Scientific Bulletin of Politehnica University of Timişoara

Transactions on HYDROTECHNICS

Volume 66 (80), Issue 1, 2021

THE HYDROLOGICAL ANALYSIS OF THE CATCHMENT AREA AND EVALUATION QUALITATIVE OF WATER

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Abstract: Due to the increasing pressure on water resources at Union level European Parliament has promoted legislative instruments for protection and management their sustainability. Within these legislative instruments, the most important action is Directive 2000/60 which defines water as a heritage protected, treated and preserved. In this sense, it is necessary to identify all the pollution sources and the elaboration of a management strategy in order to eliminate them or reducing to a permissible extent the consequences of these pollutants. The main objective of this paper is to analyze the water quality from the Colibita accumulation for 2011 year, and implicitly changes in the flow regime.

Keywords: catchment, hypsometric curve, slope, nitrates, temperature

1. INTRODUCTION

According to the Water Framework Directive, the status of surface water is defined by ecological status and chemical status.

The concept promoted by the Water Framework Directive on water status is based on a new approach that emphasizes biological parameters differs fundamentally from previous approaches in the field of water quality, in which the elements hydro morphological were not considered, and the preponderance belonged to the physico-chemical elements. [3], [4], [5].

Human activity causes considerable changes in natural water resources.

Influences are manifested on the distribution of water resources between different categories of resources, the quality of water resources, as well as on the distribution in time or space within the same category and consist of: [1], [2]

- activities that change the precipitation regime, considerable reductions of precipitations can appear in the vicinity of some industrial areas as a result of the emanations of smoke and steam;
- the arrangement of the territory of a river basin, which changes the flow regime of the water just before reaching the river. In this sense, the deforestation actions on sloping lands accelerate the drainage process and implicitly lead to the diminution of groundwater resources;
- interventions on riverbeds that change the flow conditions, implicitly the distribution of resources over time;
- water consumption for various human activities that leads to reduced water resources;
- influences due to water management works, which by definition have the role of changing the time and space distribution of water resources. All these influences are variable over time, depending on human activities at a given time.

The system of natural water resources which is represented by the hydrological cycle and its components: precipitation, evaporation, surface runoff and runoff underground.

2. STUDY AREA

The Colibița establishment is located on the Bistrița River, which is part of the Someș River basin (Figure 1). Someș-Tisa hydrographic space, with a total area of 22380km^2, representing 9.4% of the country's surface, having a total length of 7828 km and an average density of 0.35 km / km^2.

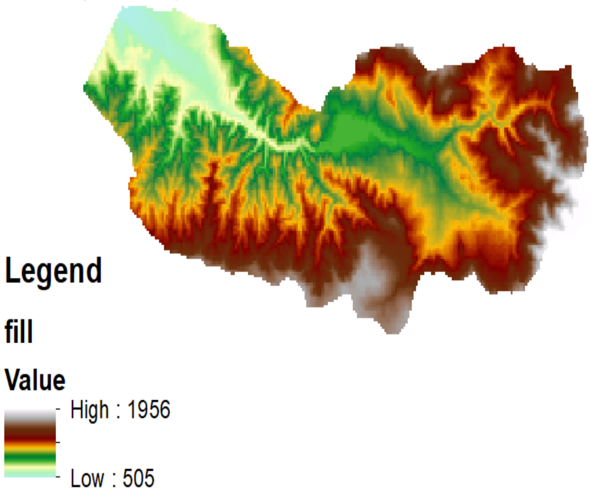

Figure 1. Digital Elevation Model of catchment area

The water resources in the Someș-Tisa hydrographic area can be considered relatively modest (but still sufficient) and unevenly distributed in time and space.

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The main purpose of the arrangement is the supply with drinking and industrial water of Bistrița municipality, ensuring a flow of 1,2 mc/s, enough to satisfy the current requirements.

Another purpose of the establishment is the use of the energy potential that is realized in C.H.E. Colibița, with an installed capacity of 21 MW.

The establishment of Colibița, besides the supply with drinking water, industrial and the use of the energetic potential, another role of these accumulations is also to ensure the attenuation of the flood wave, for a volume of 25 mill.mc.

The Colibița accumulation is located in the upper basin of the Bistrița River, (Figure 2) in the depression created between the Călimani mountains and the Bârgăului mountains, mountains that are part of the volcanic chain of the Eastern Carpathians.

