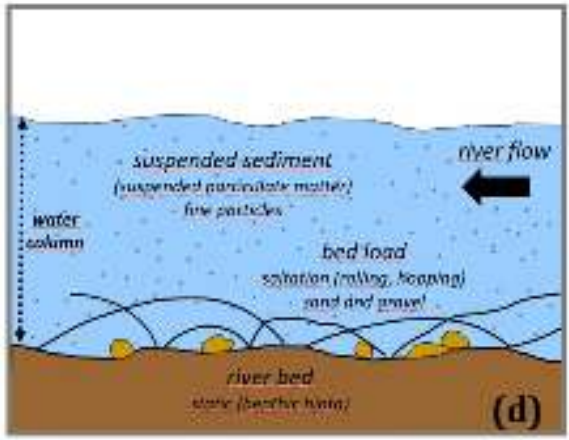


Sediment types:

Fluvial sediments (rivers)

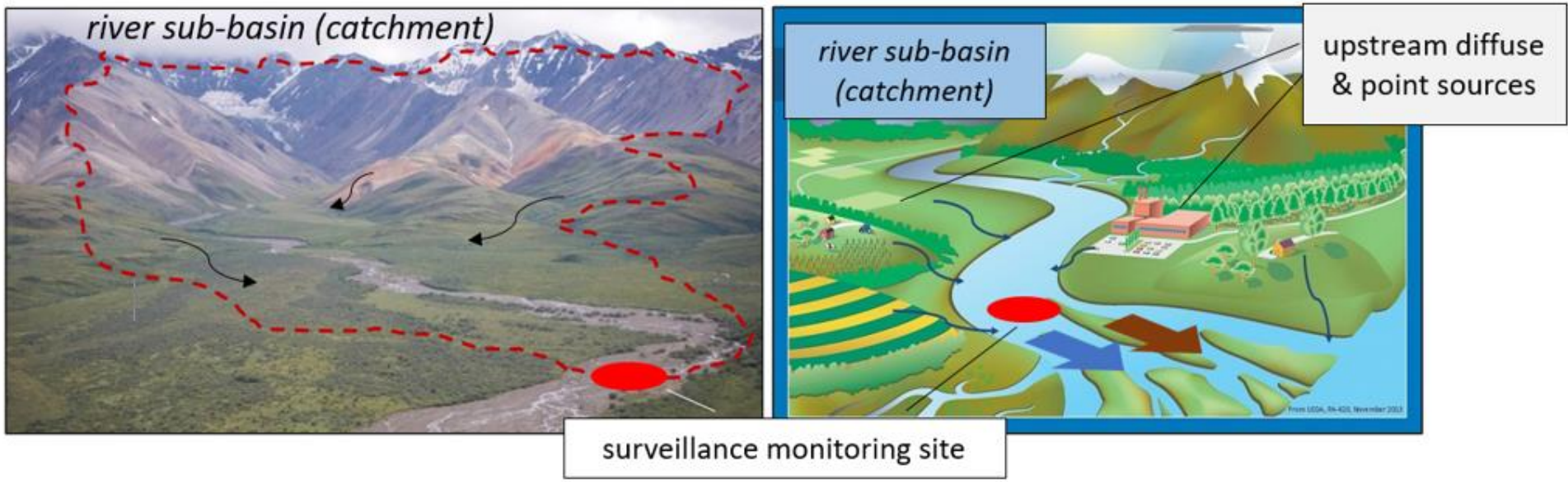
(bottom, suspended, floodplain)





Scope

Surveillance / Operational monitoring (regular monitoring for long-term changes)

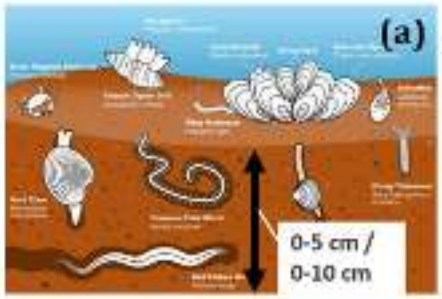


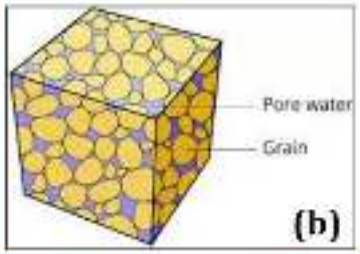
- *Single monitoring site (sampling station)*
- *Single water body*
- *Hazardous substances listed in the EU WFD*
- *Single substances (mixtures are not considered)*

Sediment quality: HS toxicity to biota (benthic & pelagic) as receptors

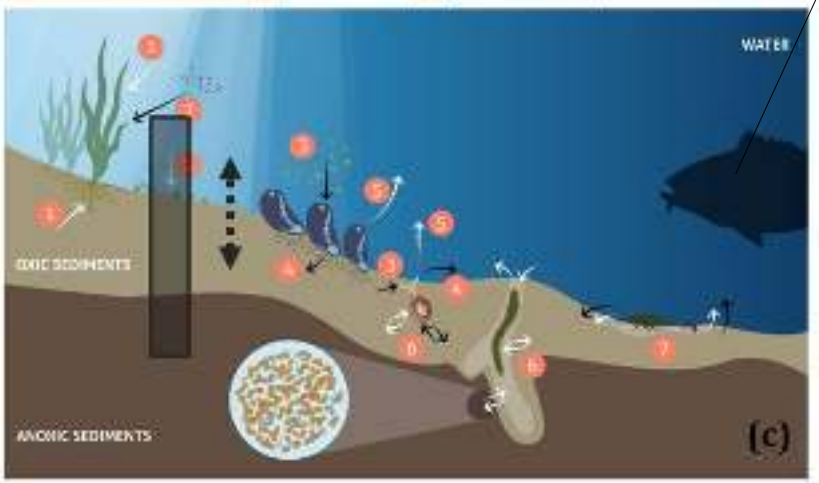
ASSESSMENT ENDPOINT:
Biota

benthic





pelagic



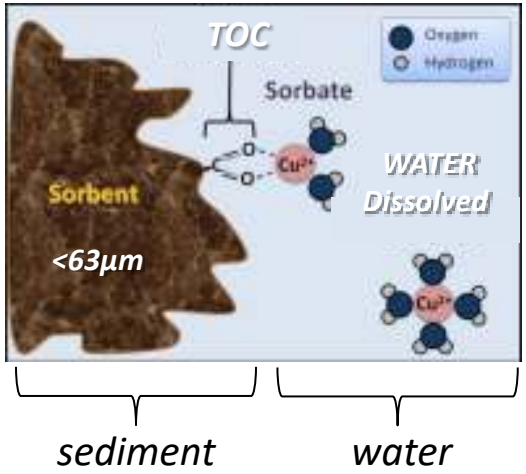
Scope

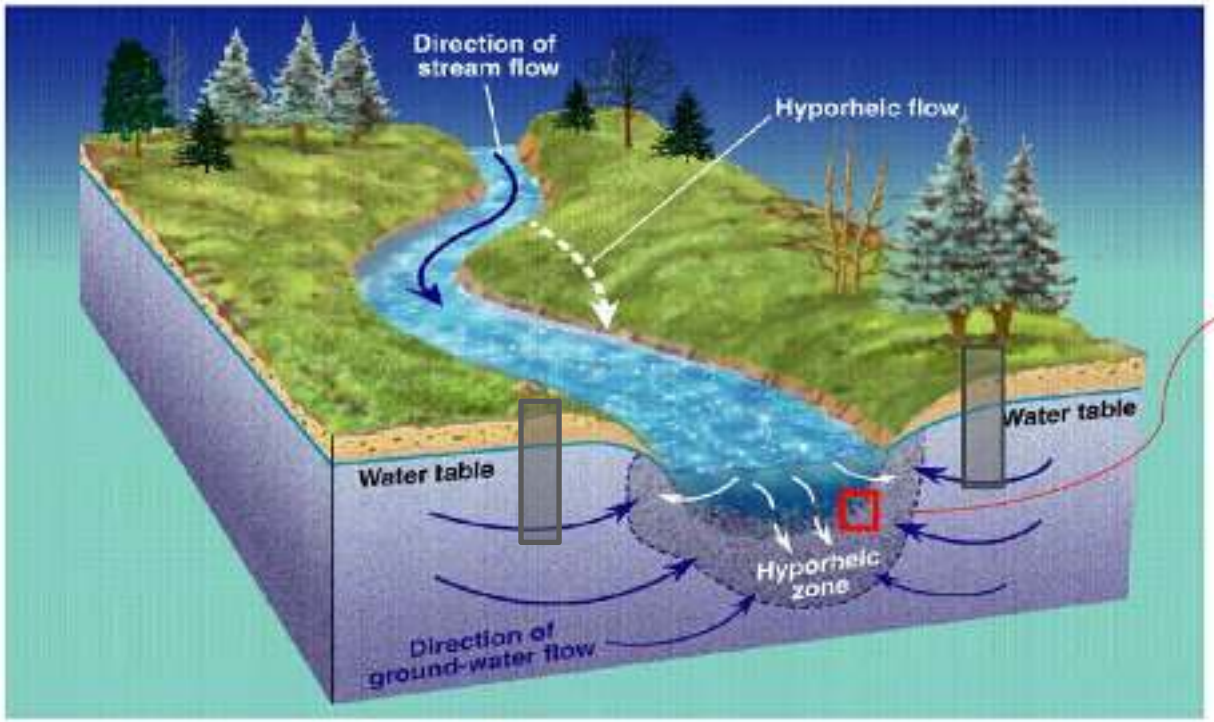
HS partitioning

between
- *solid sediment & pore **water***
- *suspended sediment & surface **water***

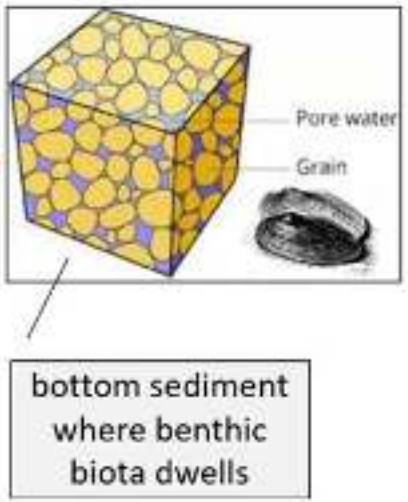
HS partitioning

within sediment
- *total organic content (**TOC**)*
- *fine grain material (**<63µm**)*





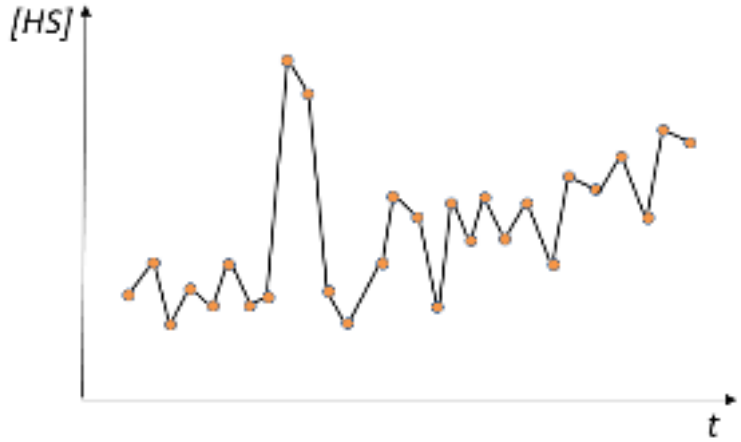
hyporheic zone



SIMONA

Monitoring: regular (repeated) observation ⇔ SURVEY

Transnational: harmonisation



DEVELOPMENT

Criteria

CRITERIA FOR METHODS

- ✓ **SCIENTIFIC** (Repeatibility/Reproducibility, Representativity)
- ✓ **LEGISLATIVE** (WFD: Surveillance/Regular Monitoring; HSs; EQS)
- ✓ **EFFICIENT** (simple, fast, cheap, ready-to-deploy, adaptive to site-specific conditions)

aid DTP Countries' **daily operational work**

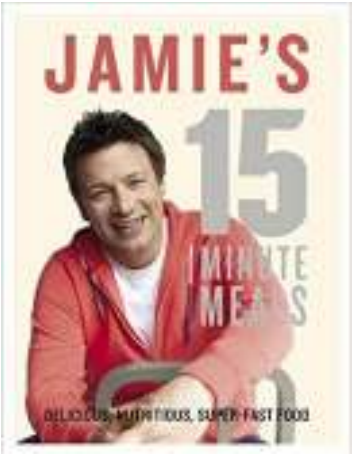


Water Framework Directive

The Cookbook Approach

step-by-step manual: scientifically-based, demonstrated

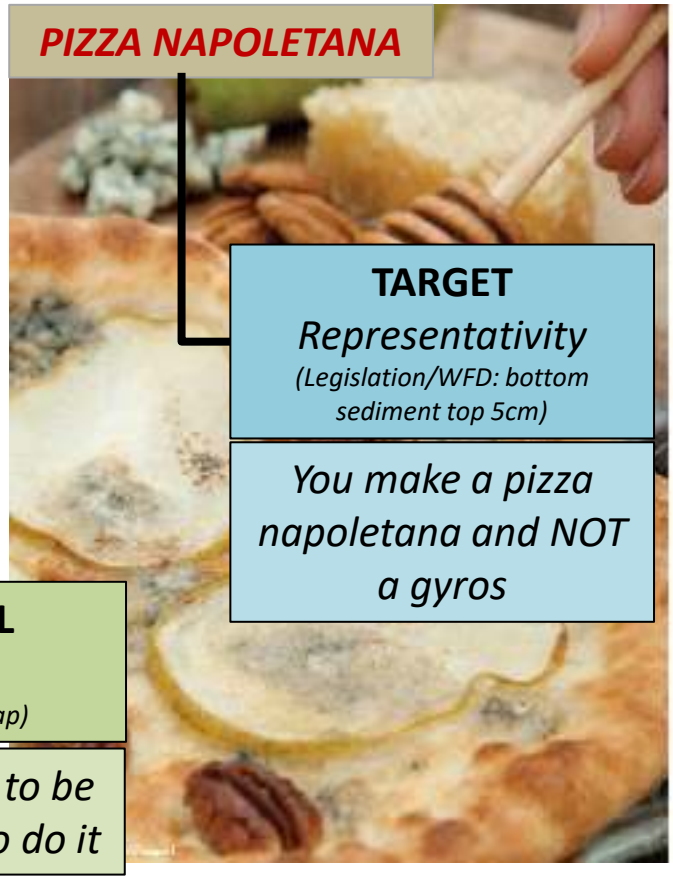
The COOKBOOK Approach



PRACTICAL
Efficiency
(simple, fast, cheap)

You don't have to be a mastercook to do it

PIZZA NAPOLETANA



TARGET
Representativity
(Legislation/WFD: bottom sediment top 5cm)

You make a pizza napoletana and NOT a gyros

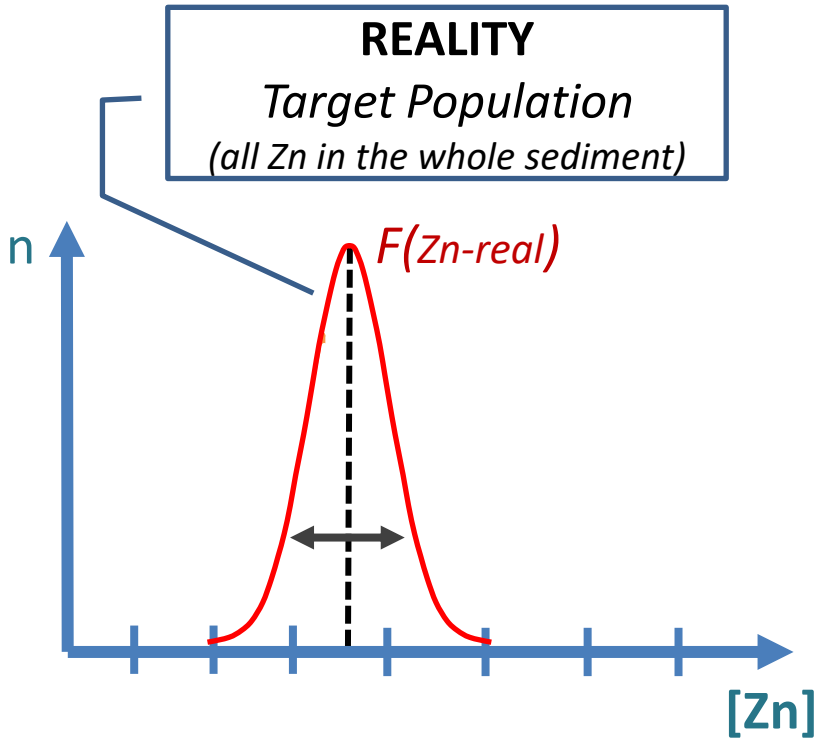
RECIPE

METHOD
Repeatibility/Reproducibility
(tools 'ingredients', instructions)

You always make the SAME pizza WHEREVER you are

SAMPLING Theory

CRITERIA FOR METHODS

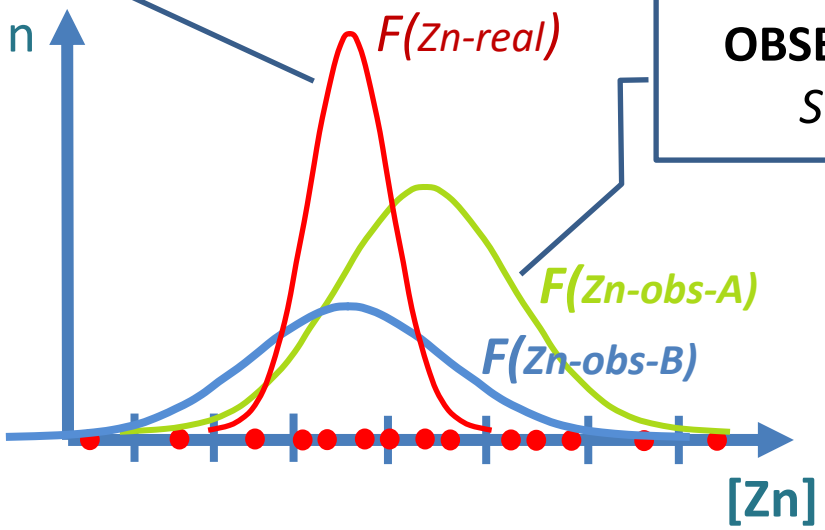


SAMPLING Theory

CRITERIA FOR METHODS

REALITY
Target Population
(all Zn in the whole sediment)

