MURA MONITORING - SZENNYEZŐ FORRÁSOK, VIZSGÁLANDÓ KOMPONENSEK, MINTAVÉTELI TERV ÉS ADATBÁZIS –FEJLESZTÉS

MURA MONITORING – POLLUTANT SOURCES, SELECTED SUBSTANCES, SAMPLING PLAN AND DATABASE DEVELOPMENT

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A cross-border region where rivers connect, not divide

Interreg
European Regional Development Fund
EUROPEAN UNION

Hungary-Croatia
Cross-border Co-operation Programme

Introduction

- **Water Framework Directive** (2000/60/EC) aims to **reach the good quality of surface and underground water** and **sustain the good ecological quality**
- There is a particular need to develop the monitoring system and expand the knowledge to other aqueous habitats as well.
- The most significant **aims of the project** were
  1) the determination of the of **main pollution sit**es along the Mura river that crosses the Croatian-Hungarian border (approximately 50 km along the Mura river and its environs, including the Croatian and Hungarian territories);

     2) the development of a **sampling methodological plan** for the selected substances and locations and

     3) the creation of an **online interactive database** to share the results of the project whit the public.

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Location of Mura River

- Mura is a river in **Central Europe**, 465 km in length, rises in Austria (1898 m above sea-level) Hohe Tauern national park of the Central Eastern Alps.
- It is a tributary of the Drava and subsequently the Danube.
- Typical border river:
  - Out of the last 130 km, it forms a state border for about 100 km (of which 45 km is the Hungarian-Croatian border).
- **POLLUTION KNOWS NO BORDERS**

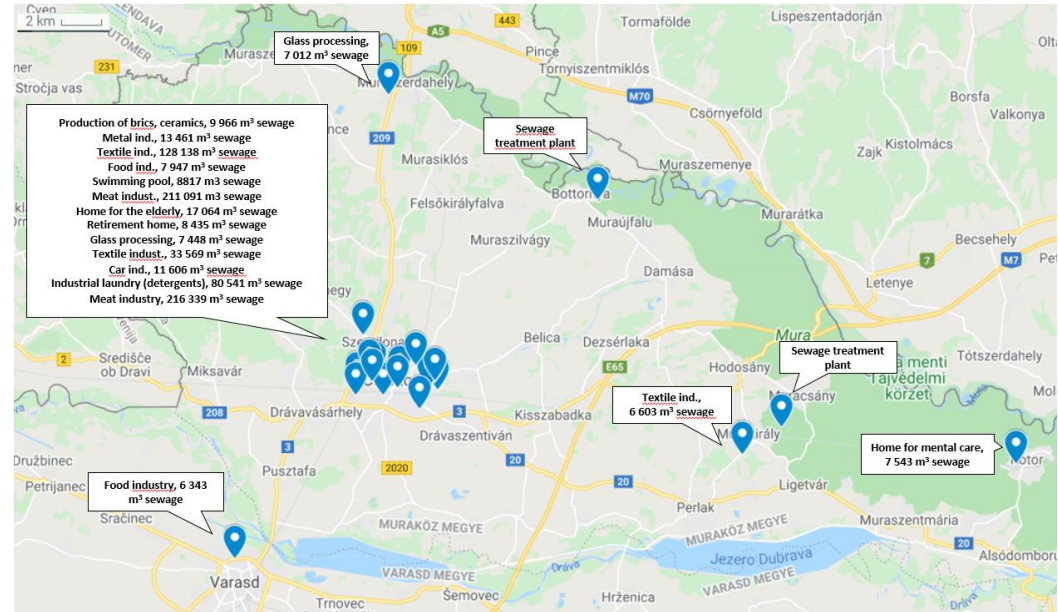*A cross-border region where rivers connect, not divide*

- There are various companies operating in the area affected by the project, which can be sources of pollution in terms of surface water and groundwater, as well as from the presumably polluted areas.

- The following main sources of pollution are to be considered in the project area of Hungary, broken down by settlements.

