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Issues Regarding the Hydromorphological Pressures and their Impact on Water Quality from Surface Water Accumulation in Timiș and Bega River Basin

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Abstract: Banat River Area is located in the southwestern part of Romania, covering a territory that stretches from south of the Mureș River to the confluence of Cerna River with the Danube an area of 18 393,15 km^2, which represents 7,7% of Romania's territory. The Banat Hydrographical Space Area is composed of six hydrographic basins and from the river basins tributaries of the the left side of the Danube River between Cerna River and Nera River. This paper analyzes the aspects of the hydro morphological pressures for Bega and Timiș River which have characteristics specific to the southwest part of the country, still they also stand out as systems with specific characteristics for each river basin and the human influence has a definite role for the water drainage in this area, some hydro technical arrangements have a history of more than 250 years in this part of Romania. The barrier lake with a surface greater than 0.5 km^2 are in number of 9 in the Banat Hydrographical Space and as a hydro morphological pressure they cause mainly flow and regulating flow continuity interruption. The water accumulations are situated mainly in the hydrographical basins of Timiș, Bega, Caraș and Cerna. They were built with multiple purposes for the water use: drinking and industrial water supply, hydraulic energy and flood defense.

Keywords: hydrographical Space. hydrographic basins, hydro morphological pressures, drinking and industrial water supply

1. INTRODUCTION

From the many activities carried out on waters or related to waters, only a few exert a significant pressure on them [1]. The evaluations of these pressures are performed using criteria and thresholds given in Table. 1.

Based on these criteria, were estimated that watercourses that are significantly affected by the presence of the hydromorphological pressures [1].

Table 1. Criteria for defining significant hydromorphological pressure

No.	Hydrotechnical Construction (hydromorfological alterations)	Effects	Parameters that reflect the pressure	Threshold
1	*Transversal sectioning works.* a) dams, spillways, bottom sills	On the hydrological regime, sediment and biota migration [1)]	Threshold Density (no/km) or	> 1
			Obstacle height (cm)	≥ 20
	b) barrier lake – discharge of pulse waves	Over the minimum flow and biota	Minimum flow on the River bed/ Q[*2)] (%)	≤100
		Over the hydrological regime, and riverbed and flora stability	Gradient of water rising/lowering (cm) / hour	≥ 50
2	*Works along the River* a) pier, agrarian arrangements fisheries, etc	Over the lateral connection, vegetation, from the flooding meadow and reproduction area.	Pier length / Water body length (%)	≥ 30
			Affected surface / Flooding meadow surface (%)	≥ 30
	b) Regularization works and strengthening banks, meanders cuts	Over the longitudinal profile of the river, structure substrate and biota.	Length of regularization work / The water body length (%)	≥ 30
3	*Fairways*	Over the riverbed stability and biota	The width of the channel (dredged) / The width of the riverbed (%)	≥ 30
4	*Water intake, refunds usage (evacuations), bypass*	Over the minimum flow, riverbed and biota	Collected or returned flow / Annual average flow (%)	≥ 10
			Minimum Riverbed flow / Q[*2)] (%)	≤ 100

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Note:

[1] it is taking into consideration only the migrating biota

[2] $Q^* = Q_{95\%}$ (m^3/s)+ 0,1 for $Q_{95\%}$> 200 l/s ; $Q^* = 1,25 \times Q_{95\%}$ (m^3/s)+ 0,05 for $Q_{95\%}$< 200 l/s; $Q_{95\%}$ - monthly average annual minimum flow with the insurance of 95 % (mc/s)

[3] frequency > 1 / day

The barrier lake with a surface greater than 0.5 km^2 are in number of 9 in the Banat Hydrographical Space and as a hydromorphological pressure they cause mainly flow and regulating flow continuity interruption [2]. The water accumulations are situated mainly in the hydrographical basins of Timiş, Bega, Caraş and Cerna. They were built with multiple purposes for the water use: drinking and industrial water supply, hydraulic energy and flood defence [2].

The Accumulation Surduc is the largest accumulation from the Bega River Basin and it was built mainly for the temporal regulation of River flows, in Timisoara area.

In the Timis hydrographical basin are found the "Trei Ape" accumulation (at the junction of the Timis River springs), Poiana Marului being built with the power purpose and the accumulation of Zervesti.

In the superior basin of the river Nera are found the accumulation Gozna, Văliug, Secu which provides water utilities requirements in Resiţa and harnesses the hydropower potential of the hydrographical basin.