OBSERVATION
Sample



HOMOGENEITY
Statistics

REPRESENTATIVITY: ***F(Zn-real)*** **=** ***F(Zn-obs-A)***

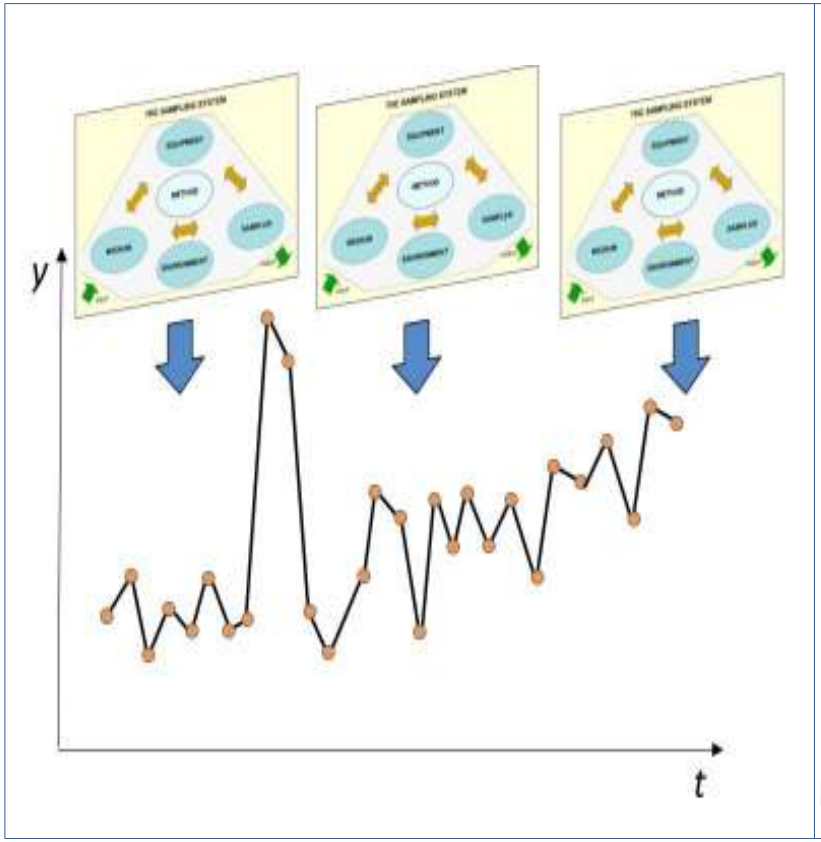
REPRODUCIBILITY: ***F(Zn-obs-B)*** **=** ***F(Zn-obs-A)***

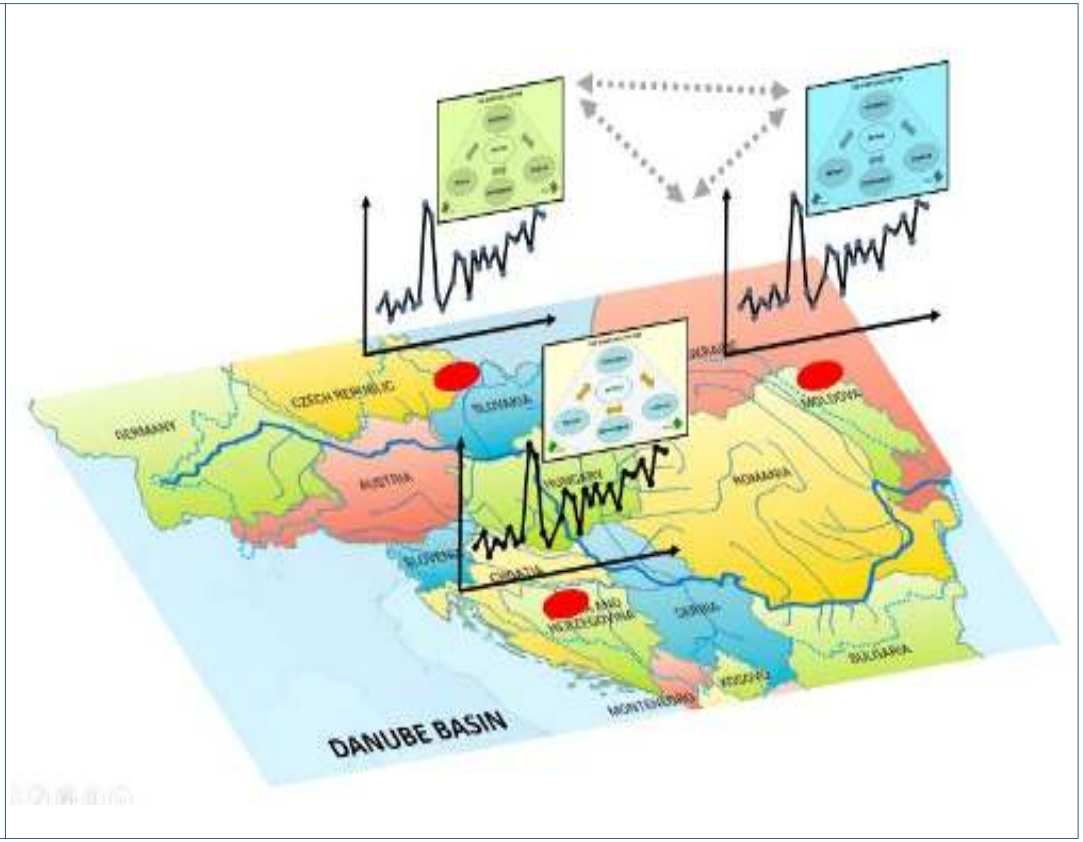
ERROR

$$\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(S_i - O_i)^2}$$

SAMPLING Theory

CRITERIA FOR METHODS

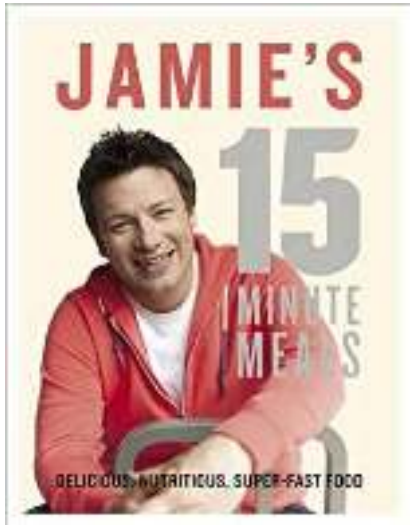




Repeatibility
regular observation

Reproducibility
harmonisation

The COOKBOOK Approach



COOKBOOK
PROTOCOL/MANUAL

RECIPES

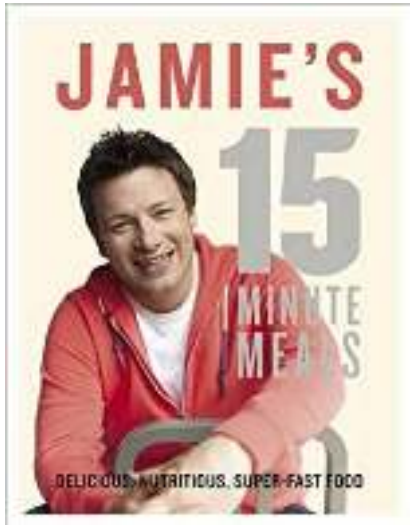
Bottom Sediment

Suspended Sediment

Floodplain Sediment

MOVIE
Sampling VIDEO

The COOKBOOK Approach



COOKBOOK
PROTOCOL/MANUAL

RECIPES

Bottom Sediment

Suspended Sediment

Floodplain Sediment

MOVIE
Sampling VIDEO

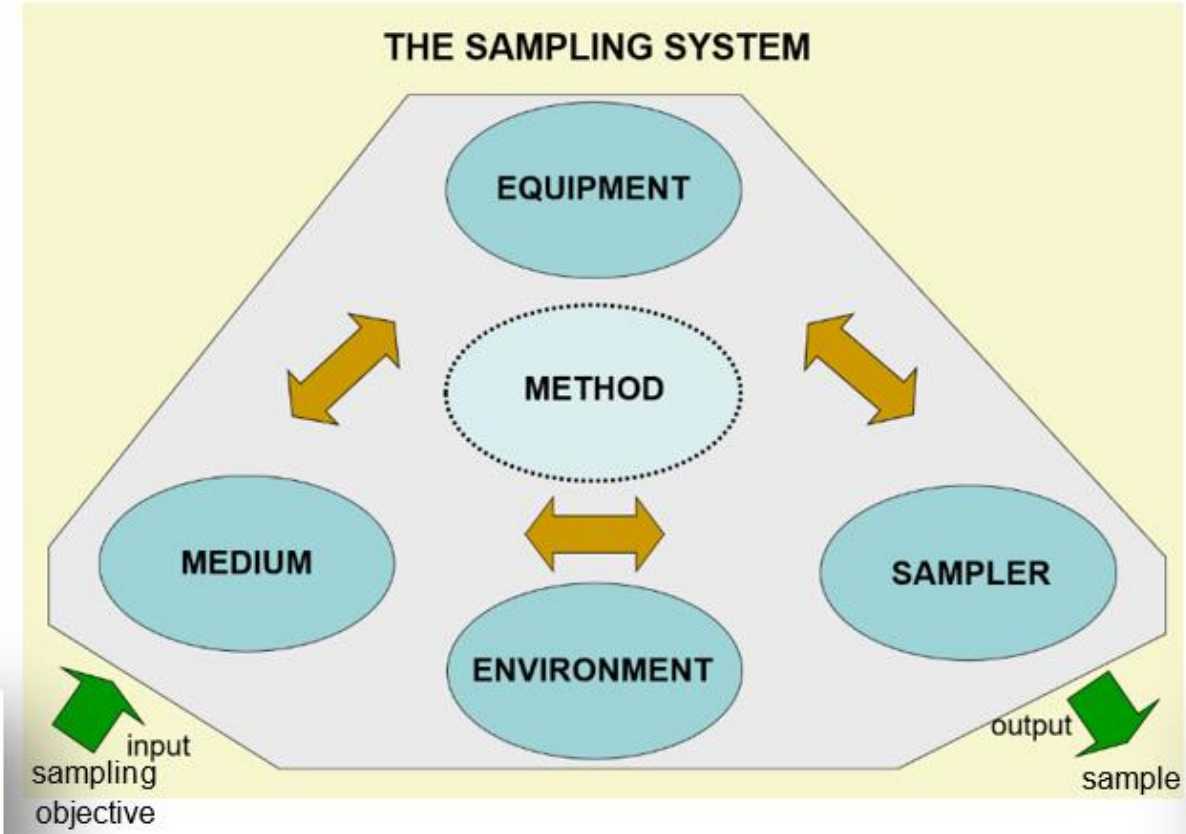
Harmonisation

trans-boundary cooperation for joint Danube Basin water management

Harmonisation

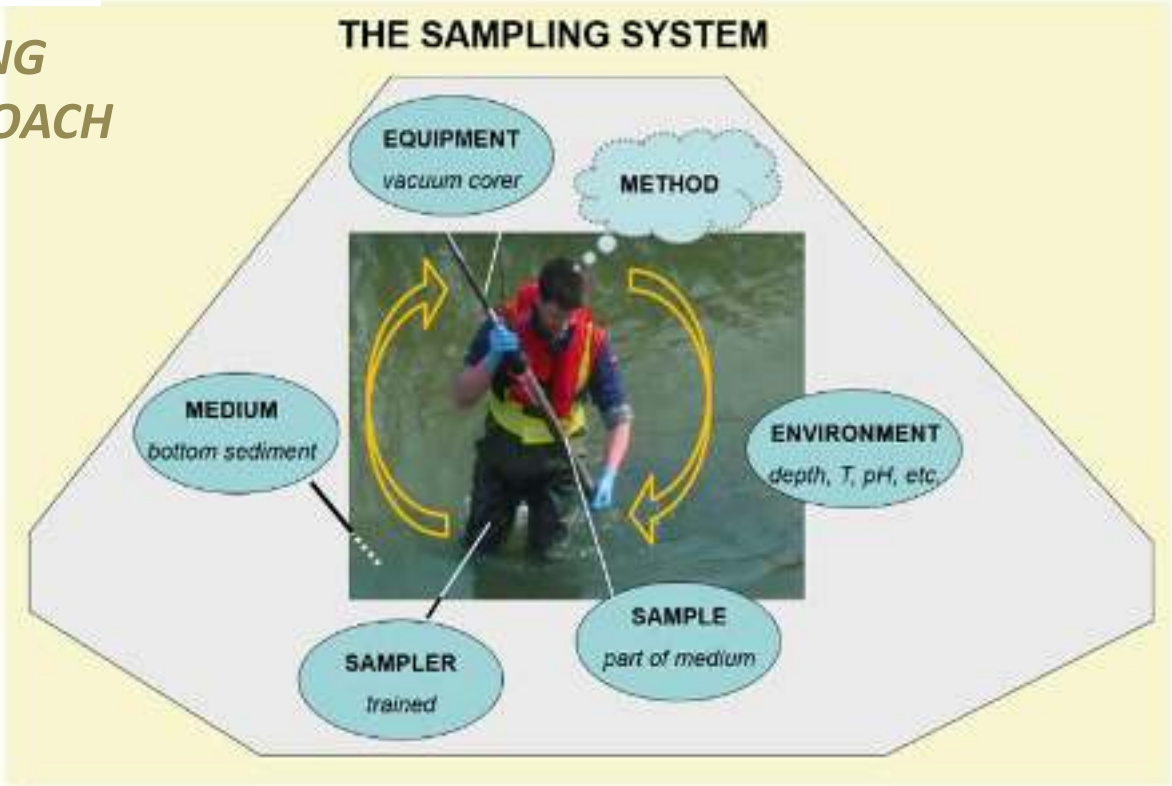
Sampling

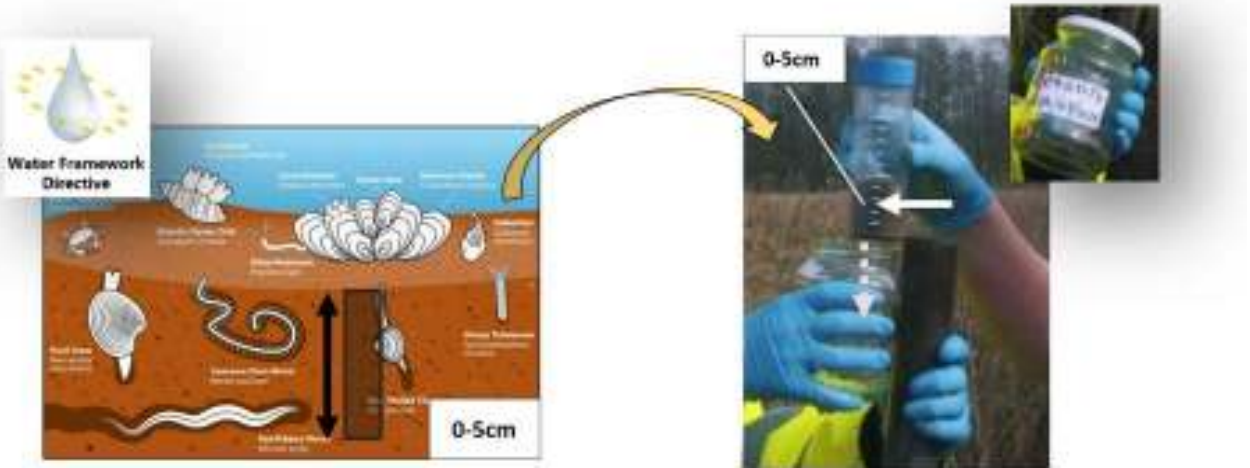
1. THE SAMPLING SYSTEM APPROACH



Water Framework Directive

1. THE SAMPLING SYSTEM APPROACH





1. THE SAMPLING SYSTEM APPROACH

Sampling System Component	WHAT TO DOCUMENT IN THE FIELD	Example
EQUIPMENT	**WHICH TOOLS** and devices are used for sample collection?	the aluminium scoop and the Romanian grabber
PEOPLE	**WHO** are taking the sample?	samplers' names
PROCESS	**WHICH METHOD** is used for sample collection?	the scoop-grab system
MATERIALS	**WHAT** is the target population and in which sampling media?	HSs in the upper 0-5cm river bottom sediment
ENVIRONMENT	**WHAT KIND OF CONDITIONS** prevail during sample collection?	air and river water T, land use, precipitation, etc.
MANAGEMENT	**WHICH QC** (quality control) procedures are used during sample collection?	field duplicate of composite samples

DEVELOP YOUR SEDIMENT SAMPLING SYSTEM

2. FIELD TESTING OF SAMPLING SYSTEMS

14-15 July 2020, Harkány, Hungary

international expert meeting and field exercise

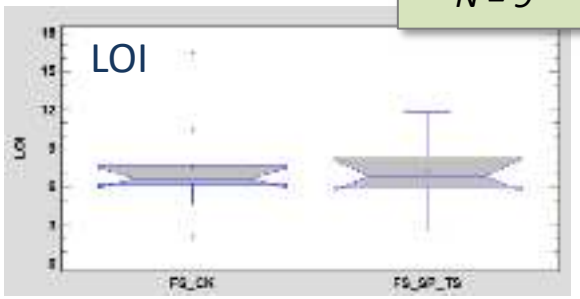
Evaluation Criteria

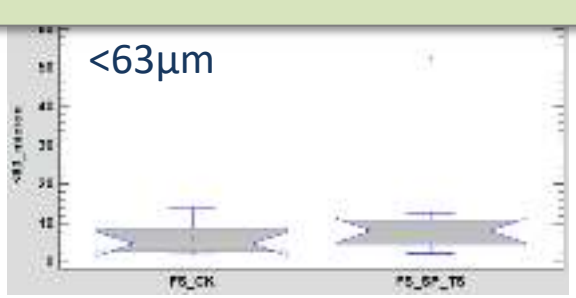
1. Sampling should be scientifically-based: reproducible and representative
2. Sampling should be in full compliance with EU legislation (Water Framework Directive)
3. Sampling should be practice-oriented: 'Ready-to-deploy'
4. Sampling should be flexible and adaptive to the site-specific conditions such as lowland versus mountainous conditions, etc.