Tószerdahely	Molnári	Murakeresztúr	Letenye	In addition, the following may pose a potential threat to the quality of surface water and groundwater in all settlements
abandoned gravel mine (south-east of the settlement)	plants on the site of a former producer cooperative, petrol station there (about 1 km to the east of the settlement)	plants on the site of former producer cooperatives (northeast of the municipality)	livestock farm (gray cattle major)	abandoned illegal landfills (one or two within each settlement)
plants on the site of a former producer cooperative site (on the western edge of the settlement, towards Letenye)	abandoned brick factory, clay pond lakes (on the eastern edge of the settlement)	railway lines passing through the settlement, the total area of railway station	Letenye thermal (inflow into Béci stream)	illegally drilled wells (there are many of them in every settlement, there are no usable records of them, although they are problematic in several respects)
municipal sewage treatment plant	waterworks	operating gravel quarry (west of the settlement)	patrol station	diffuse pollution of intensively farmed areas involving the application of fertilizers and pesticides (typical everywhere in the project area, it may even has a great impact on surface water and groundwater quality for certain parameters)
	municipal sewage treatment plant	the part of the village without a public sewerage system	municipal sewage treatment plant	
		municipal sewage treatment plant	Letenye border crossing	

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The main sources of pollution - HR

In the investigated area, in Croatia, the most important companies in sewage consumption, are the following:

- Meat industry - fat
- Textile industry - dye
- Industrial laundry - detergents
- Hospital – chemicals, pharmaceuticals, citotoxines
- Wagon maitenance – oil
- Metal industy
- Car
- Food
- Production of bricks, ceramics, glass

Glass processing, 7 012 m³ sewage

Production of brics, ceramics, 9 966 m³ sewage
Metal ind., 13 461 m³ sewage
Textile ind., 128 138 m³ sewage
Food ind., 7 947 m³ sewage
Swimming pool 8817 m3 sewage
Meat indust., 211 091 m3 sewage
Home for the elderly, 17 064 m³ sewage
Retirement home, 8 435 m³ sewage
Glass processing, 7 448 m³ sewage
Textile indust., 33 569 m³ sewage
Car ind., 11 606 m³ sewage
Industrial laundry (detergents), 80 541 m³ sewage
Meat industry, 216 339 m³ sewage

Sewage treatment plant

Sewage treatment plant

Textile ind., 6 603 m³ sewage

Home for mental care, 7 543 m³ sewage

Food industry, 6 343 m³ sewage

Selected substances according to pollution sources

Chemical parameters	Metals	Organic components	Pesticides	Microbiology
• water temperature (in field) • dissolved O_2 (in field) • turbidity • sulfate • cianide • boron • pH • conductivity • total P • Kjeldal N/ total N • nitrate • nitrite • ammonia • BOD • COD • TOC • CH	• iron • manganase • cadmium • copper • lead • mercury • arsenic	• PAH - total PAH • total PCBs • THM - total THM	• total pesticides	• Coliform • Escherichia coli • Enterococcus • Colony count 22°C

PESTICIDES

METALS

CHEMICAL PARAMETERS

PHARMACEUTICALS

ORGANIC PARAMETERS
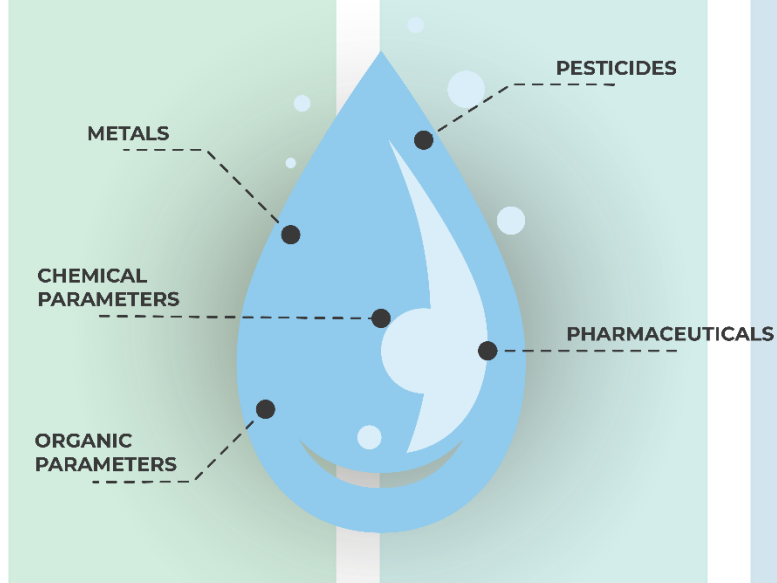
Sampling locations

Sampling locations - surface water
1. Podturen/Bottornya 1. Ra...
2. Podturen/Bottornya 2. In f...
3. Podturen/Bottornya 3. Aft...
4. Letenye 1. In front of, on t...
5. Letenye 2. After on the Mura
6. Cakovec/Csáktornya 1. Tr...
7. Cakovec/Csáktornya 2. In ...
8. Cakovec/Csáktornya 3. Af...
9. Tótszerdahely 1. Birkitói di...
10. Tótszerdahely 2. In front of...
11. Tótszerdahely 3. After, on...
12. Molnári 1, Vicsa creek
13. Molnári 2. In front of, on t...
14. Molnári 3. After, on the M...
15. Murakeresztúr 1. Kolláts...
16. Murakeresztúr 2. In front ...
17. Murakeresztúr 3. After, o...
18. Donji Kraljevec/Murakirál...
19. Donji Kraljevec/Murakirál...
20. Donji Kraljevec/Murakirál...