In Cerna River Basin are found two reservoirs: Valea lui Iovan which is part of hydropower Cerna-Motru-Tismana and Herculane which besides harnessing hydropower potential ensure coverage of water requirements for the city Băile-Herculane.

1. Experimental part

The Monitoring network should provide an overview of ecological and chemical state in the hydrographic area Banat and to allow classification of surface waters in five classes of quality in accordance with the norm regarding benchmarks for classification of the surface water quality approved by Order no. 161/2006 [4].

In establishing the monitoring sections of rivers were used the following criteria:

• border criteria - the entry and exit sections of rivers in the country;

• confluence criteria;

• criteria of point sources of pollution - sections downstream of these sources of pollution;

• criteria of water uptake for drinking - control sections in capture.

During 2013 [1], water quality in the Hydrographical Space Banat was tracked through 36 monitoring sections with a frequency of monthly monitoring of physical - chemical parameters and indicators 4 times a year for the biological and bacteriological parameters. Also, there were a total of 10 lakes surveyed, namely: Surduc in Bega River Basin; Trei Ape, Poiana Mărului, Gozna and Secu in Timis River Basin; Buhui and Dognecea Mică in Caraş River Basin; Taria in Nera River Basin; Valea lui Iovan and Herculane in Cerna River Basin. From these, the barrier lake Buhui, Dognecea Mică and Taria have a surface of less than 0.5 km^2 (Figure No. 1).

Figure 1. The monitoring network for surface waters

The samplings were made from sections established for each lake, in dam area, in the middle inlet lake (lake tail) and major branch. Samplings were performed, depending on the location of the section, on multiple vertical. Generally, the frequency of sampling is four times a year for all indicators, except sections capture from reservoirs aimed water supply to the population, when the frequency can be greater (4-12 times per year). Samples were analyzed for physico - chemical, biological and microbiological point of view.

Most of these accumulations are both sources of energy, and sources of drinking water for a number of adjacent localities, so analyzes have been accorded special attention, especially for the indicators of eutrophication in order to establish state food of each lake, the rate of evolution and their dynamics [2].

The current national system of monitoring is in a process of modernization and development in order to adapt it to the European directives on water quality protection.

2. RESOULTS AND DISCUSSIONS
LAKES WATER QUALITY

In the Banat Hydrographical Space they were define a number of 8 water bodies, all of which are monitored in 16 monitoring sections.

In Bega hydrographic basin were monitored two bodies of water with one lake for each body of water. The accumulation lake Surduc - LW5.1.10_B1 is located on the river Gladna, a left tributary of the Bega Superior River, about 4 km upstream from the village Surducul Mic. The water accumulation is built in 1976 with a total volume of 51.08 million cubic meters at tle level of normal level of retention - NNR (198 mdMB) in the final stage and a water surface of 538 ha. Currently the lake area on the NNR level is 357 ha, the average depth is 6.60 m. The length of the dam is 130 m, with a retention time of 0.670 years, use complex and typology ROLL 10a.

Monitoring is made for two sections, in the dam and middle of the lake. Minimum operating level of the lake is at elevation 187 mdMB. The dam is located at an altitude of 195 mdMB crest elevation is 203 mdMB. Assessment of potential ecological body of water: In terms of biological elements water body was placed in good ecological potential. Biological elements assessed were classified in good ecological potential phytoplankton and phytobenthic placed in maximum ecological potential.

In terms of physico-chemical elements, the body of water was placed in good ecological potential. In terms of specific pollutants, the water body was placed in good ecological potential. The body of water was placed in a good ecological potential.

After assessing the chemical status, body of water was falling into disrepair estate because the maximum determined cadmium, nickel and lead [1].

The accumulation Murani Lake - LW5.1.21.2_B1 Măgheruş (Fibiş, Niarad) is located on the water Măgheruş cadastral code V-1.21.2 at km 190 + 00 upstream from Murani.

This accumulation was put into operation in 1971, working with non-permanent retention (with the role of attenuating flood waves). In 1980, after additional work performed, it becomes with permanent retention. The lake area on the NNR level is 95 ha, with an average depth of 1.55 m. The length of the dam is 688 m, with a retention time of 0.386 years, use complex typology ROLL 3:01 with one monitoring section, on the middle of the lake. Accumulation serves flood protection which is achieved by reducing and regulating the flow of flood wave's defluent. Thus, on the 0.1% assurance the maximum tributary flow is 62 m³ / s and the defluent flow is reduced to 44.00 m^3/s. On the 1% assurance, the tributary flow is 30 m³/s, the defluent flow decreasing to 5.37 m^3/s. The lake at Murani Măgheruş has other uses: pisciculture (the impoundment reservoir), recreation (fishing, canoeing).