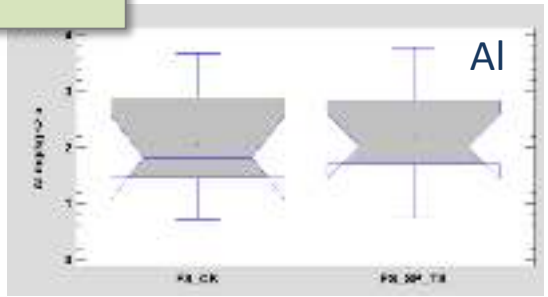
3. SCIENTIFIC COMPARISON OF SAMPLING SYSTEMS

3.1 Spade system **versus** 3.2 Top soil sampler – Austrian soil cake sampler

DRAVA TEST AREA:
SAMPLING SYSTEM HOMOGENEITY (Reproducibility)
- *<63µm, LOI, Majors (Ca, Mg, Na, K, Fe, Mn, Al)*
- *N = 9*





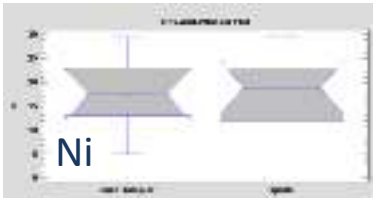


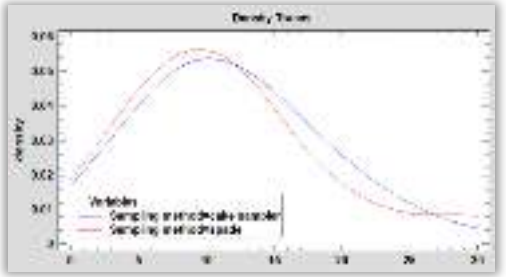
Comparison of Medians for Zn
Median of sample 1: 57.1
Median of sample 2: 62.8

Mann-Whitney (Wilcoxon) W-test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

Average rank of sample 1: 9.88889
Average rank of sample 2: 9.11111

W = 37.0 P-value = 0.791077
Do not reject the null hypothesis for alpha = 0.05.





4. STANDARD SAMPLING KIT

Standard Sediment Monitoring Sampling Kit

12 Danube Countries

Harmonisation

Laboratory

Harmonisation - Laboratory

1. *ACCREDITED LABS*
2. *INTERLABORATORY TRIALS*
3. *REFERENCE LABS*

Interreg
Danube Transnational Programme
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ICPDR 2003. List of Priority Substances for the Danube River Basin. International Commission for the Protection of the Danube River, 4p.

ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. International Organization for Standardization and International Electrotechnical Commission.

ISO 5666:1999 Water quality – Determination of mercury. International Organization for Standardization.

ISO 5667-12:2017 Water quality – Sampling – Part 12: Guidance on sampling of bottom sediments from rivers, lakes and estuarine areas. International Organization for Standardization.

ISO 5667-13:2011 Water quality – Sampling – Part 13: Guidance on sampling of sludges. International Organization for Standardizat

ISO 5667-15:2009 Water quality – Sampling – Part 15: Gui
vation and handling of sludge and sediment samples
firm

ISO 103
poly
capt

EN ISO 15009:2016 Soil quality – Gas chromatog
content of volatile aromatic hydrocarbons, na
genated hydrocarbons – Purge-and-trap meth
European Standardisation Organisation and I
Standardization.

EN ISO 23161:2018 Soil quality – Determinatio
pounds. Gas-chromatographic method. Europ
sation and International Organization for Star

EN 16171:2016 Sludge, treated bio-waste and soi
using inductively coupled plasma mass spect
Standardisation Organisation.

EN 16181:2018 Soil, treated biowaste and sludge – Determination of polycyclic aromatic hydrocarbons (PAH) by gas chromatography (GC) and high performance liquid chromatography (HPLC). European Standardisation Organisation.

EPA 2016. Health Effects Support Document for Perfluorooctane Sulfonate (PFOS). U.S. Environmental Protection Agency, Office of Water, Washington, DC, USA, 245p.

EPA 2017 Technical Fact Sheet – Polybrominated Diphenyl Ethers (PBDEs). U.S. Environmental Protection Agency, Office of Water, Washington, DC, USA, 5p.

EPA Method 1613:1994 Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS. U.S. Environmental Protection Agency, Office of Water, Washington, DC, USA.

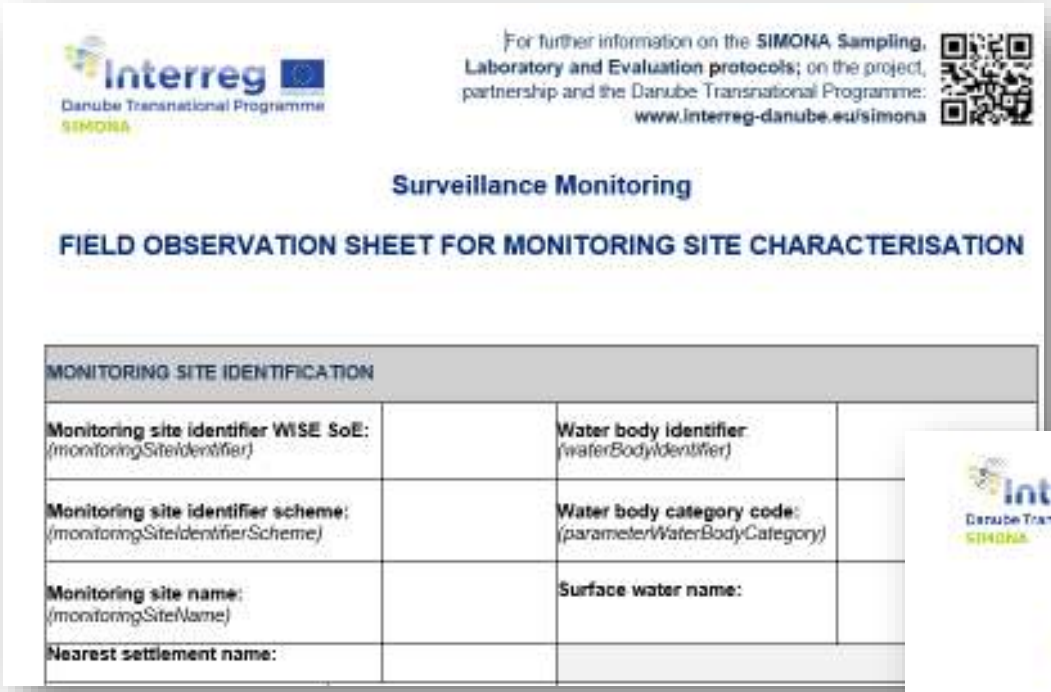
EPA Method 1614:2007 Brominated Diphenyl Ethers in water soil, sediment and tissue by HRGC/HRMS. U.S. Environmental Protection Agency, Office of Water, Washington, DC, USA.

EPA Method 1625:1989 Semivolatile Organic Compounds by Isotope Dilution GCMS. U.S. Environmental Protection Agency, Office of Water, Washington, DC, USA.

Harmonisation

Data Management

1. STANDARD FIELD OBSERVATION SHEET - EU WISE COMPATIBLE



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For further information on the **SIMONA Sampling, Laboratory and Evaluation protocols**; on the project, partnership and the Danube Transnational Programme: **www.interreg-danube.eu/simona**

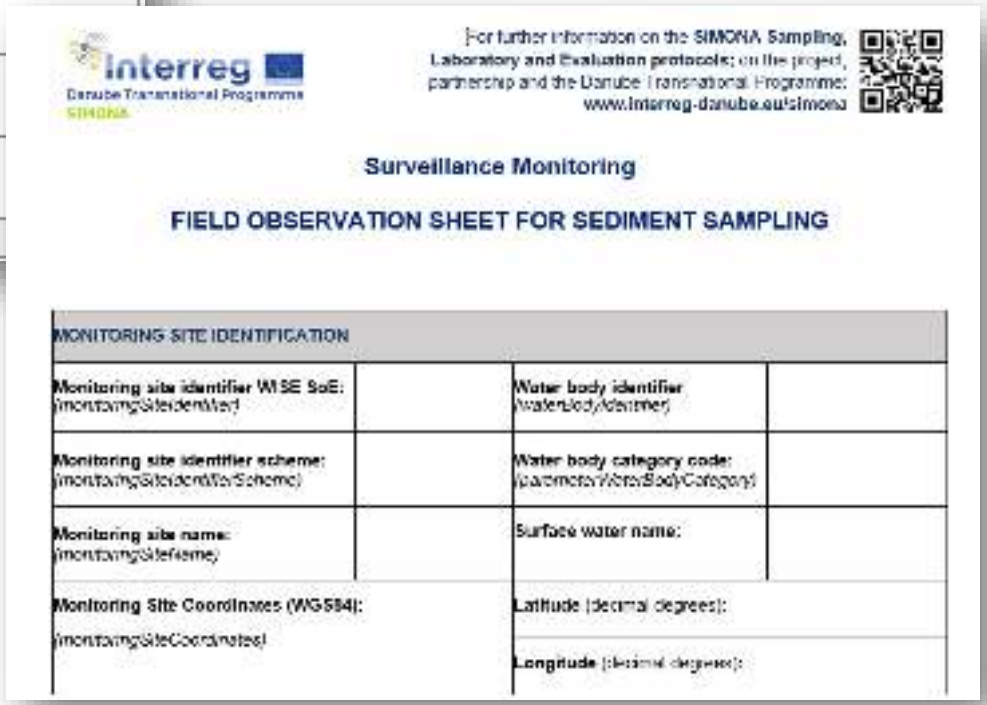
Surveillance Monitoring

FIELD OBSERVATION SHEET FOR MONITORING SITE CHARACTERISATION

MONITORING SITE IDENTIFICATION			
Monitoring site identifier WISE SoE: *(monitoringSiteIdentifier)*		**Water body identifier** *(waterBodyIdentifier)*	
Monitoring site identifier scheme: *(monitoringSiteIdentifierScheme)*		**Water body category code:** *(parameterWaterBodyCategory)*	
Monitoring site name: *(monitoringSiteName)*		**Surface water name:**	
Nearest settlement name:			

SITE CHARACTERISATION

SEDIMENT SAMPLING



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Surveillance Monitoring

FIELD OBSERVATION SHEET FOR SEDIMENT SAMPLING

MONITORING SITE IDENTIFICATION			
Monitoring site identifier WISE SoE: *(monitoringSiteIdentifier)*		**Water body identifier** *(waterBodyIdentifier)*	
Monitoring site identifier scheme: *(monitoringSiteIdentifierScheme)*		**Water body category code:** *(parameterWaterBodyCategory)*	
Monitoring site name: *(monitoringSiteName)*		**Surface water name:**	
Monitoring Site Coordinates (WGS84): *(monitoringSiteCoordinates)*		**Latitude** (decimal degrees):	
		Longitude (decimal degrees):	

FIELD OBSERVATION SHEET FOR MONITORING SITE CHARACTERISATION

Determinand code *(observedPropertyDeterminandCode)*	MINIMUM Observed value *(resultObservedValue)*	AVERAGE Observed value *(resultObservedValue)*	MAXIMUM Observed value *(resultObservedValue)*	Unit of measure *(resultUom)*
pH:				
Electric conductivity:				µS/cm
Redox potential:				mV
Dissolved oxygen:				mg/L

some statistics are required only

measured values have fixed units

WISE parameter names

value derivation requires GIS operation

SITE – PHYSIOGRAPHY *(the prevailing value in the 200m zone along both sides of the river bank)*	
Rock type: *(IUGS class)*:	
Soil type: *(FAO class)*	
Land cover/Land use: *(CORINE class Level 3)*	

values are expected from standard data-bases

SITE – SPECIFIC FEATURES *(the prevailing value in the 200m zone along both sides of the river bank)*	
NATURA2000 area:	yes ▫ no ▫
drinking water protected area:	yes ▫ no ▫
other protected area:	yes ▫ no ▫

simple Y/N Boolean parameter values

FIELD OBSERVATION SHEET FOR SEDIMENT SAMPLING

SAMPLING IDENTIFICATION				
Sampling time (date) YYYY-MM-DD: *(phenomenonTimeSamplingDate)*			**Sampling time HH-MM:** *(phenomenonTimeSamplingTime)*	
Sampler's name:			**Sampler's signature:**	
Accredited sampling:	Y ☐	N ☐		
Analysed matrix: *(procedureAnalysedMatrix)*				
Bottom sediment (BS) (S)	☐			

unique ID of sample:

Site ID + Sampling Date/Time

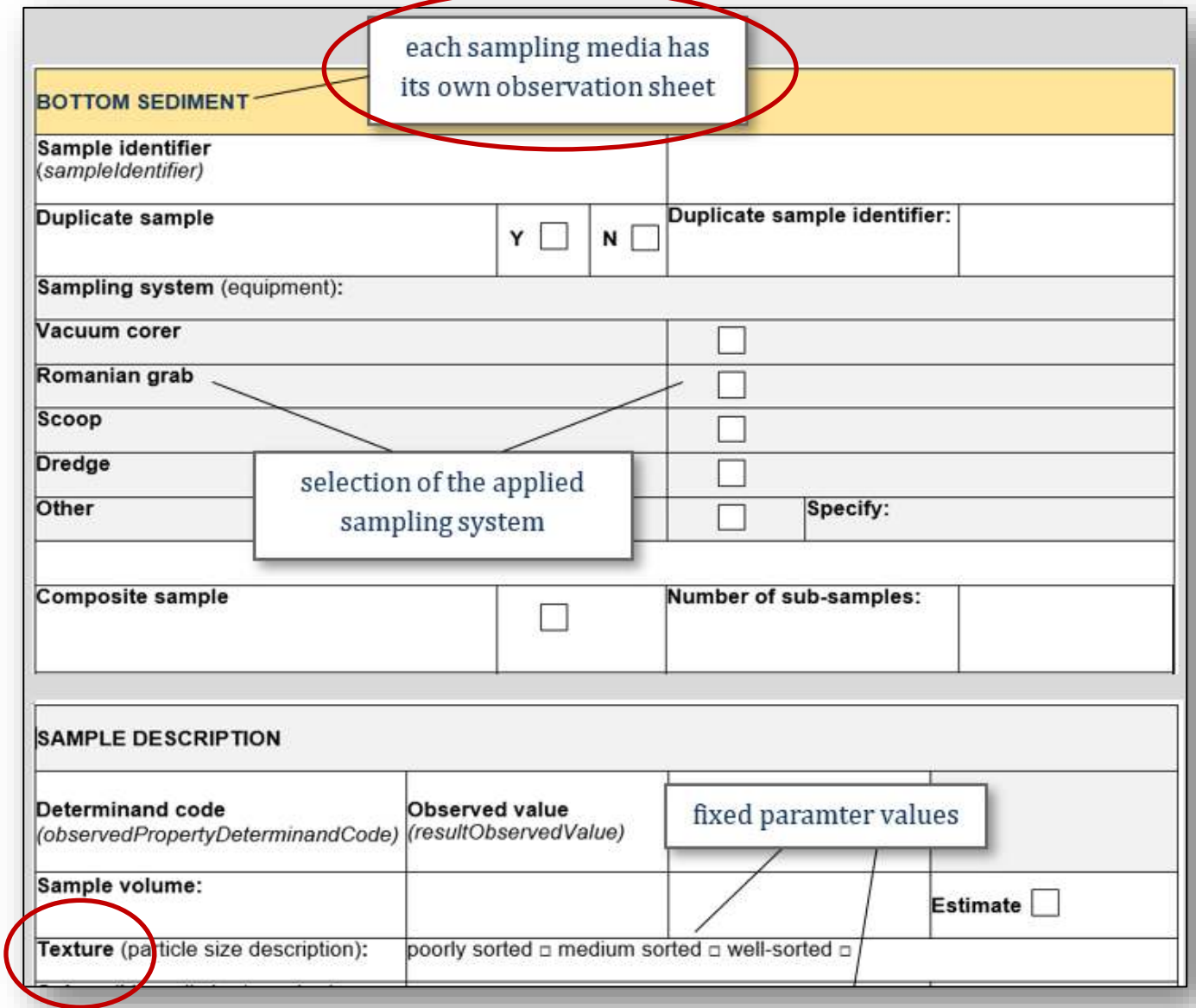
value estimation is allowed by only in fixed value classes

SAMPLING CONDITONS			
WEATHER (AIR) CONDITIONS			
Determinand code *(observedPropertyDeterminandCode)*	**Observed value** *(resultObservedValue)*	**Unit of measure** *(resultUom)*	**Estimation**
T:		Centigrade	cold ☐ average ☐ hot ☐
P:		atm	
Humidity:		%	low ☐ medium ☐ high ☐
Precipitation:		mm	no ☐ low ☐ medium ☐ high ☐

WISE parameter names

measured values have fixed units

FIELD OBSERVATION SHEET FOR SEDIMENT SAMPLING



each sampling media has its own observation sheet

selection of the applied sampling system

fixed paramter values

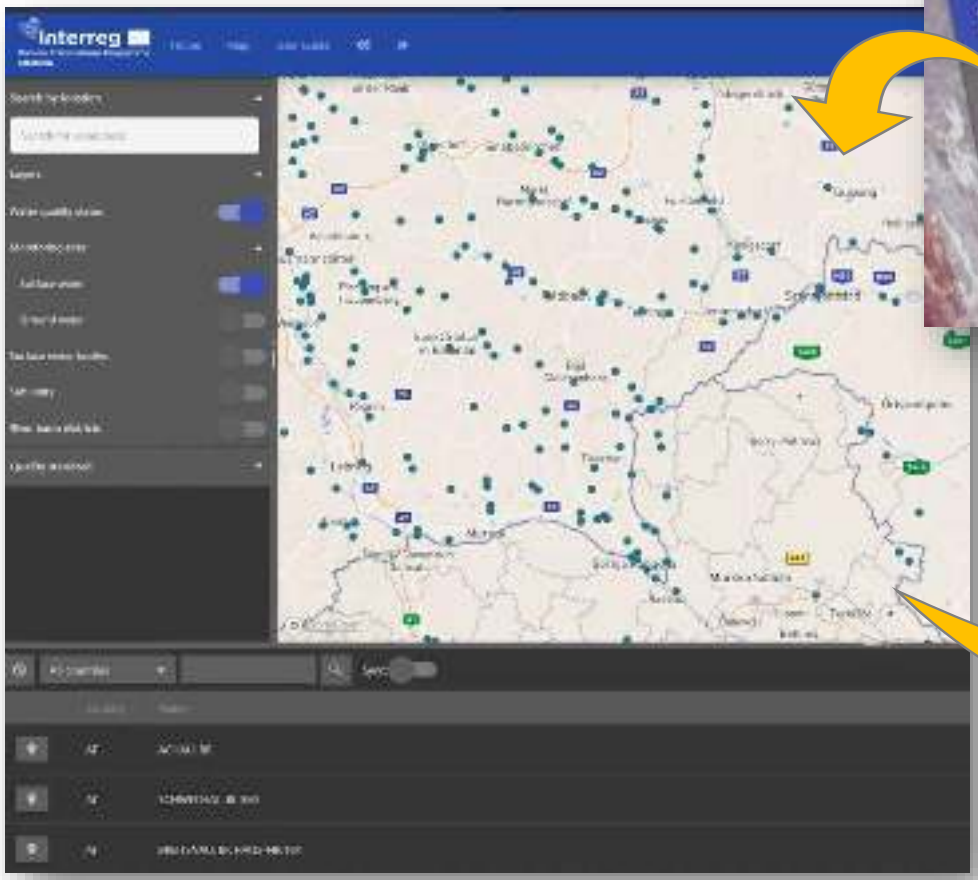
BOTTOM SEDIMENT				
Sample identifier *(sampleIdentifier)*				
Duplicate sample	Y ☐	N ☐	**Duplicate sample identifier:**	
Sampling system (equipment):				
Vacuum corer		☐		
Romanian grab		☐		
Scoop		☐		
Dredge		☐		
Other		☐	**Specify:**	
Composite sample	☐		**Number of sub-samples:**	