Sampling locations - monitoring ..
21. Drávavásárhely/Nedelisce
22. Perlak/Prelog No.1
23. Letenye K58 (5F)
24. Molnári K34 (13F)
25. Murakeresztúr (1F)
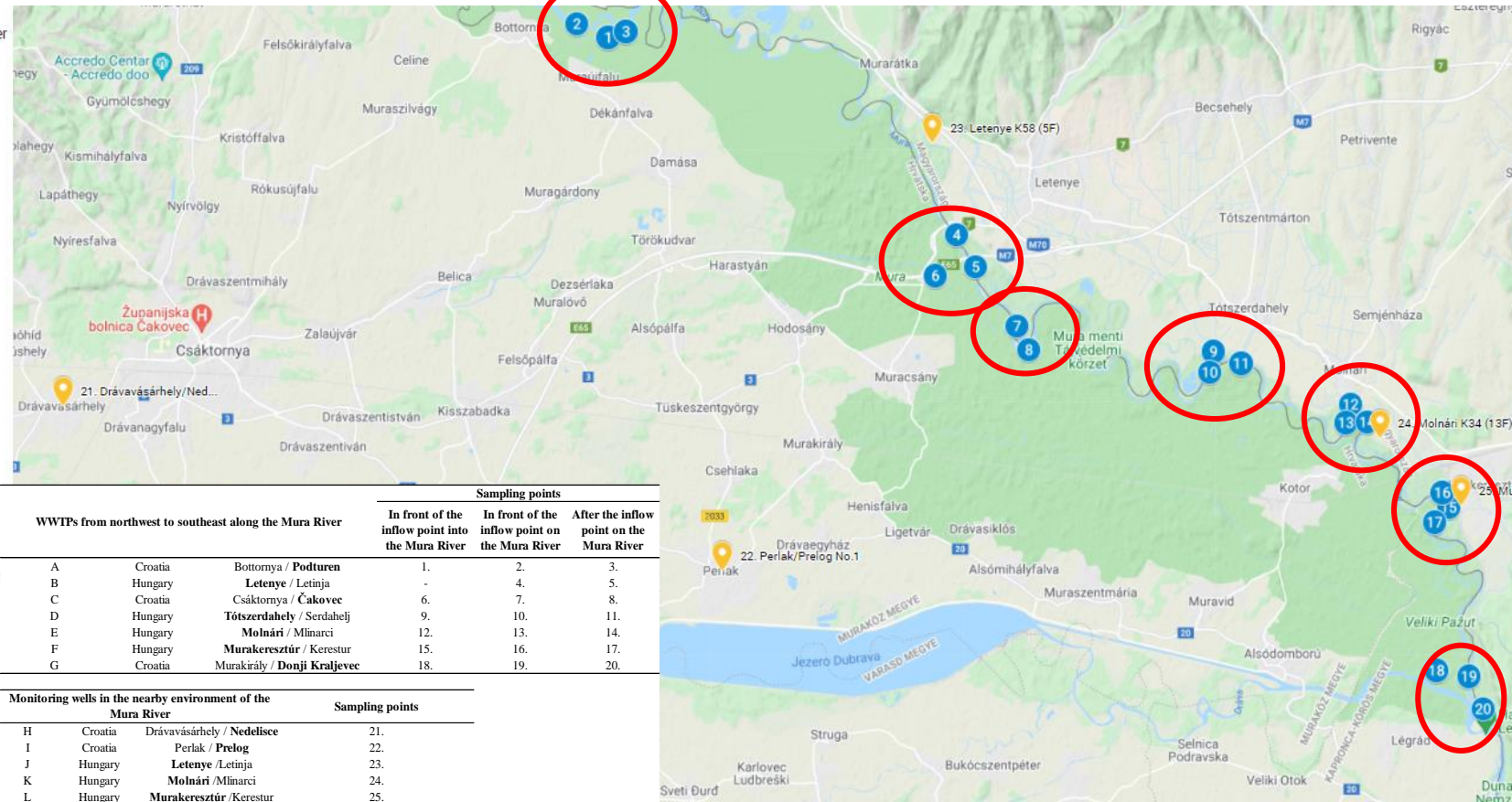
WWTPs from northwest to southeast along the Mura River			Sampling points		
			In front of the inflow point into the Mura River	In front of the inflow point on the Mura River	After the inflow point on the Mura River
A	Croatia	Bottornya / **Podturen**	1.	2.	3.
B	Hungary	**Letenye** / Letinja	-	4.	5.
C	Croatia	Csáktornya / **Čakovec**	6.	7.	8.
D	Hungary	**Tótszerdahely** / Serdahelj	9.	10.	11.
E	Hungary	**Molnári** / Mlinarci	12.	13.	14.
F	Hungary	**Murakeresztúr** / Kerestur	15.	16.	17.
G	Croatia	Murakirály / **Donji Kraljevec**	18.	19.	20.