Assessment of ecological potential of the water body: In terms of biological elements water body was placed in maximum ecological potential. Biological elements evaluated were placed in phytoplankton and phytobenthic maximum ecological potential. In terms of physico-chemical elements, the water body was classified as moderate ecological potential, determined by the oxygen balance and nutrient [1].

In terms of specific pollutants, the water body was placed in good ecological potential. Water body was classified as moderate ecological potential. After assessing the chemical status, the water body was falling into disrepair state because the maximum determined of cadmium, nickel and lead.

In Table 2 we present the amounts of nitrates and phosphates discharged in the river Bega-Timiş, from various sectors.

Table 2. Tthe amounts of nitrates and phosphates discharge (tons/year) 2014 – B.H. Bega-Timiş, Timiş county

Type of activities	Ammonium (NH_4)	Total Nitrogen (N)	Nitrates (NO_3)	Nitrites (NO_2)	Total cyanides (CN)	Total phosphorus (P)
Capture and process water for feed	194,494068	481,247112	1044,989043	9,912070	0,022196	61,071083
Trade and services for the population	0,050285	0,161006	0,091093	0,006575		0,038506
Civil engineering	0,314851	0,313610	0,004238	0,001641		0,026516
Transport industry						

Food industry	1,237970	3,001952	2,102783	0,234528		1,024359
Quarrying industry	0,086183	0,265563	0,002371	0,000132		0,129203
Metallurgical and machine building	0,000000	0,012700			0,000000	0,001000
Woodworking Industry		0,009242				
Light industry	0,820605	1,885000	2,932223	0,421902		0,487286
Education and health		2,061508				0,210615
Precision Mechanics and Electrotechnical	0,546627	1,200846	2,801684	0,008665		0,108570
Chemical processing	0,000300	2,225896				0,211266
Transports	0,262316	0,257186	0,040688	0,001317		0,035182
Zootechnics	0,000006	0,000390	0,001235	0,000113		0,000065
Other activities	0,119977	1,485801	0,178456	0,006165	0,000000	0,096744
TOTAL	197,933188	494,127812	1053,143814	10,593108	0,022196	63,440395

Where was determinate a suspicion of the vulnerability of water bodies to nitrates from agricultural sources was monitored the river from Bega-Timiş hydrographical basin, that is shown in table 3 [3].

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Table 3. Monitoring Sections in vulnerable areas B. H. Bega – Timis, Timis County

Hydrographic basin	Water stream - water body- water body code	Monitoring system - water body type - Body water length (km)	Monitoring section	N NO_2	N NO_3	N NH_4	Total nitrogen	Total phosphorus	Nutrients	General physico-chemical characteristics
BEGA	Magherus (Fibis, Niarad) - ROLW5.1.21.2_B1	Lakes - heavily modified - 3,11	Murani middle accumulation	Good	Maximum	Maximum	Maximum	Maximum	Good	Moderate
BEGA	(Gladna) River -SURDUC Accumulation ROLW5.1.10_B1	Lakes - heavily modified - 5,085	Dam Surduc Acumulation - Middle Surduc Acumulation	Good	Maximum	Maximum	Maximum	Good	Good	Good
TIMIS	Barzava - GOZNA Accumulation ROLW5.2.38_B1	Lakes - heavily modified - 2,164	Dam Gozna Acumulation - Middle Gozna Acumulation	Good	Maximum	Maximum	Maximum	Maximum	Good	Good
TIMIS	Bârzava –SECU Accumulation ROLW5.2.38_B2	Lakes - heavily modified - 4,359	Dam Secu Accumulation - Drinking outlet Resita Middle Secu Accumulation	Good	Maximum	Maximum	Maximum	Maximum	Good	Good
TIMIS	Bistra Mărului - POIANA MĂRULUI Accumulation ROLW5.2.20.5_B1	Lakes - heavily modified - 5,575	Middle Poiana Mărului Accumulation Dam Poiana Mărului Accumulation	Good	Maximum	Maximum	Maximum	Maximum	Good	Good
TIMIS	Timiş - TREI APE Accumulation ROLW5.2_B1	Lakes - heavily modified 4,138	Dam Trei Ape Accumulation	Good	Maximum	Maximum	Maximum	Maximum	Good	Good

In Timiş hydrographic basin were monitored four bodies of water with one lake on each water body.

The water body LW5.2_B1 Timiş - Trei Ape Accumulation has a lake surface at NNR level about 52.60 ha, the average depth is 8.60 m, with 298 m long of the dam, a retention time of 0.123 years, with complex usage, typology ROLL 13, the monitoring section at the dam.