SAMPLE DESCRIPTION			
Determinand code *(observedPropertyDeterminandCode)*	**Observed value** *(resultObservedValue)*		
Sample volume:			**Estimate** ☐
Texture (particle size description):	poorly sorted □ medium sorted □ well-sorted □		

HARMONISATION - Data Management

2. IT TOOL - EU WISE COMPATIBLE WEB APP

1. DATA INPUT (field, lab)



2. DATA MANAGEMENT & VISUALISATION

3. DATA EVALUATION

Harmonisation

Training

HARMONISATION - Training

Train–the–Trainer

RESULTS

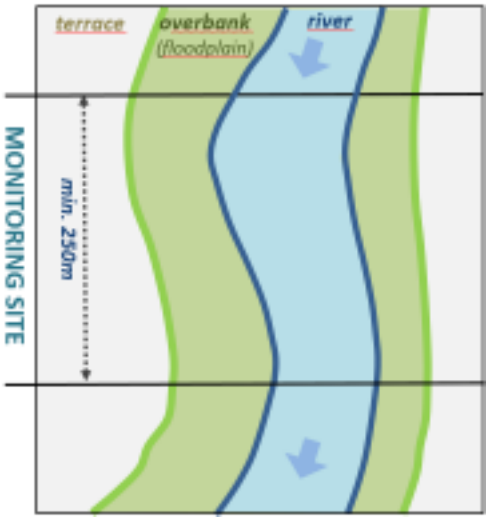
Sampling

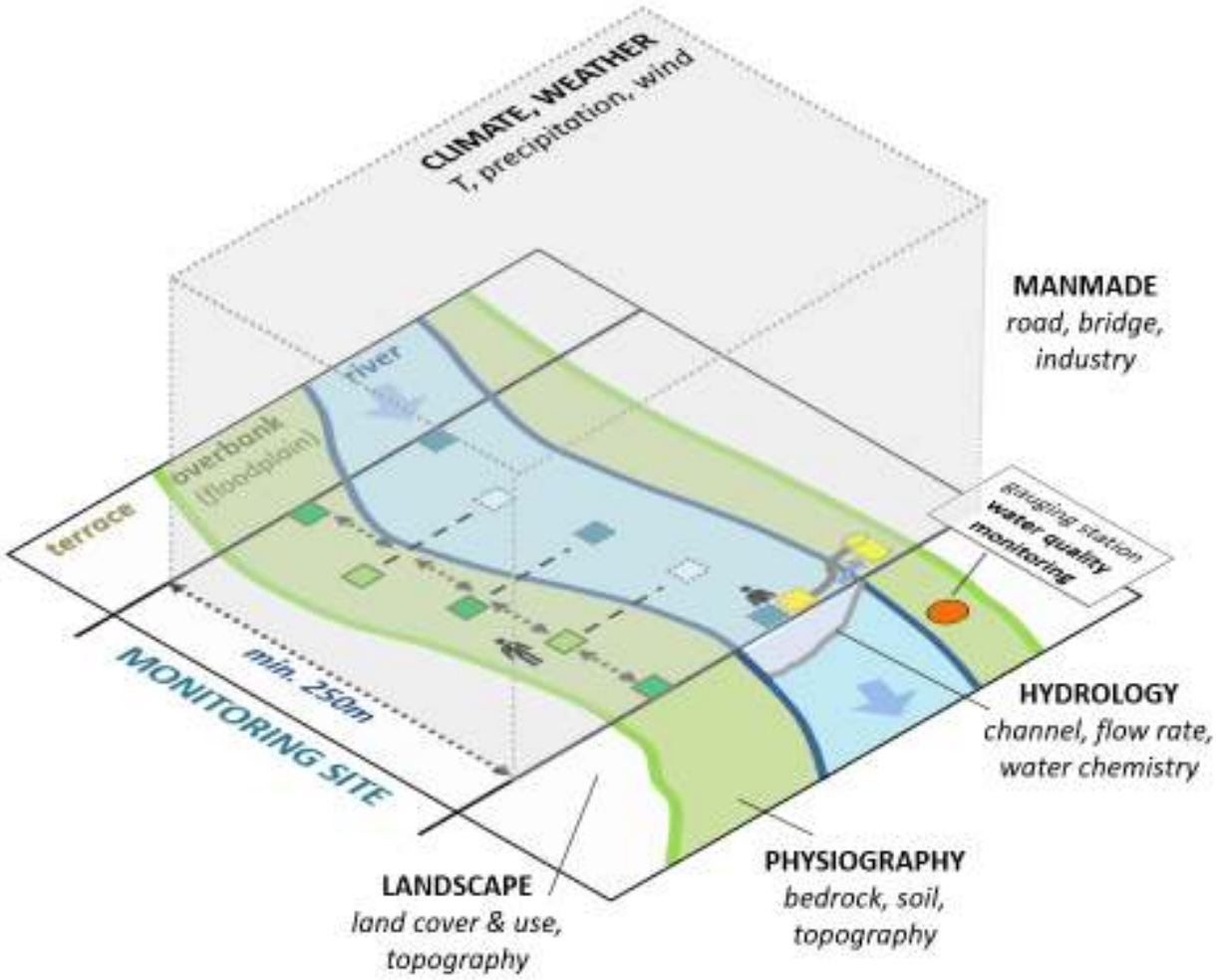
Sampling

Monitoring Site Selection

risk-based ranking and selection of monitoring sites

MONITORING SITE SELECTION – DEFINITION





Monitoring site *is the area where sampling system (the samplers and the tools) gets in* ***interaction with the site environment*** *including the sampling media (fluvial sediment) so sampling system may affect the sampling media and eventually the sample to be collected.*

MONITORING SITE SELECTION – RISK BASED RANKING

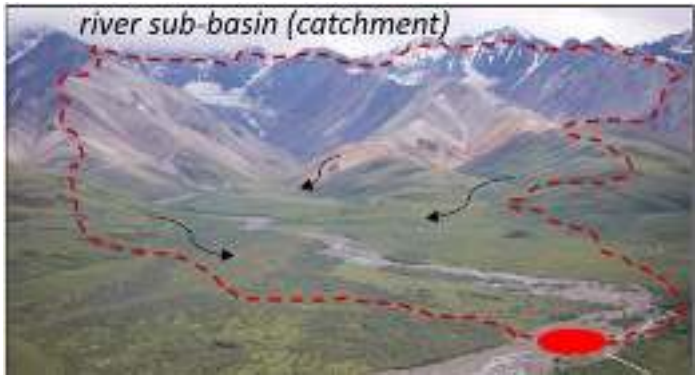
CRITERIA	PARAMETER	VALUE (Y/N/UNKNOWN)
Class 1 RISK	Is there **known impact** of contaminated sediment? (toxic effect on biota)	
	Is there known risk posed by **sediment**? (HS>QS)	
	Is there known risk posed by **water**? (HS>QS)	
	Is the water body status bad?	
	Is there significant HS **point pollution source** (SEVESO II, mines, smelters, pharmaceutical and other industry) posing direct risk at the water body or located in the catchment?	
	Is there significant HS **non-point pollution source** (intensive agricultural activity: pesticides, fertilizers) posing direct risk at the water body or located in the catchment?	
	Is there polluted area posing direct risk at the water body or located in the catchment?	
Class 2 Strategy	Is the sites relevant for assessing pollutant loads which are transferred **across boundaries of Contracting Parties** and are transported into the marine environment?	
	Is there an **TNMN** monitoring point?	
	Is the site placed just upstream/downstream of an international border?	
	Is the site located in a transbordary catchment?	
Class 3 Science	Is the site **representative** for an extended section of the river (water body or cathcment) (no local pollution sources, e.g. tourism, boating, waste site)?	
	Does the site enable the **repeated** collection of all the 3 types of fluvial sediments for risk assessment?	
	Is the sediment in site **homogeneous** based on preliminary (pilot) survey?	
	Is the site sediment quality conditions (geochemical background, link to groundwater: hyporheic zone, hydromorphology and hydrography such as flood frequency) understood sufficiently?	

MONITORING SITE SELECTION – RISK BASED RANKING

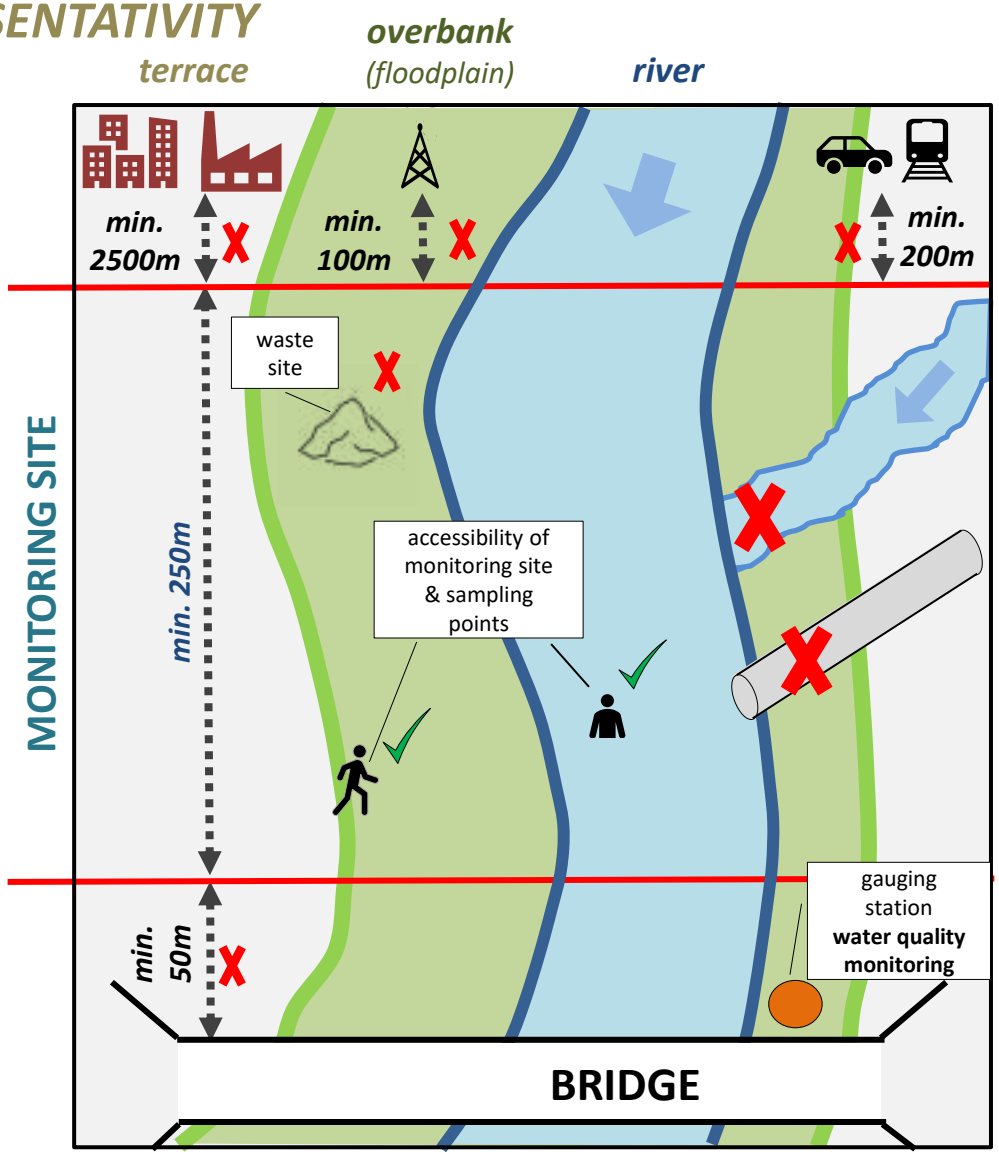
CRITERIA	PARAMETER	VALUE (Y/N/UNKNOWN)
Class 4 Information	Is there **regular** SEDIMENT quality **monitoring** data?	
	Is there **archive** SEDIMENT quality **monitoring** data?	
	Is there **archive** SEDIMENTquality data (e.g. FOREGS sampling point)?	
	Is there **regular/archive** WATER discharge **monitoring** data?	
	Is there **regular** WATER quality **monitoring** data?	
	Is there **archive** WATER quality **monitoring** data?	
	Is there **archive** WATER quality data (e.g. FOREGS sampling point)?	
	Is there sufficient general background data? Meteorology and Climate (e.g. temperature, precipitation, solar radiation); Hydromorphology and hydrography (e.g. discharge, water depth, current, velocity); Geology and Soil (e.g. bedrock and soil type, characteristics/composition/stratification of sediments, erosion); Land use/Land cover; Biology (e.g. with reference to macrophyte accumulation)	
Class 5 Technical	Is there easy transboundary access to the site?	
	Is there easy **access to the site** (e.g. road, distance, fence)?	
	Is there easy **access to the sampling point(s)** in the site (e.g. slope condition vegetation cover)?	
	Can sampler enter the river to collect bottom sediment sample (water depth<ca. 1.5m) once every month at least (e.g. floods, ice cover) ('small river')?	

- *ISO 5667-12:2017*
- *ISO 5667-17:2008*
- *WFD TGD No. 25*
- *ICPDR TNMN Monitoring Sites Criteria*
- *SIMONA WG1 Sampling*

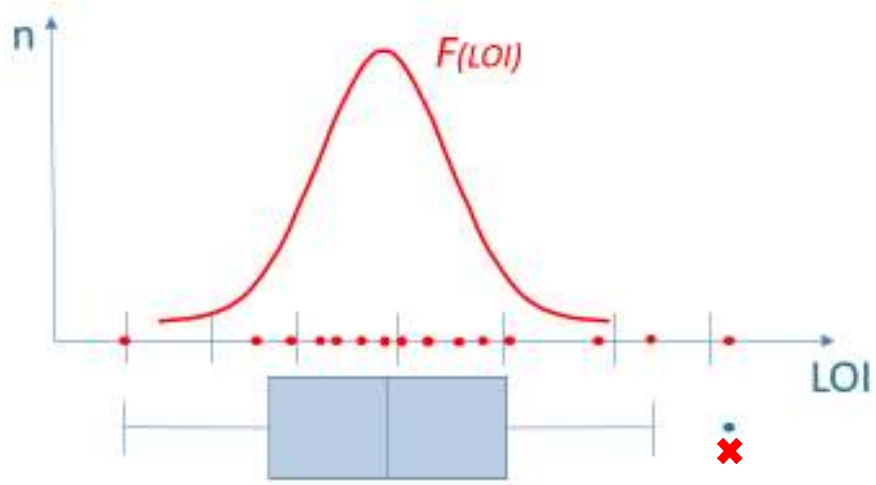
MONITORING SITE SELECTION – REPRESENTATIVITY

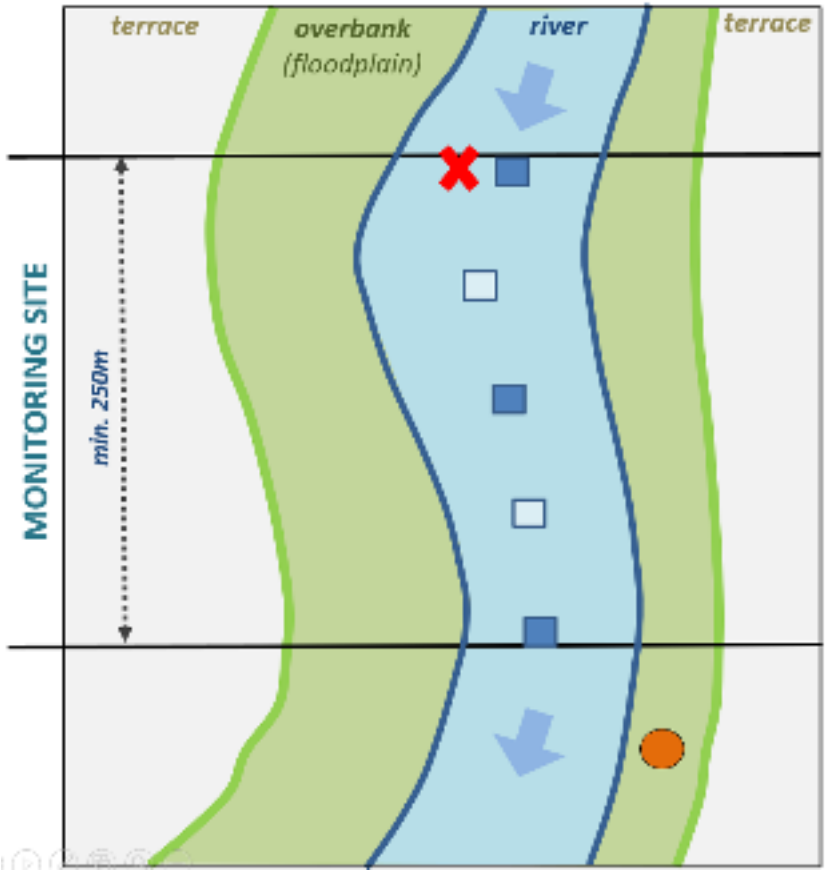


1. **AT NATIONAL WATER QUALITY MONITORING POINT** *(preferably upstream)*
2. **MIN. 250M LONG**
3. **BOTTOM -, SUSPENDED -, OVERBANK SEDIMENT SAMPLING POSSIBLE** *(availability, accessibility)*
4. **AVOID TRIBUTARY CONFLUENCE**
5. **AVOID KNOWN CONTAMINATED SITE**
6. **AVOID LOCAL CONTAMINATION SOURCE**
   - *Discharge channel or pipe; Waste site; Industry or power plant; Railway lines & major roads; Electric line & pylon; Bridge; Other sources*
7. **UNIFORM HYDROMORPHOLOGY**