Monitoring wells in the nearby environment of the Mura River			Sampling points
H	Croatia	Drávavásárhely / **Nedelisce**	21.
I	Croatia	Perlak / **Prelog**	22.
J	Hungary	**Letenye** /Letinja	23.
K	Hungary	**Molnári** /Mlinarci	24.
L	Hungary	**Murakeresztúr** /Kerestur	25.

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Sampling plan

- Group
- Components
- Total number of samples
- Frequency of sampling
- Pretreatment
- Amount of samples (L)
- Container
- Time of arrival at the lab
- Notes

- June 2021 – May 2022 (monthly)
- 12 or 4 samples per year

Group	Components	Total number of samples	Total number of samples	Frequency of sampling	Pretreatment	Amount of samples (L)	Container	Time of arrival at the lab	Notes
1. Metals	Iron	84	100	4/year					
	Manganese	84	100	4/year					
	Cadmium	84	100	4/year	cooling, 1 ml nitric acid solution 1:1	0,1	Plastic container (100ml)	within 24 hours after sampling	sampling without rinse
	Copper	84	100	4/year					
	Lead	84	100	4/year					
	Arsenic	84	100	4/year					
	Mercury	84	100	4/year	cooling, Potassium dichromate nitric acid solution (1%)	0,2	PTFE or glass bottle (200ml)	within 24 hours after sampling	sampling without rinse
2. Chemical parameters	Turbidity	252	252	12/year	cooling	1	glass bottle		
	sulfate	252	252	12/year	cooling	0,5	glass bottle		
	cianide	252	252	12/year	cooling	0,1	HDPE		acidify using 4 ml 12,5% HNO3
	Boron	252	252	12/year	cooling	1	Winkler, glass stopper		
	pH	252	252	12/year	cooling				
	cond	252	252	12/year	cooling				
	total P	252	252	12/year	cooling				
	Kjeldal N/ total N	252	252	12/year	cooling				
	NO3	252	252	12/year	cooling				
	NO2	252	252	12/year	cooling				
	NH3	252	252	12/year	cooling				
	BOD	252	252	12/year	cooling				
	COD	252	252	12/year	cooling				
	dissolved O2	252	252	12/year	cooling				
	TOC	252	252	12/year	cooling				
	CH	252	252	12/year	cooling				
3. Organic parameters	Bensol	236	235	12/year	cooling, bubble-free sampling, 5mg Na2S2O3 / vial	0,08	EPA VIAL (2*40ml)	within 24 hours after sampling	sampling without rinse
	Benz(a)pirene+PAH	236	235	12/year	Cooling (2-8°C), Na2S2O3	1	1 L, darkened, glass bottle	within 24 hours after sampling	sampling without rinse and fill the container up to 90%
	PCB	236	235	12/year	Cooling (2-8°C), Na2S2O3	1,04	1 L, darkened, glass bottle + 40ml EPA vial (for	within 5 days after sampling	sampling without rinse and fill the container up to 90%
	THM	236	235	12/year				within 24 hours after sampling	sampling without rinse
	pesticides+total pes	84	100	4/year	Cooling (2-8°C), Na2S2O3	1,09	1 L, darkened, glass bottle (for pesticide meas	within 3 days after sampling	sampling without rinse and fill the container up to 90%
	Hexabromocyclodo	84	100	4/year	SPE method	2	2 x 1 L, darkened, glass bottle	within 3 days after sampling	sampling without rinse and fill the container up to 90%
4. Pharmaceuticals	diclofenac	252	252	12/year	Cooling	2	2,5 L, darkened, borosilicate glass with Teflon	within 24 hours after sampling	Sampling from a depth of 1 m below the water surface and acidify using 2 mL of 100% HCOOH
	naproxen	252	252	12/year					
	ethynil-estradiol	252	252	12/year					
5. Biological parameters	Escherechia coli	252	252	12/year	Cooling	0,5	sterile bottle		
	Coliform	252	252	12/year					
	Colony count 22°C	252	252	12/year					
	Enterococcus	252	252	12/year					