Assessment of ecological potential of water body[3]:

In terms of biological elements water body has a good ecological potential. The biological elements assessed were phytoplankton – that was included in

good ecological potential and phytobenthos - placed in maximum ecological potential.

In terms of physico-chemical elements, the body of water has a good ecological potential.

In terms of specific pollutants, the water body was placed in good ecological potential.

The water body was placed in a good ecological potential.

After assessing the chemical status, the water body was placed in good condition.

The water body LW5.2.20.5_B1 Bistra Mărului - POIANA MĂRULUI Accumulation has a lake surface at NNR level about 272 ha, the average depth is 22,80 m, with 407 m long of the dam, a retention time of 0.381 years, with complex usage, typology ROLA 08a, with two monitoring section: at the dam and middle of the lake.

Assessment of ecological potential of water body [3]:

In terms of biological elements water body has a good ecological potential. The biological elements assessed were phytoplankton – that was included in good ecological potential and phytobenthos - placed in a good ecological potential.

In terms of physico-chemical elements, the body of water has a good ecological potential.

In terms of specific pollutants, the water body was placed in good ecological potential.

The water body was placed in a good ecological potential.

After assessing the chemical status, the water body was placed in good condition.

The water body LW5.2.38_B1 Bârzava - GOZNA Accumulation has a lake surface at NNR level about 59,50 ha, the average depth is 16,30 m, with 220 m long of the dam, a retention time of 0.230 years, with complex usage, typology ROLA 08a, with two monitoring section: at the dam and middle of the lake.

Assessment of ecological potential of water body [3]:

In terms of biological elements water body has a good ecological potential. The biological elements assessed were phytoplankton – that was included in maximum ecological potential and phytobenthos - placed in a good ecological potential.

In terms of physico-chemical elements, the body of water has a good ecological potential.

In terms of specific pollutants, the water body was placed in good ecological potential.

The water body was placed in a good ecological potential.

After assessing the chemical status, the water body was placed in good condition.

The water body LW5.2.38_B2 Bârzava - SECU Accumulation has a lake surface at NNR level about 73,40 ha, the average depth is 9,50 m, with 136 m long of the dam, a retention time of 0.184 years, with complex usage, typology ROLA 10a, with two monitoring section: at the dam + middle of the lake and drinking outlet Resita.

Assessment of ecological potential of water body:

In terms of biological elements water body has a good ecological potential. The biological elements assessed were phytoplankton – that was included in good ecological potential and phytobenthos - placed in a maximum ecological potential.

In terms of physico-chemical elements, the body of water has a good ecological potential.

In terms of specific pollutants, the water body was placed in good ecological potential.

The water body was placed in a good ecological potential.

After assessing the chemical status, the water body was placed in good condition.

The results of classification of heavily modified and artificial water bodies, rivers monitored, in the categories of ecological potential and adequate chemical status indicates that a number of 11 (52.38%) of heavily modified water bodies have good ecological potential and 10 (47.62 %) heavily modified of water bodies have moderate ecological potential [1].

Good chemical status has 10 water bodies (47.62%) and was poor at 11 water bodies (52.38%).

The results of classification of surface water bodies, lakes, in the categories of potential ecological and adequate chemical status reveals that 7 water bodies (87.5%) have good ecological potential and one water body (12.5%) has potential ecological moderate [1].

3. CONCLUSIONS

The status of surface water quality in Bega-Timiş Hydrographic Basin was maintained in recent year's parameters.

There is a limited capacity for sewage stations serving the activities of animal growth, mining, woods industry, etc. This leads to dumping on the emissaries of increased quantities of potentially polluting elements.

It requires revaluation of the sustainable management strategy in Bega-Timiş Hydrographic Basin, in the context of new economic development and new developments on climate change.

The main strategies and actions regarding sustainable management of water resources are these:

✓ The utilization of the resources is slower than economic output. This partial decoupling is encouraging but Europe is still using ever more natural resources.

✓ Drinking water used for population and economic activity declined. The specific water management for sustainable use are only partially required.

✓ The quality of water resources has to improve in recent years. EU Member States should aim to achieve a better state in all water bodies of surface water as far as 2015 and groundwater at the latest of 2027.

✓ The implementation of the Water Framework Directive 60/2000/EEC and those of other European directives on water, throughout the county, requires a longer transition period, due to reduced economic opportunities in the county.

✓ The management Plan of Banat Hydrographic Basin is the main instrument for achieving the targets of implementation of the Water Framework Directive.

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