MONITORING SITE SELECTION – HOMOGENEITY



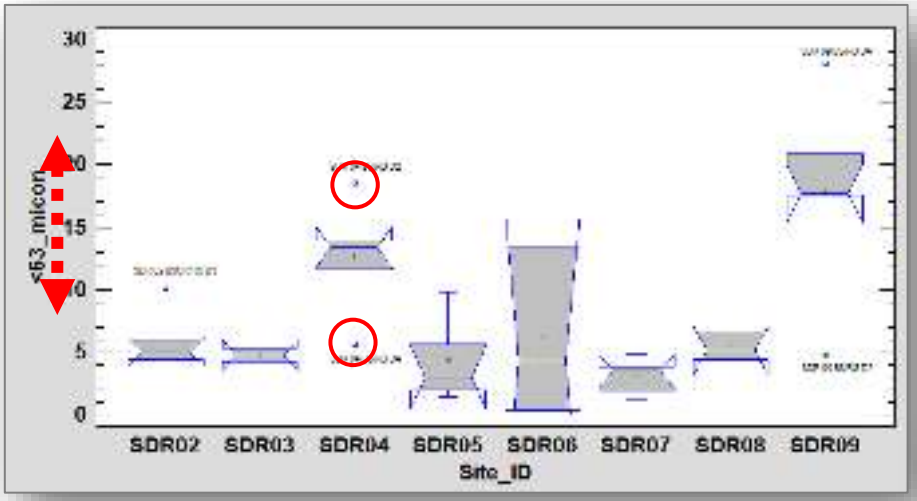


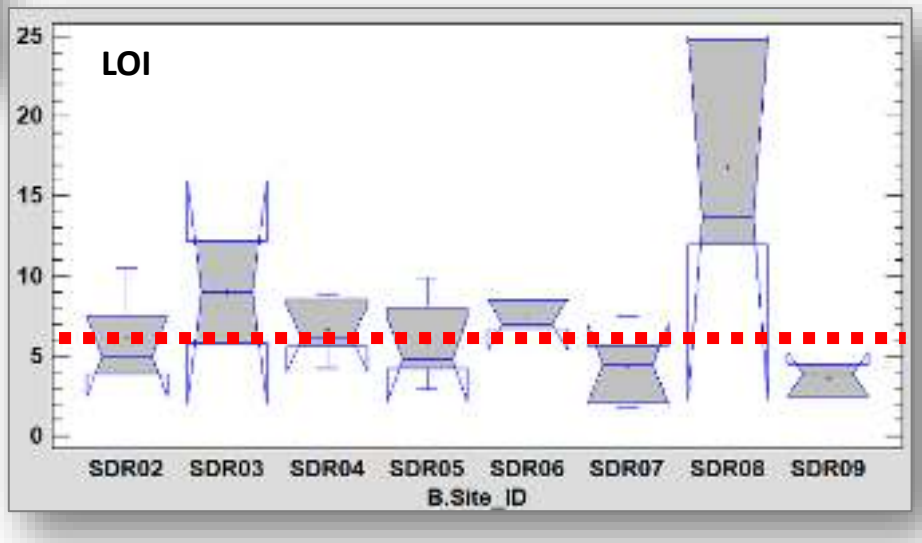
DRAVA TEST AREA:

SITE HOMOGENEITY

- *<63µm, LOI, Majors (Ca, Mg, Na, K, Fe, Mn, Al)*

MONITORING SITE SELECTION – HOMOGENEITY



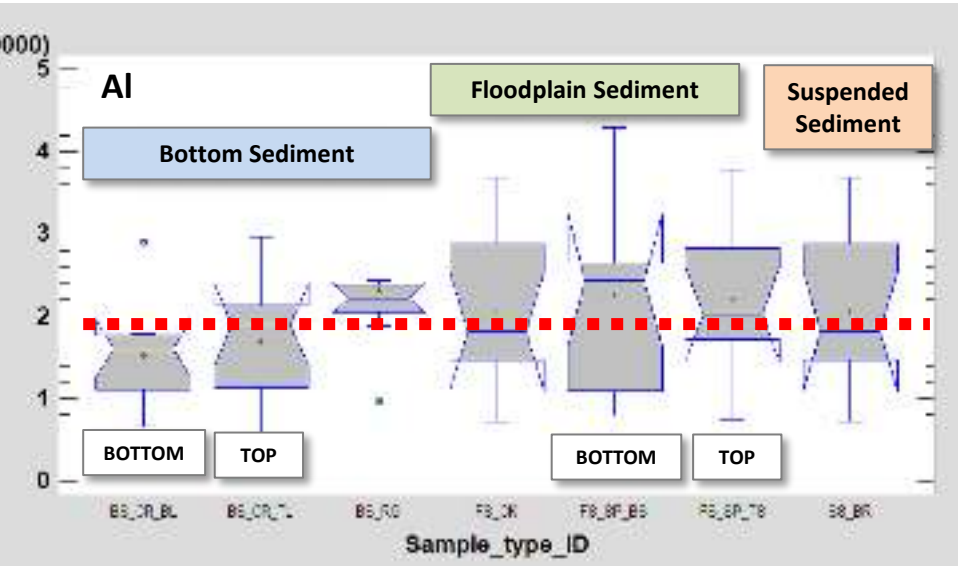


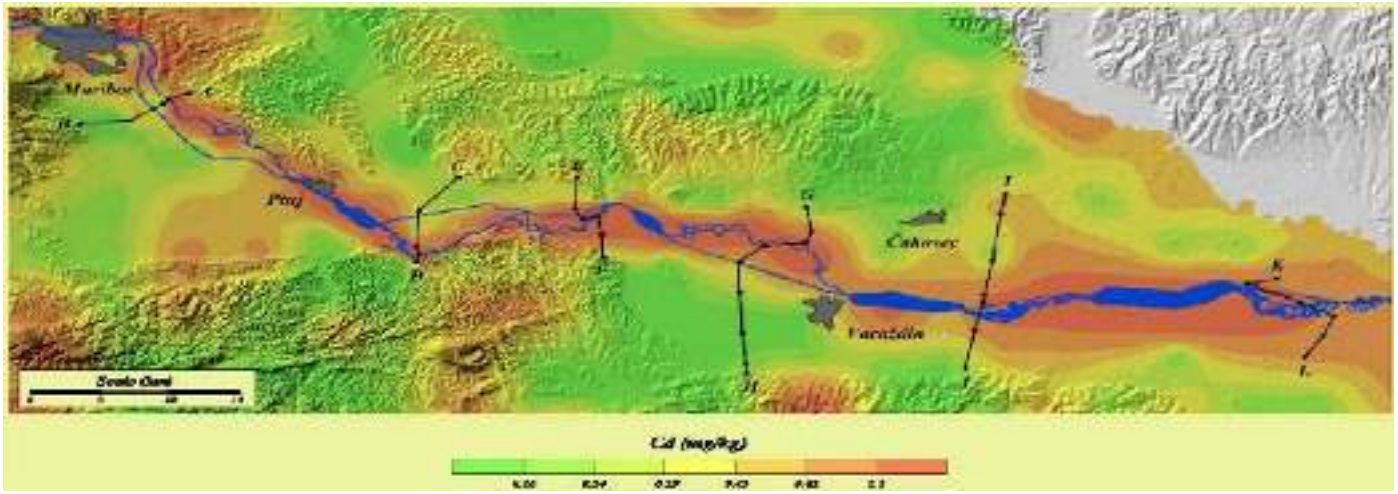
DRAVA TEST AREA:

SITE HOMOGENEITY

- *<**63µm**, **LOI**, Majors (Ca, Mg, Na, K, Fe, Mn, **Al**)*
- *N = 3-5*

MONITORING SITE SELECTION – HOMOGENEITY





DRAVA TEST AREA:

SITE HOMOGENEITY

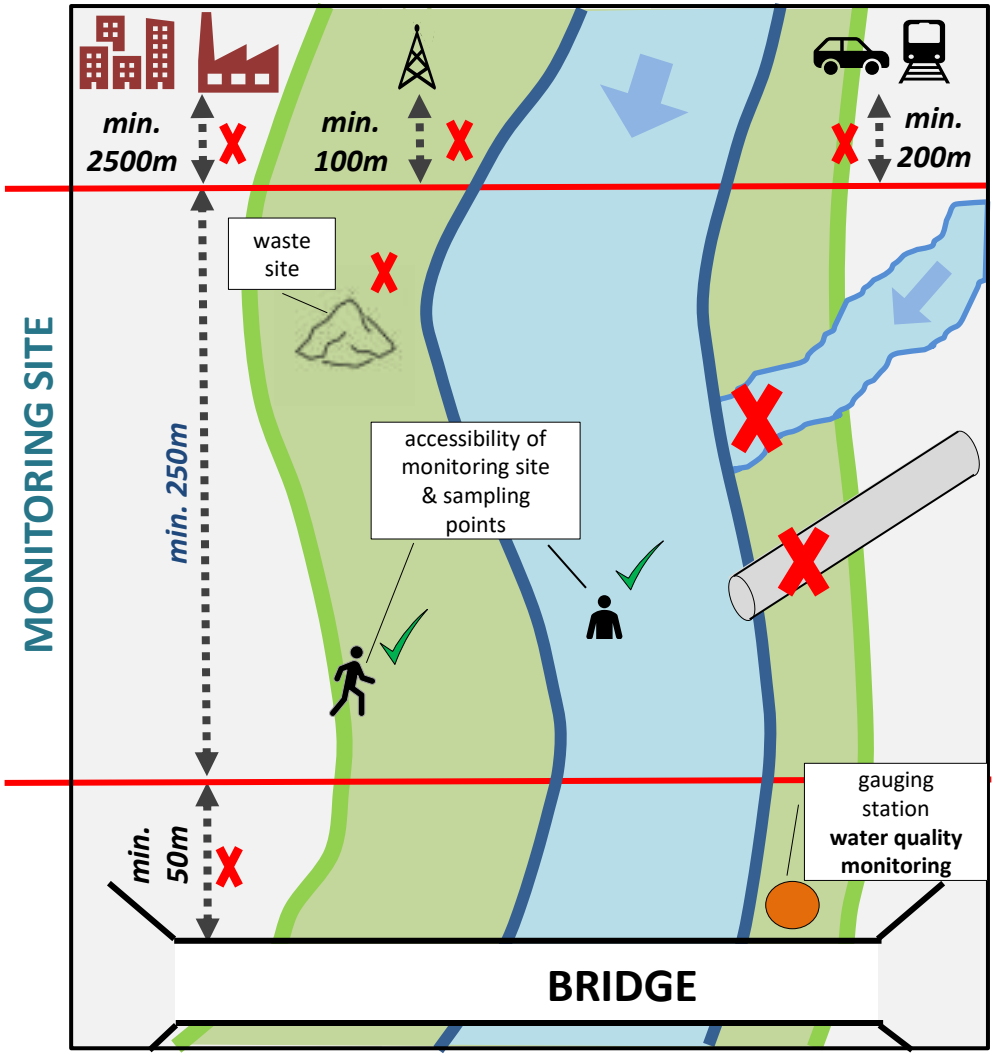
- *<63µm, LOI, Majors*
- *N = 3-5*

Sampling

Sampling Design

SAMPLING DESIGN

1. **AT NATIONAL WATER QUALITY MONITORING POINT** *(preferably upstream)*
2. **MIN. 250M LONG**
3. **BOTTOM SEDIMENT, SUSPENDED SEDIMENT, OVERBANK SEDIMENT SAMPLING POSSIBLE** *(availability, accessibility)*
4. **AVOID TRIBUTARY CONFLUENCE**
5. **AVOID KNOWN CONTAMINATED SITE**
6. **AVOID LOCAL CONTAMINATION SOURCE**
   - *Discharge channel or pipe*
   - *Waste site*
   - *Industry or power plant (min. distance 2500m)*
   - *Railway lines & major roads (min. distance 200m)*
   - *Electric line & pylon (min. distance 100m)*
   - *Bridge (min. distance 50m upstream)*
   - *Other sources*
7. **UNIFORM HYDROMORPHOLOGY**



SAMPLING DESIGN

BOTTOM SEDIMENT

HORIZONTAL DESIGN

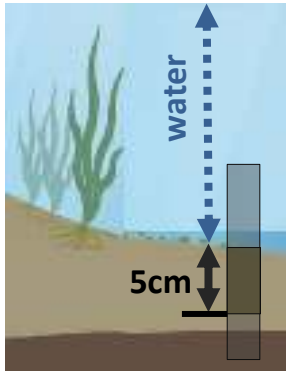
1. **5-10 SAMPLING POINTS**

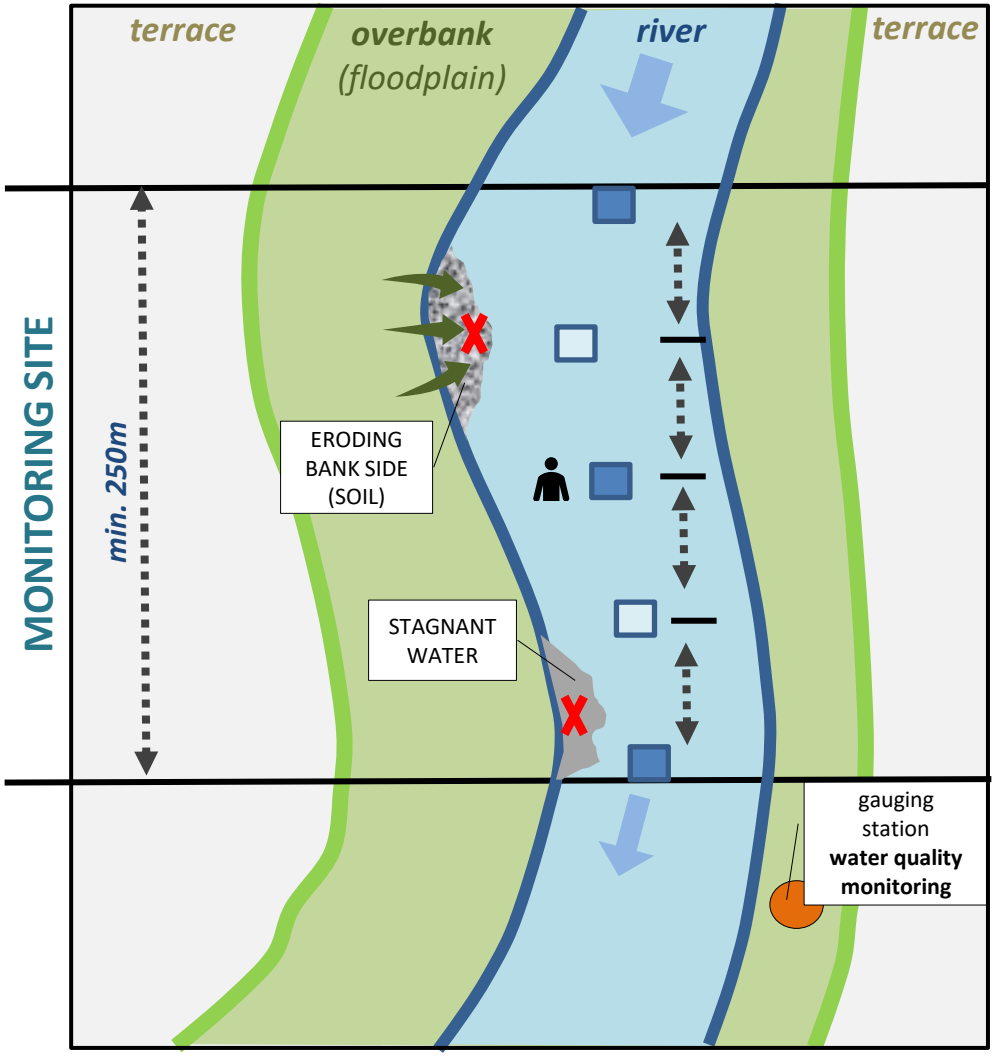
   - *Composite sample: 5-10 sub-samples (always at least 3)*

2. **SAMPLING POINTS EQUIDISTANT**
3. **SAMPLING POINTS IN MAIN STREAM LINE** *(active river flow)*
4. **AVOID STAGNANT (NON-ACTIVE) WATER**
5. **AVOID EDGE EFFECTS** *(local river bank erosion into river)*

VERTICAL DESIGN

1. **TOP 0-5 CM**
2. **AVOID PLANTS & PLANT REMNANTS**
3. **SAMPLED SEDIMENT IN CONTACT WITH (UNDER) RIVER WATER**





SAMPLING DESIGN

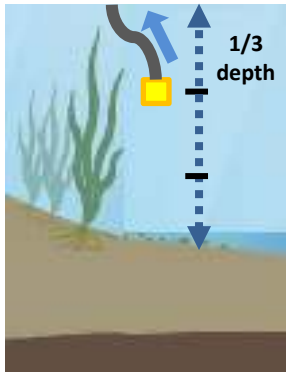
SUSPENDED SEDIMENT

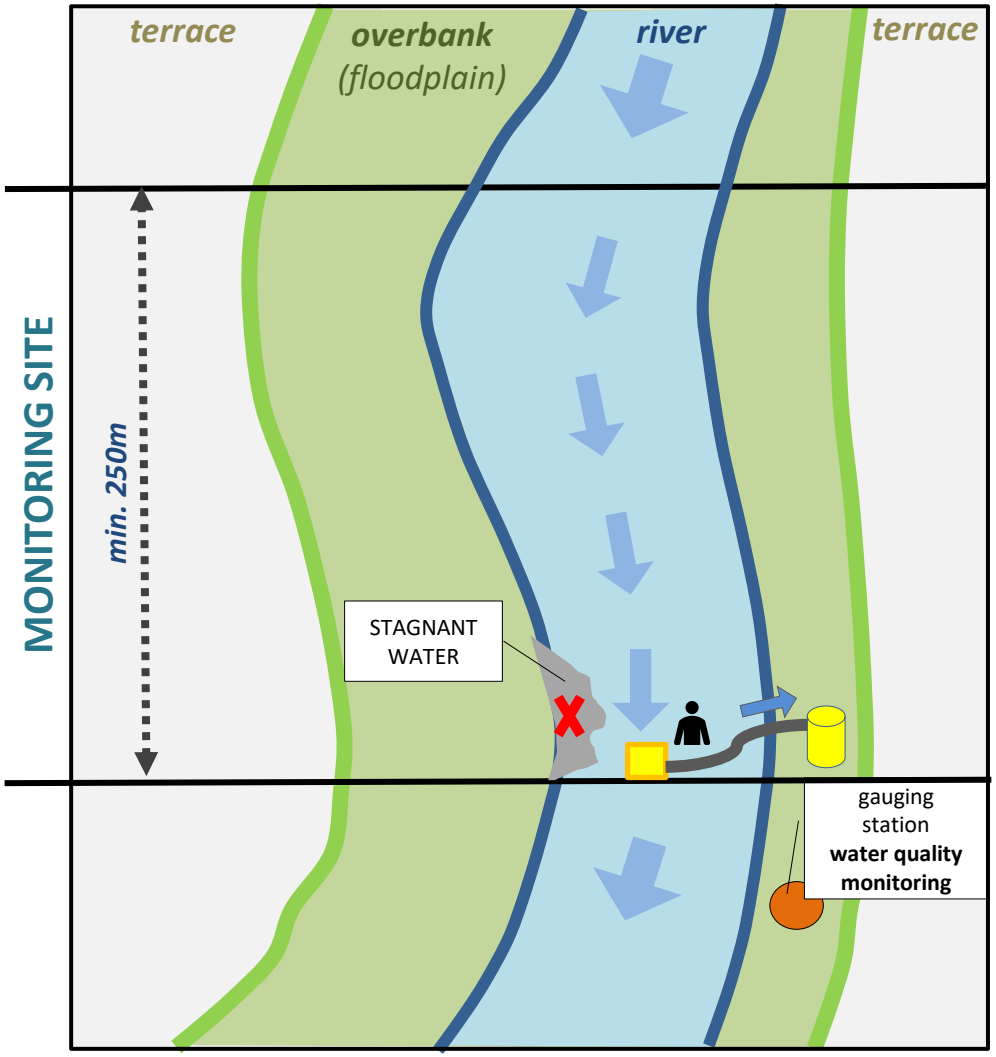
HORIZONTAL DESIGN

1. **ONE SAMPLING POINT**
   - *Composite sample: suspended sediment sample is natural composite by flowing river water mixing*
2. **SAMPLING POINT LOCACTION AT DOWNSTREAM END OF MONITORING SITE**
3. **SAMPLING POINTS IN MAIN STREAM LINE** *(active river flow)*
4. **AVOID STAGNANT (NON-ACTIVE) WATER**