| Components group	Date											
	02/06/2021	06/07/2021	03/08/2021	07/09/2021	05/10/2021	02/11/2021	07/12/2021	07/01/2022	01/02/2022	01/03/2022	05/04/2022	03/05/2022
1. Metals												
2. Chemical parameters												
3. Organic parameters (benzole, benz(a)pyrene, PAH, PCB,THM)												
4. Organic parameters (pesticides,hexabromocyclododecane)												
5. Pharmaceuticals												
6. Biological parameters												

Database
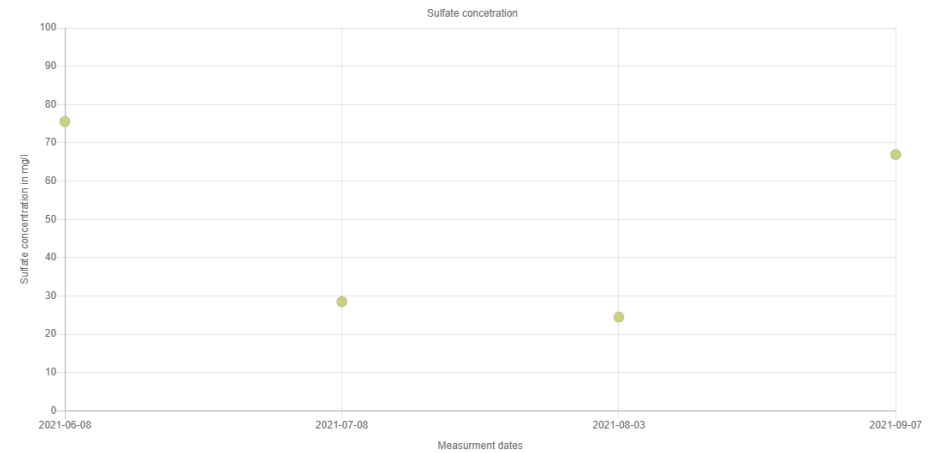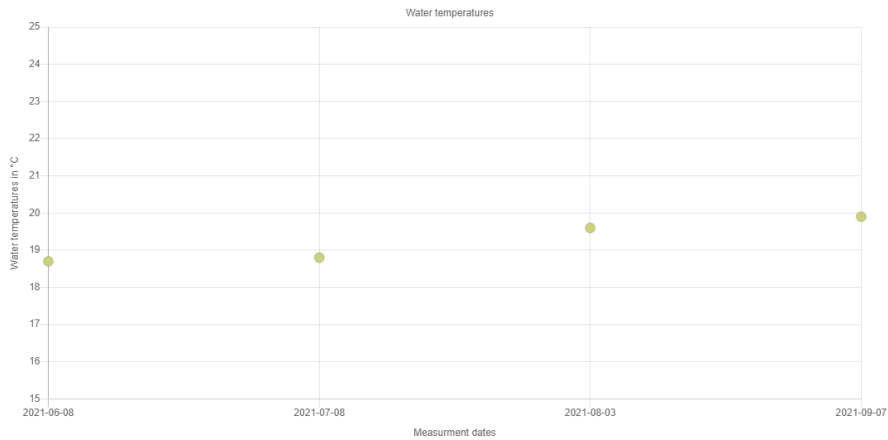
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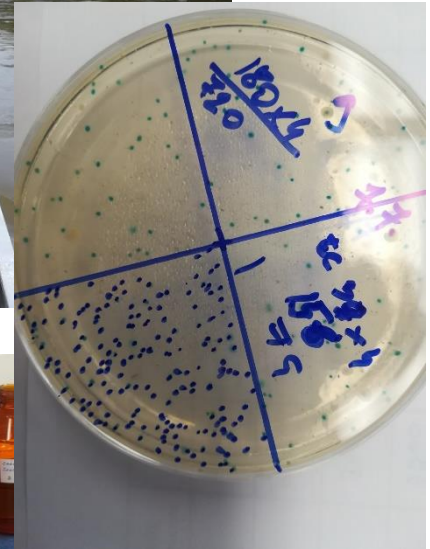
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