VERTICAL DESIGN

1. **AT TOP 1/3 OF WATER DEPTH**





SAMPLING DESIGN

OVERBANK SEDIMENT

HORIZONTAL DESIGN

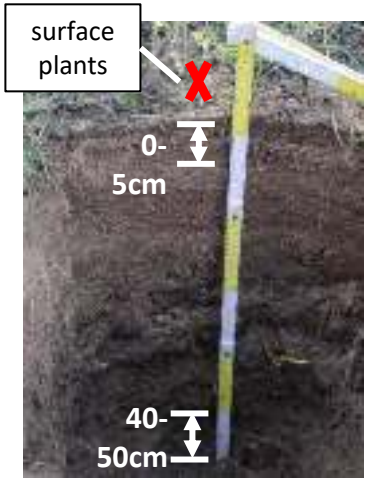
1. **5 SAMPLING POINTS**

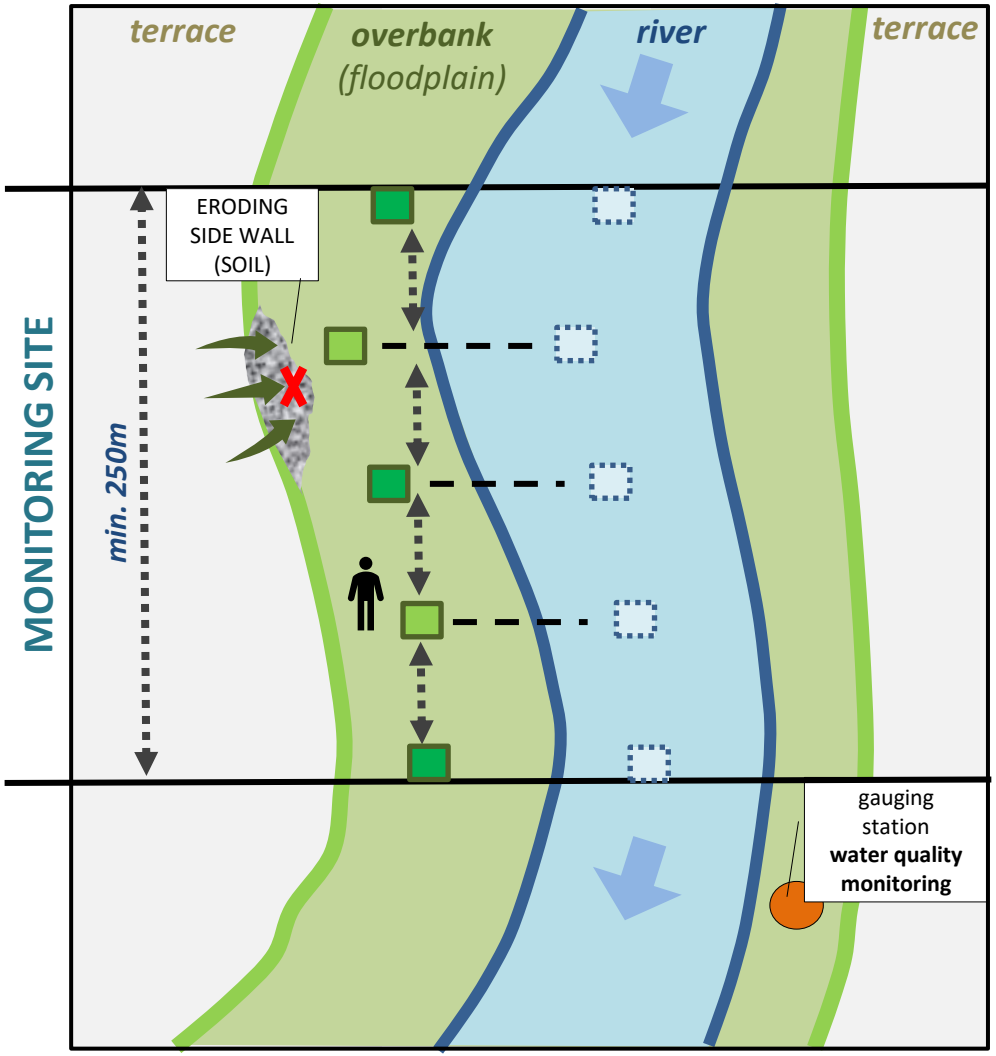
   - Composite sample: 5 sub-samples (always at least 3)

2. **SAMPLING POINTS EQUIDISTANT**
3. **SAMPLING POINTS ON ACTIVE OVERBANK**
   (overbank flooded min. once per year)
4. **AVOID EDGE EFFECTS** *(local side wall erosion onto overbank)*

VERTICAL DESIGN

1. **TOP 0-5 CM**
2. **BOTTOM 40-50 CM**
3. **AVOID SURFACE PLANTS**



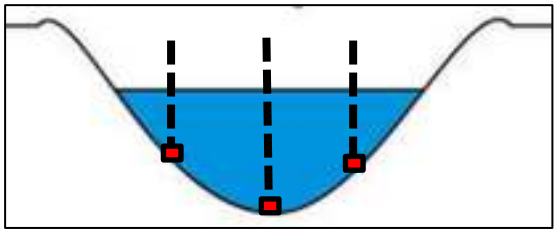


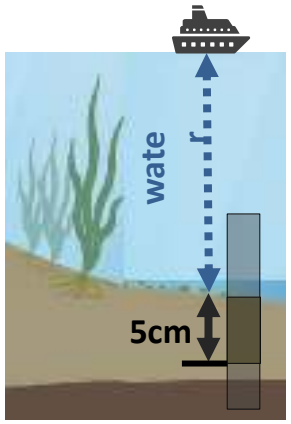
SAMPLING DESIGN

BOAT - BOTTOM SEDIMENT

HORIZONTAL DESIGN

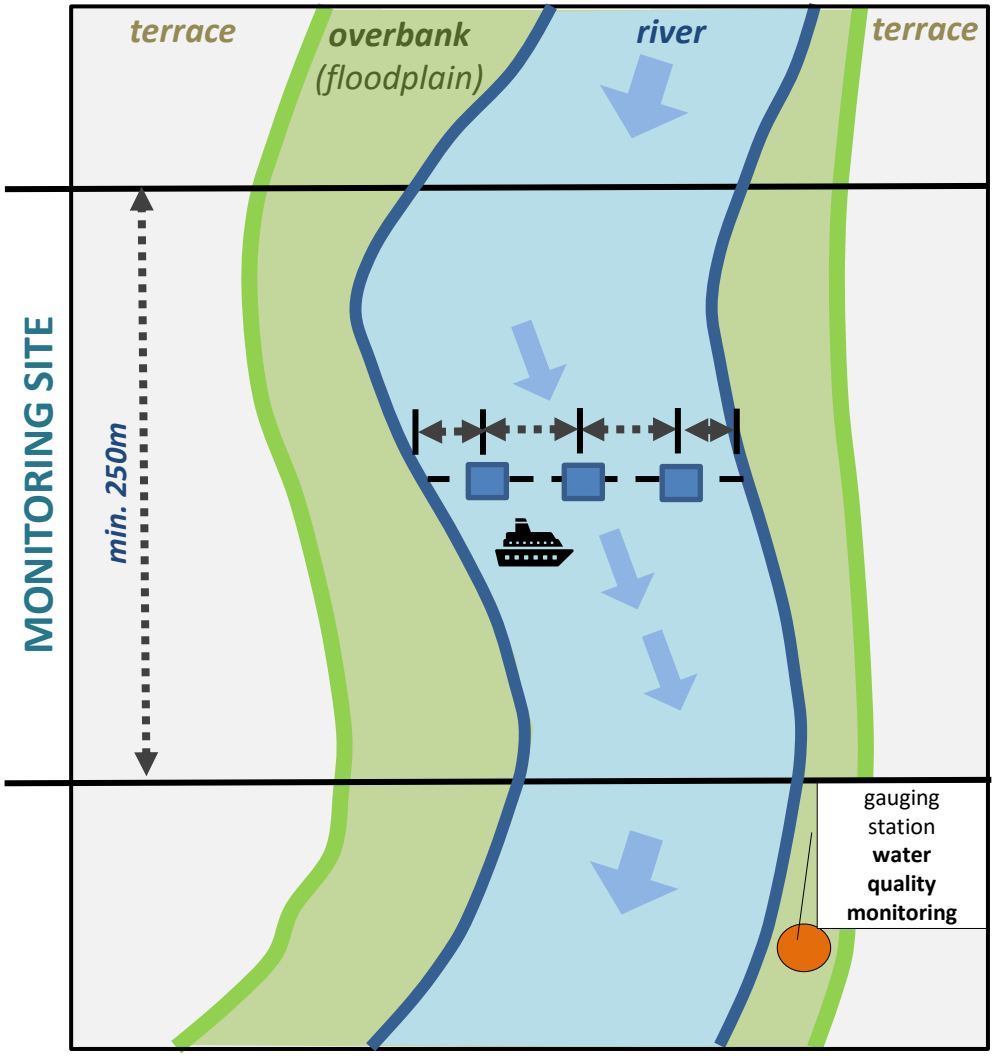
1. **3 SAMPLING POINTS AT LEAST**
   - *Composite sample: 3 sub-samples at least*
2. **SAMPLING TRANSECT IN STRAIGH RIVER SECTION**
3. **AVOID RIVER BENDS**
4. **SAMPLING POINTS EQUIDISTANT**
5. **SAMPLING POINTS IN MAIN STREAM LINE** *(active river flow)*





VERTICAL DESIGN

1. **TOP 0-5 CM**



Sampling

Sampling Method

SAMPLING METHOD

SMALL RIVERS
in river

LARGE RIVERS
from boat

LOWLAND

ALPINE

Bottom Sediment

Suspended Sediment

Floodplain Sediment

Results - Sampling

SAMPLING METHOD

SAMPLING MANUAL

SAMPLING VIDEOS

Results - Sampling

SAMPLING METHOD

Table of Contents

SAMPLING MANUAL

PHASE 3. SAMPLE COLLECTION

STEP 3.1 PICK UP SEDIMENT SAMPLE

STEP 3.1 / 1 LOWER VACUUM CORER

- ***SAMPLER 1**: Signal 'SAMPLE COLLECTION STARTS!'*
- ***take position** of sample collection (turn upstream, maximise distance between sampler and vacuum corer)*
- ***sink** the corer gently under water (valve open) until hitting the bottom sediment mildly (do not disturb uppermost layer)*
- ***push** the corer into sediment firmly*

disturbs up the top layer of bottom sediment

STEP 4.2 DOCUMENTATION

STEP 4.2 / 1 CHECK FIELD SHEET DOCUMENTATION

TYPICAL MISTAKE: Field Sheet documentation is incomplete, not checked and corrected.

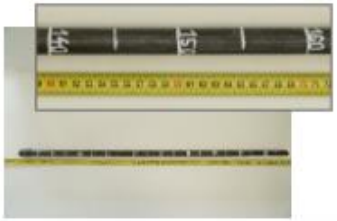
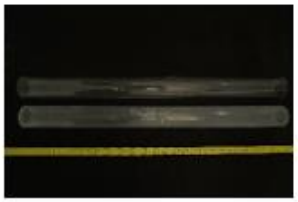
STEP 4.2 / 2 CHECK PHOTO DOCUMENTATION

TYPICAL MISTAKE: Field photo documentation is incomplete, not checked and corrected.

ded by the European Union (ERDF, IPA and ENI)

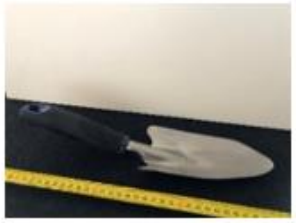
Results - Sampling

SAMPLING METHOD

EQUIPMENT			
CHECK	Sampling Unit		NOTE
	Vacuum unit		
	Extension		- 2 pieces - steel - 5 cm grade for water depth measurement
	Plexiglass tube		- 2 pieces - 50 cm
	Rope		min 5 m

DEVELOP YOUR SAMPLING SYSTEM: EQUIPMENT & TOOLS

SAMPLING METHOD

ITEM	GOOD EXAMPLE	BAD EXAMPLE	NOTE
Spade			**unpainted stain-less-steel** spade vs painted spades
Hand spade		 	**unpainted stainless steel** hand spade vs - painted hand spade - coloured plastic spade

DEVELOP YOUR SAMPLING SYSTEM: EQUIPMENT & TOOLS

SAMPLING METHOD

Painted spade: spade is Fe-steel, but paint contains HS contamination.

Element	Painted spade sampler		Steel spade
	unpainted part	painted part	
	Concentration (%)	Concentration (%)	Concentration (%)
Fe	**98.36**	**77.71**	**99.1**
Mn	**1.17**	**1.11**	**0.78**
Cr	**0.316**	**0.36**	0.106
Ti		16.87	
V		2.34	
Co		**1.48**	

Cake sampler

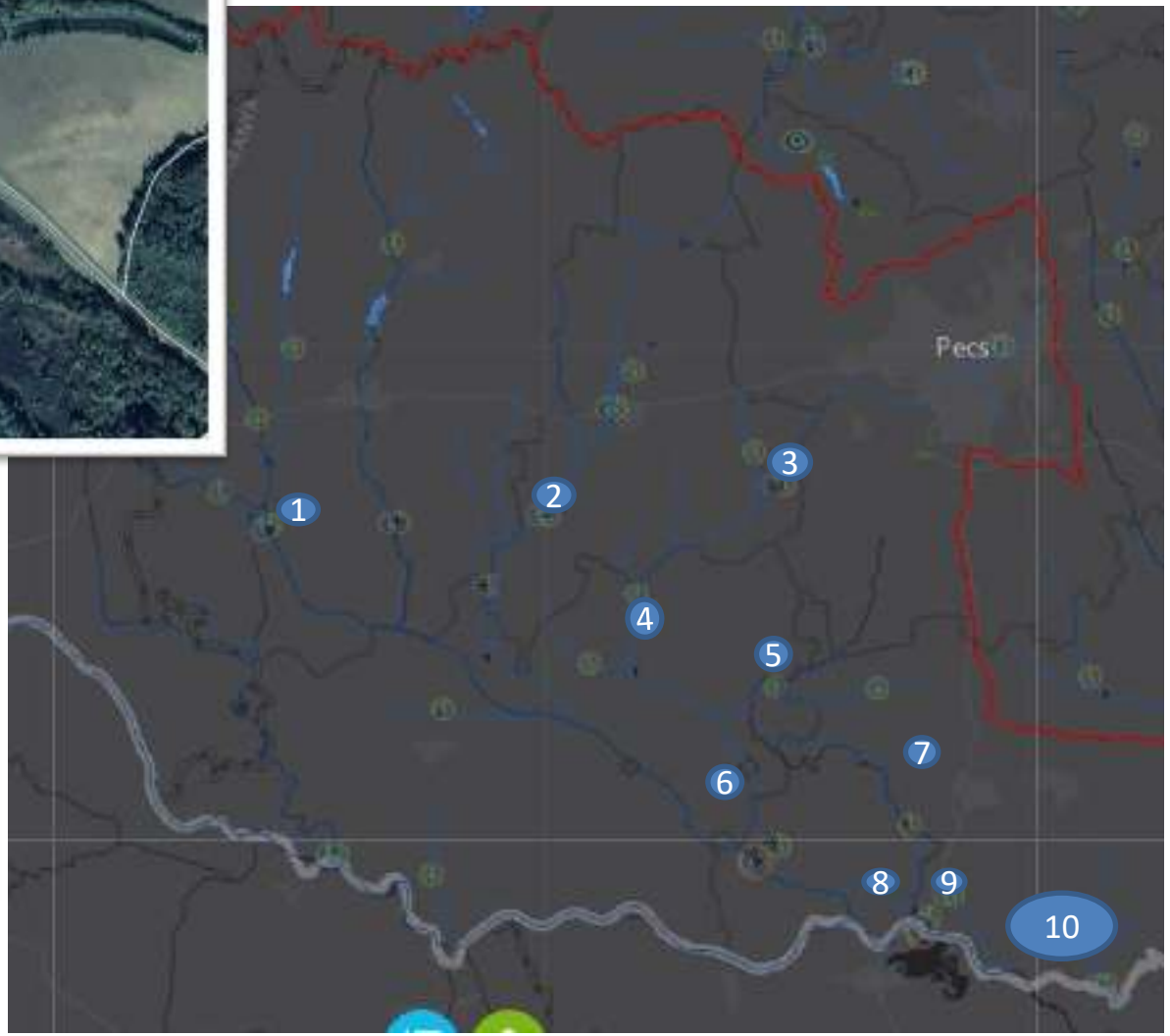
Cake sampler	
Element	Concentration (%)
Fe	**99.48**
Mn	**0.405**
Cr	0.028
Ni	0.017
Cu	0.066

Scoop sampler

Scoop sampler	
Element	Concentration (%)
Al	**94.1**
Fe	**1.94**
Zn	**1.71**
Mn	0.297
Ti	0.112
Cu	**1.47**
Pb	0.18

DEVELOP YOUR SAMPLING SYSTEM: EQUIPMENT & TOOLS

MONITORING SITE SELECTION – REMOTE SENSING & GIS



DRAVA TEST AREA:

- HU **TNMN** point + HR5 Donji Miholjac
- *HU operative WATER monitoring points: presence of **hazardous materials**.*

http://geoportal.vizugy.hu/vizgyujtogazd04_06/

SAMPLE COLLECTION

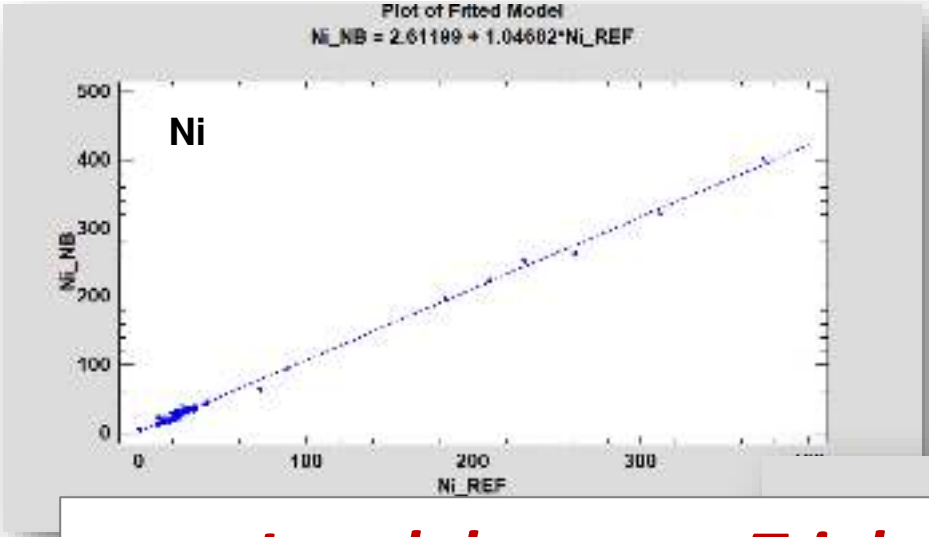
D.C.2.1 Drava Test Area Sampling Action

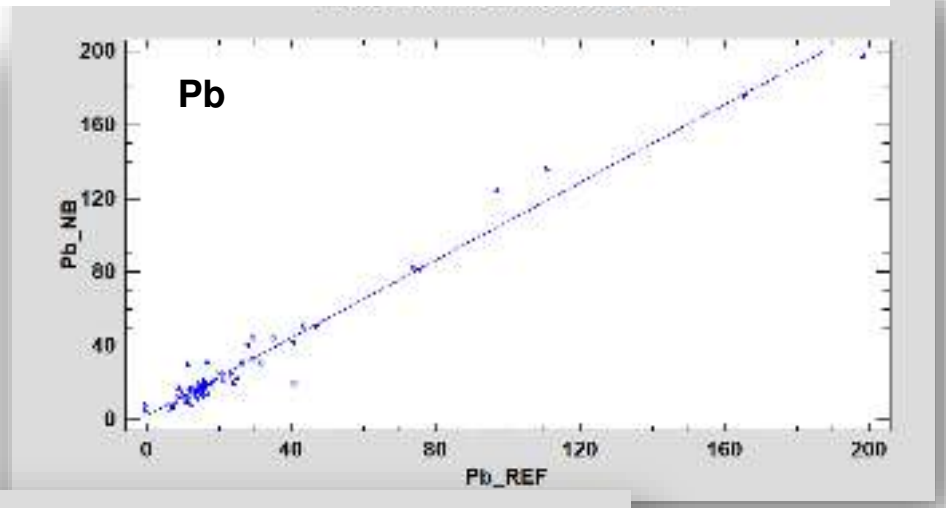
4-7 August 2020, Harkány, Szigetvár

Laboratory Analysis

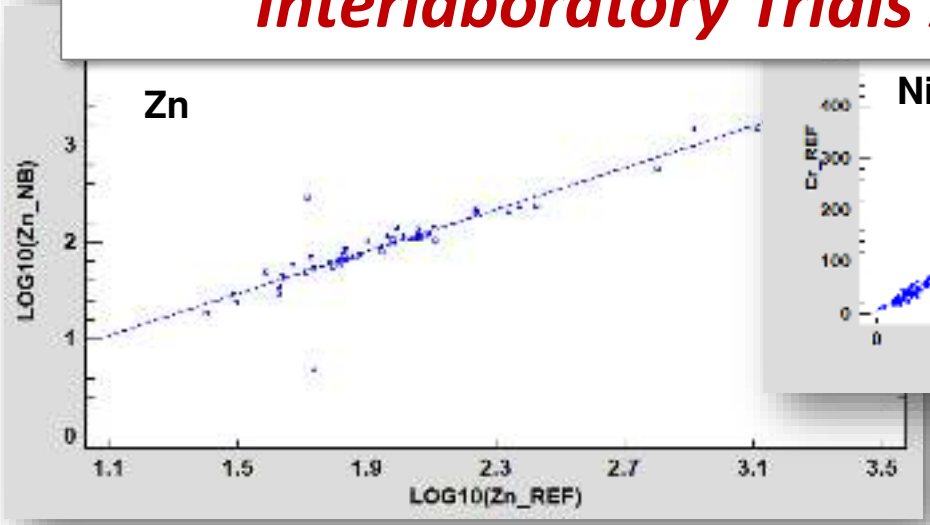
CASE STUDY

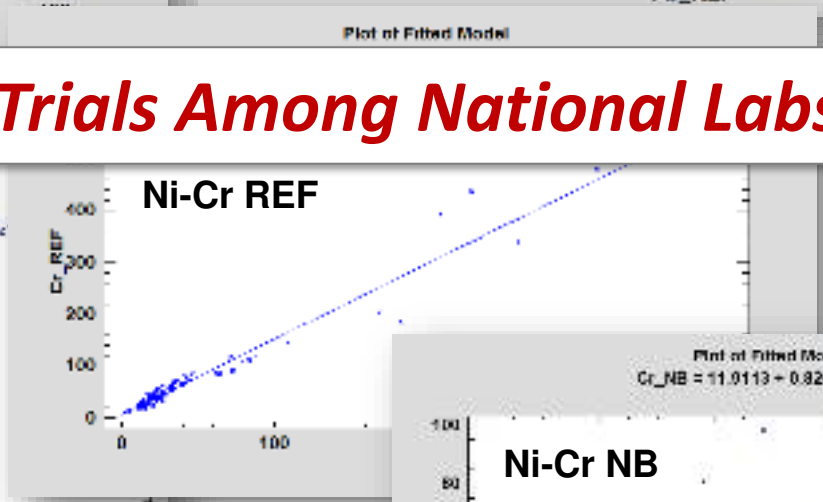
Results - Laboratory

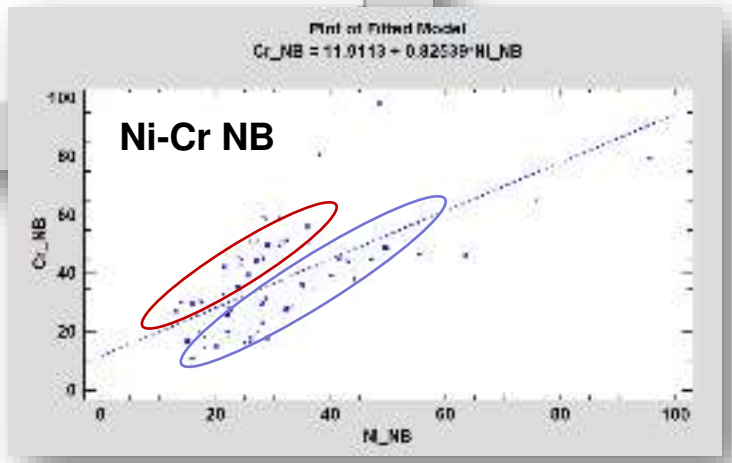




Interlaboratory Trials Among National Labs!



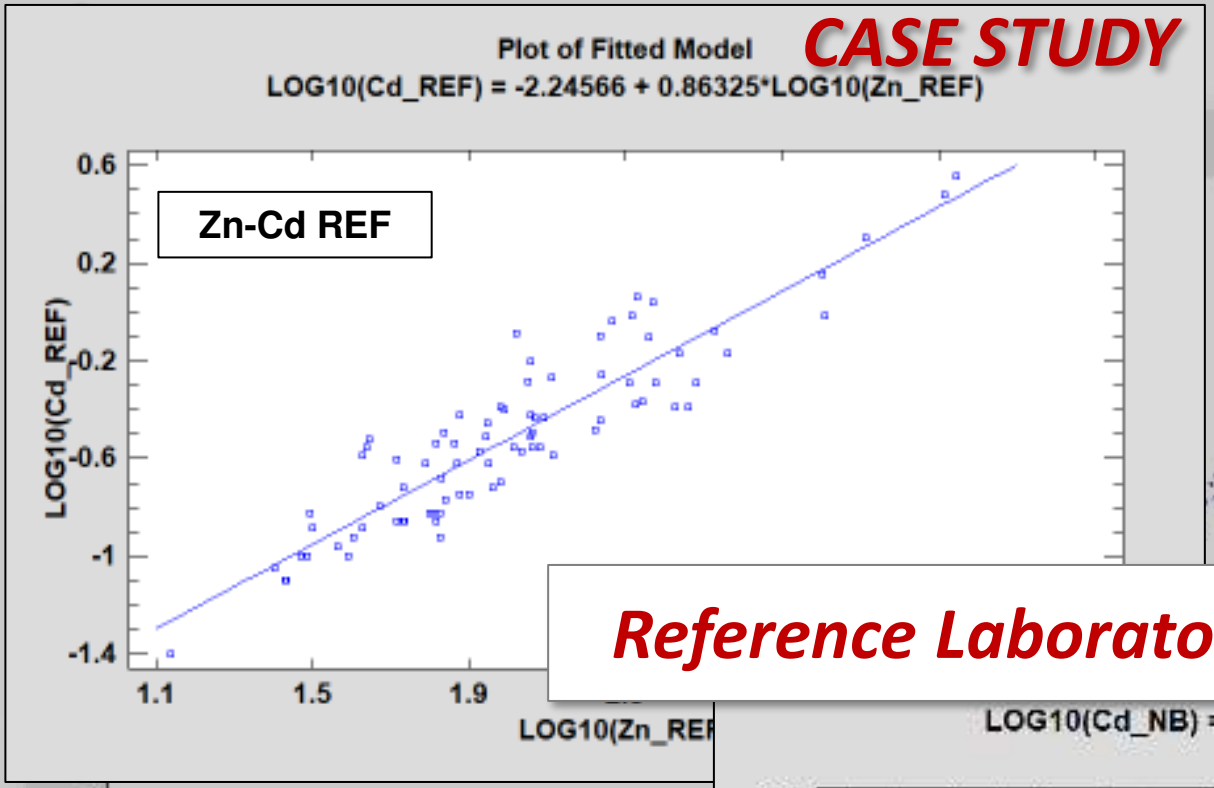


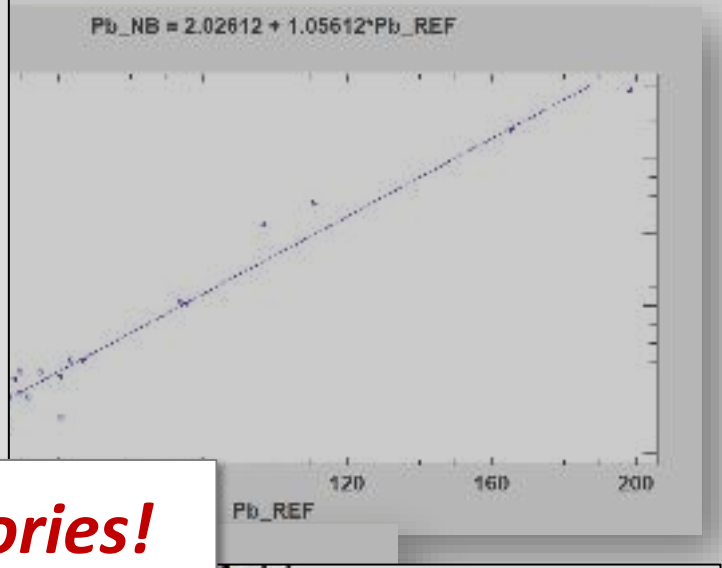


SAMPLE PREP *(Drying, Sieving, Homogenisation): Reference Lab (REF)*
EXTRACTION *(Acid): National Baseline Lab (NB)*

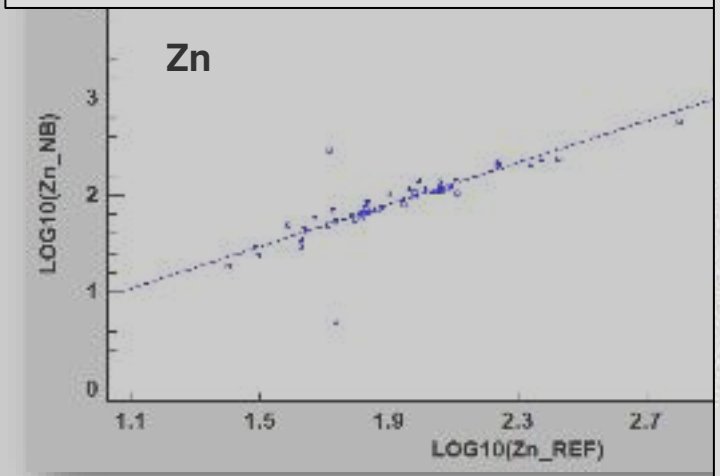
CASE STUDY

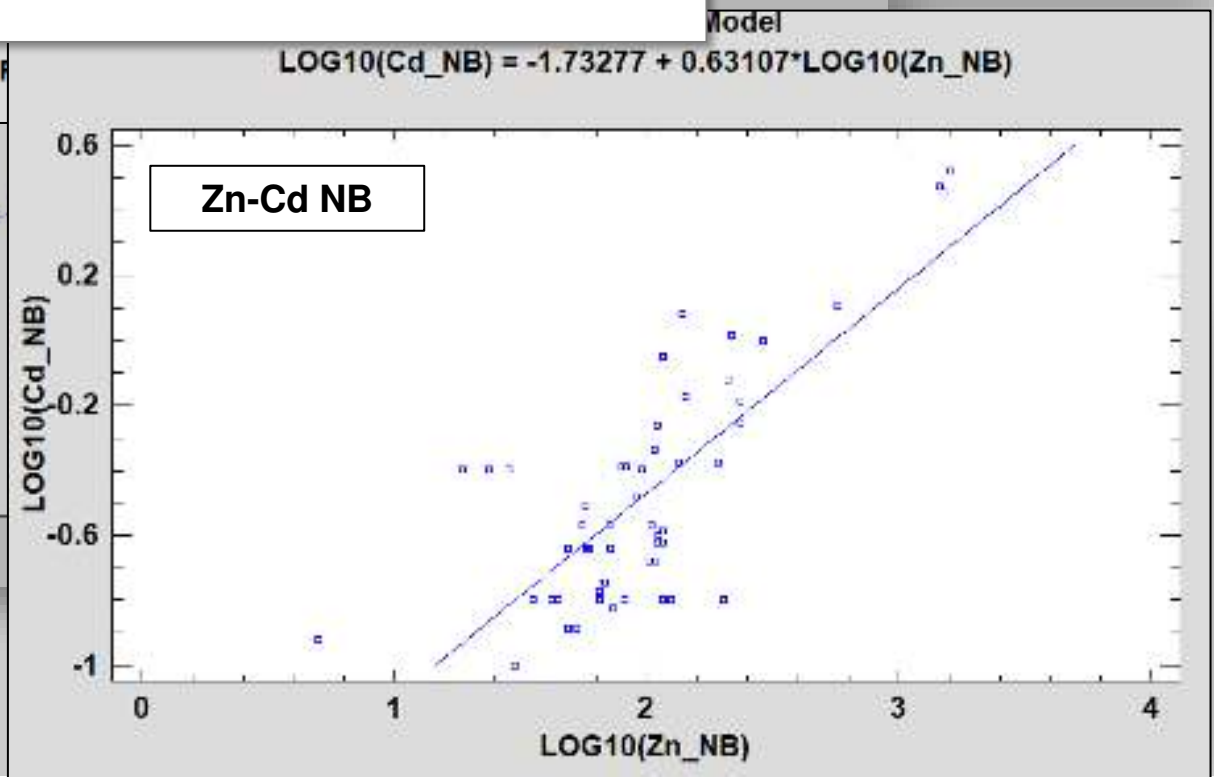
Results - Laboratory





Reference Laboratories!





Evaluation

EVALUATION – COMPARISON TO (1) NATIONAL EQS OR (2) INTERNATIONAL EQS

uation results 2/2.			Support fields for Evaluation results 2/2.											
ther limit values (see on the right side)			Lower QS limit values			Intervention QS limit values						Comperison to the lower QS limit value (Risk Ratio = C / QS)		
Good / Bad / unknown status	Evaluation result text	Evalution result notes	Elbe basin (IKSE/ICPER 2018) S-2000 Lower threshold	US EPA S-2000 TEC	Dutch pollution list F-2000 Target value	Elbe basin (IKSE/ICPER 2018) S-2000 Upper Threshold	Rhine basin (ICPR, 2009) S-2000 poor	Rhine basin (ICPR, 2009) S-2000 bad	US EPA S-2000 PEC	Dutch pollution list F-2000 Intervention value	Hungarian legislation (6/2009 (IV. 14.)) F-2000 Geological media	Elbe basin (IKSE/ICPER 2018) S-2000 R= C / Lower threshold	US EPA S-2000 R= C / TEC	Dutch pollution list F-2000 R= C / Target value
Good					0	53	400				0	0.3268	0.228212	not relevan
unknown					0	53	400				0	not relevan	not relevan	not relevan
Good			0.15	0.18	0	0.47	2	4	1.06	0	0	1.2	1	not relevan
unknown			0.15	0.18	0	0.47	2	4	1.06	0	0	not relevan	not relevan	not relevan
Good			0.15	0.18	0	0.47	2	4	1.06	0	0	1.133333	0.944444	not relevan
unknown			0.15	0.18	0	0.47	2	4	1.06	0	0	not relevan	not relevan	not relevan
Good			3	22.7	0	53	200	400	48.6	0	0	0.51	0.067401	not relevan
unknown			3	22.7	0	53	200	400	48.6	0	0	not relevan	not relevan	not relevan
Good			3	22.7	0	53	200	400	48.6	0	0	4.666667	0.61674	not relevan

RIVER ELBE

National

Normalisation

- *<63µm*
- *Toxicology-based preferred*

EVALUATION – (3) CALCULATIONS BASED ON PARTITIONING: SITE SPECIFIC

Based on total concentrations and partitioning coefficients.

$$C_{water,\ total}\left[\frac{mg}{L}\right] = C_{water,\ dissolved}\left[\frac{mg}{L}\right] + C_{susp,\ water}\left[\frac{mg}{L}\right]$$

$QS_{susp,\ solid}\left[\frac{mg}{kg}\right]$ $QS_{water,total}\left[\frac{mg}{L}\right]$

$$C_{susp,\ solid}\left[\frac{mg}{kg}\right] = K_{p,\ susp}\left[\frac{L}{kg}\right] \cdot \frac{C_{water,total}\left[\frac{mg}{L}\right]}{1 + K_{p,susp}\left[\frac{L}{kg}\right] \cdot C_{SPM}\left[\frac{mg}{L}\right] \cdot 10^{-6}}$$

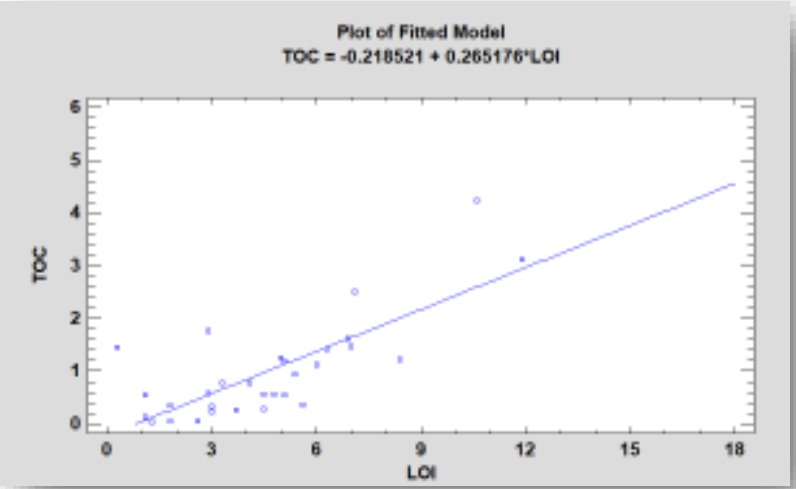
$$Kp,\ susp\left[\frac{L}{kg}\right] = \frac{C_{susp,solid}}{C_{water,dissolved}} \frac{\left[\frac{mg}{kg}\right]}{\left[\frac{mg}{L}\right]}$$

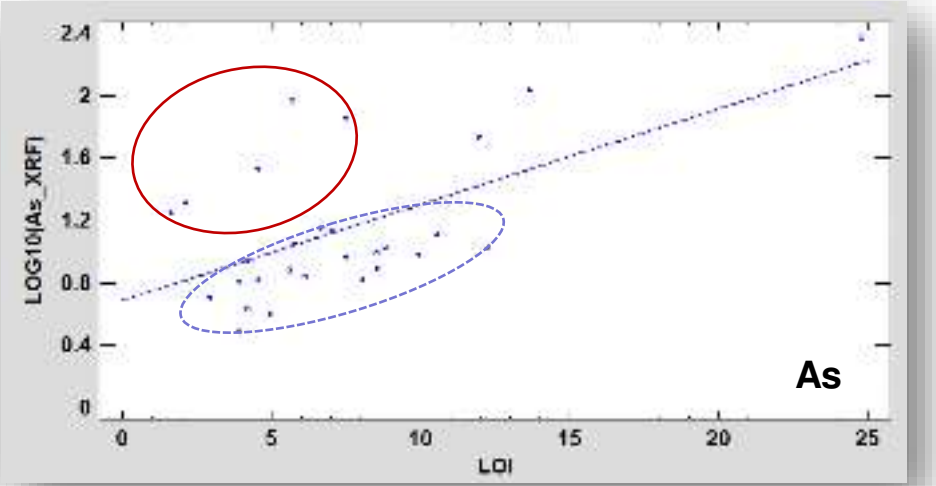
$C_{susp,\ solid} < QS_{susp,\ solid}$

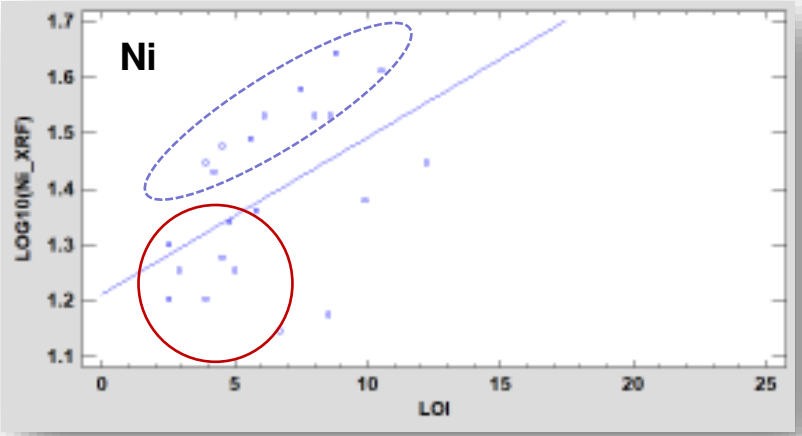
$$QS_{sediment,EqP,\ ww} = \frac{K_{sed-water}}{RHO_{sed}} \times QS_{fw,\ eco} \times 1000$$

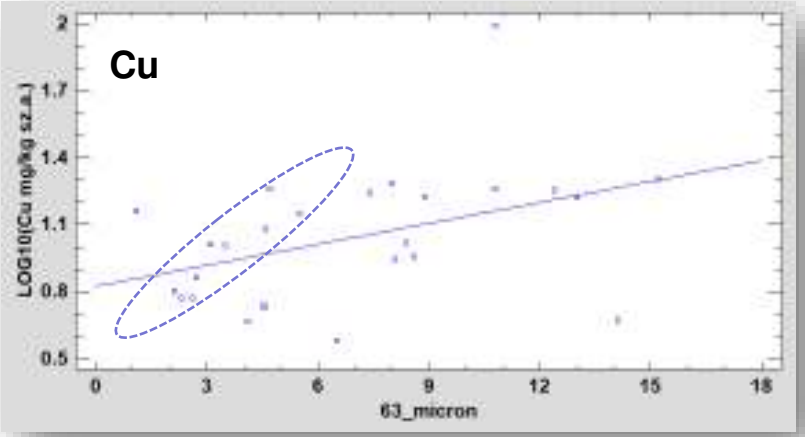
Error Propagation
(uncertainty analysis)

EVALUATION – NORMALISATION: SITE SPECIFIC









Passive Sediment Monitoring Station

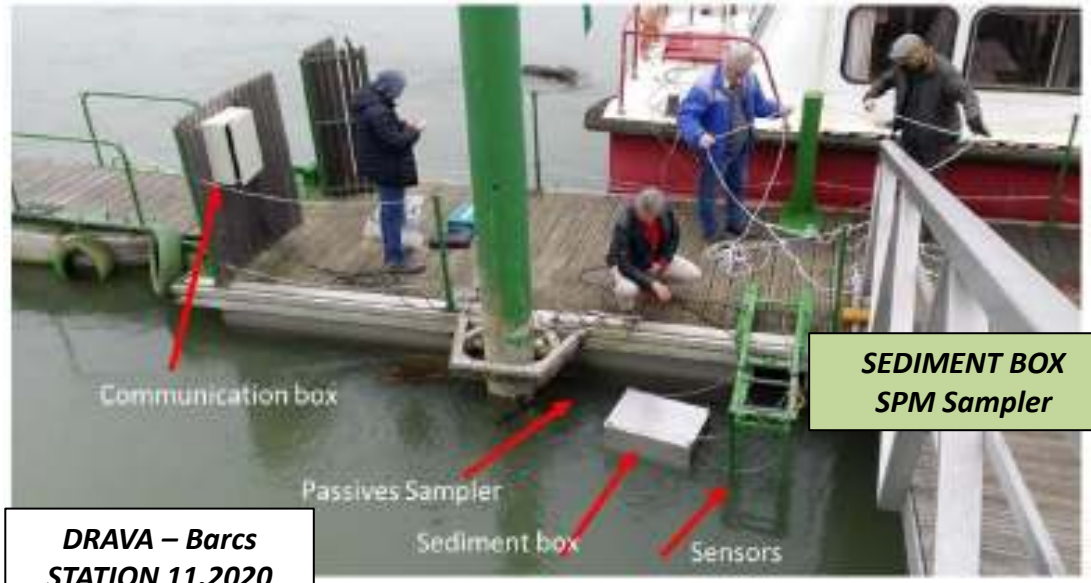
PASSIVE SAMPLING SYSTEM

Monitoring site - BARCS

Our goal is to apply an easy-to-use, fast and efficient tool in terms of operation, and from a scientific point of view, the process should be representative and reproducible.

PASSIVE SAMPLING SYSTEM

ONLINE SENSORS Sampler



SEDIMENT BOX SPM Sampler

DRAVA – Barcs STATION 11.2020

PASSIVE MEMBRANE Sampler

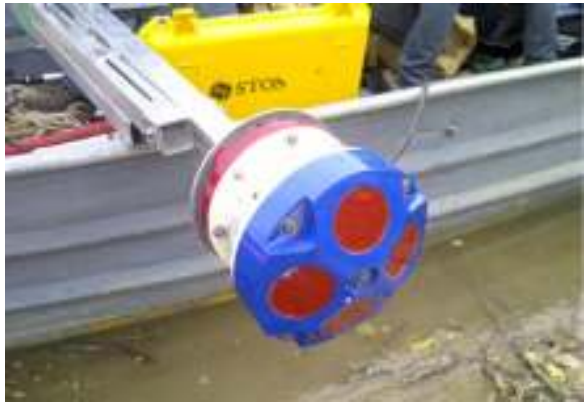
SEDIMENT BOX Overbank Sampler

INFINIT-SINK DGT Pore Water Sampler

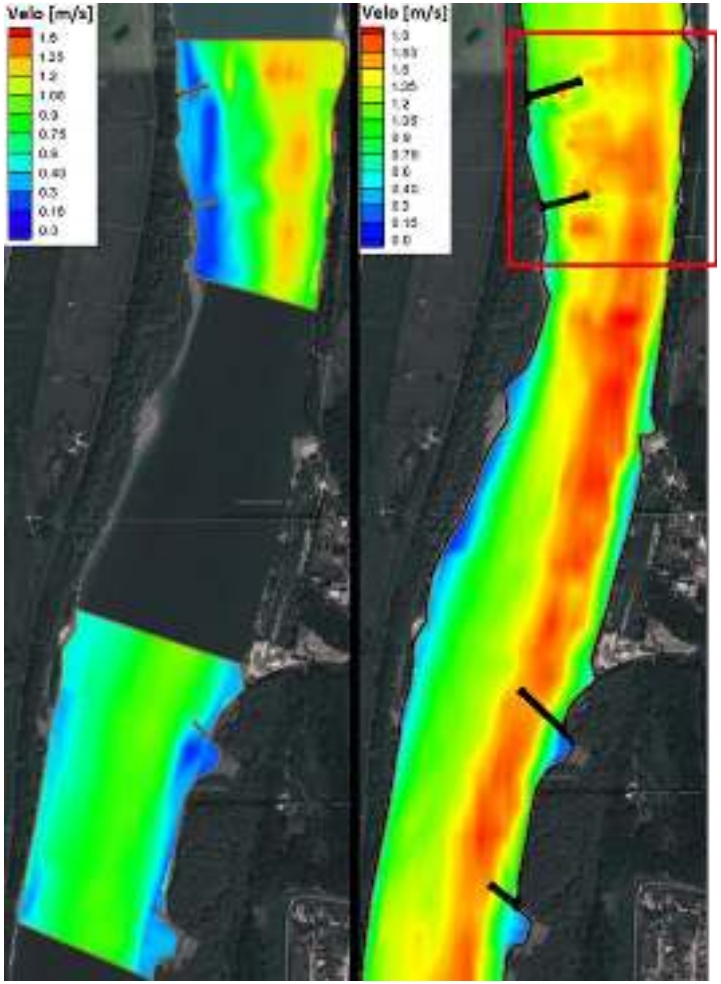
Outlook

SEDIMENT QUALITY VS SEDIMENT QUANTITY

ADCP



Flow velocity field



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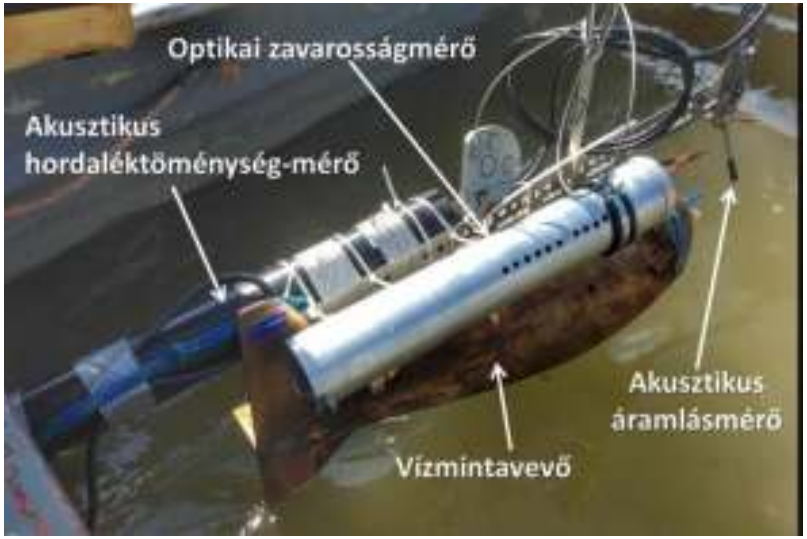
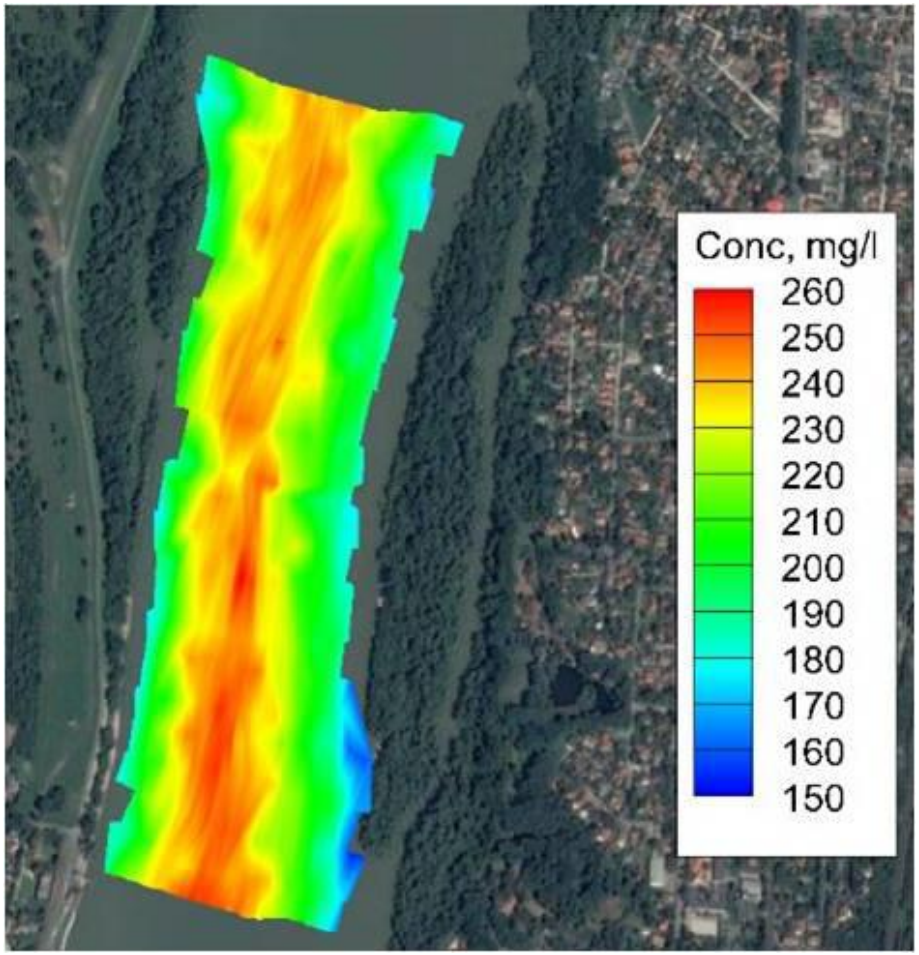
SEDIMENT QUALITY VS SEDIMENT QUANTITY

Suspended sediment

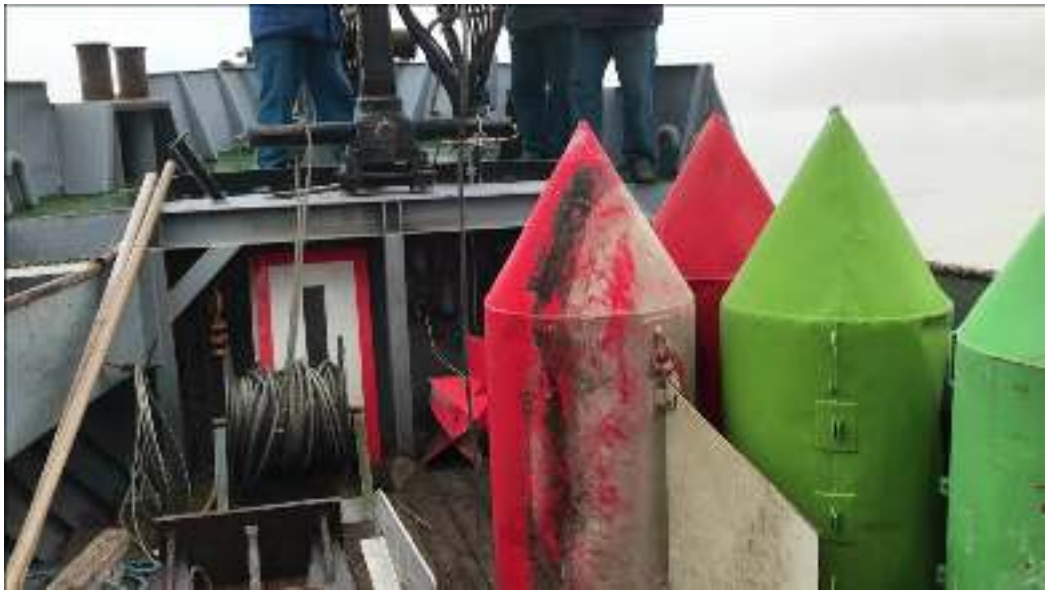


Suspended sediment concentration



SEDIMENT QUALITY VS SEDIMENT QUANTITY

Bed load



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Interreg
Danube Transnational Programme
SIMONA

Cooperation in the Danube Basin

Welcome to the Danube Basin!

Danube River Basin — A EUROPEAN CULTURAL AND HISTORICAL CENTRE

Danube River Basin — NATURE & PEOPLE

SIMONA welcomes you to the Danube Basin!

Interreg
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Project co-funded by the European Union
http://www.interreg-danube.eu/approved-projects/simona