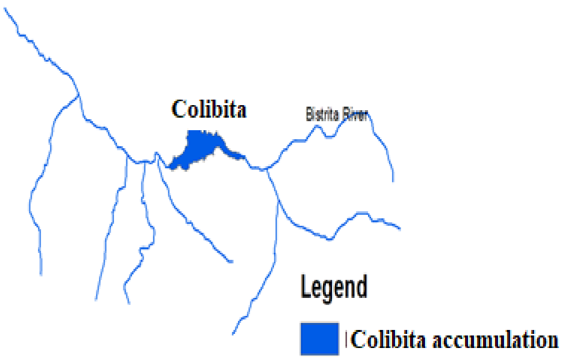

Figure 2. Hydrographic network of the Bistrița River

In the Colibița accumulation area, the relief rises from the elevation of 720 mSL, the pressure node, the boiler and the compensating basin are located on the left bank of the Bistrița in the study area, between the elevations of 615 mSL and 800 mSL [6].
The upper basin of the Bistrița River has an average altitude of 1073 m, it has a temperate-continental climate with mountain specificity (Figure 3).

The upper basin of Bistrița has a level-rainwater supply regime.

The level component of the supply plays a main role due to the specific climatic and topo-climatic conditions on the northern slope of the Călimani Mountains, which allow a persistence and a late melting of the snow (the period can extend until the end of spring).

During the year, the highest leakage is registered in March-May (reaching up to 40-45% of the annual volume), and the lowest in August-October. During the winter, the volume of runoff is relatively low (15-20% of the annual volume) [7].

The floods are specific to the transition seasons (spring and autumn).

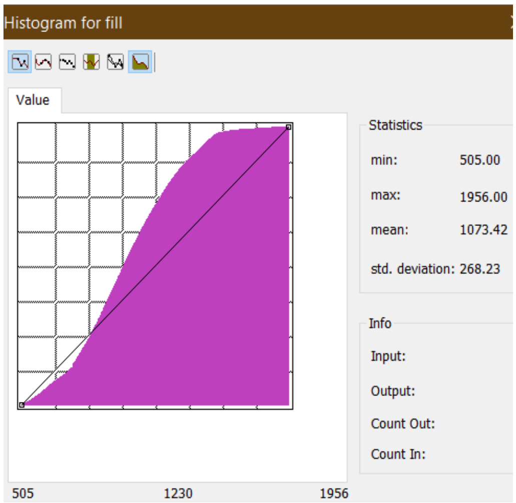

Figure 3. Hypsometric curve

The average annual temperature is 5,4° C, and the average annual rainfall exceeds 880 mm. The relative humidity has an average annual value of about 85%.

The slopes of the Colibița accumulation have gentle slopes and are generally covered with a rich vegetal cover, which makes the erosion not to deeply affect their geological structure (Figure 4).

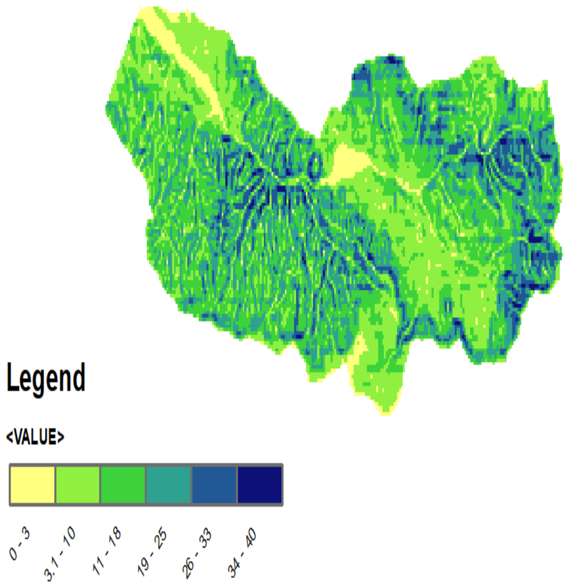

Figure 4. Slope of the river basin

The soils (Figure 5) found in this hydrographic basin are brown mountain soils of acid forest and brown podzolic in the area of mixed forests of beech and spruce, with coarse texture, dark brown soils of acid and moderately acid forest in the area of mixed forests (beech and softwood), with a clay content of 30%.

Both types of soils have the last (lower) horizon formed by partially disintegrated rock, which makes the transition to compact rock.

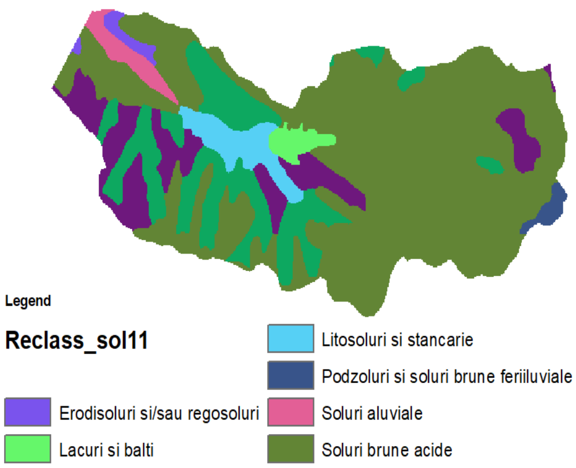

Figure 5. Soil Map

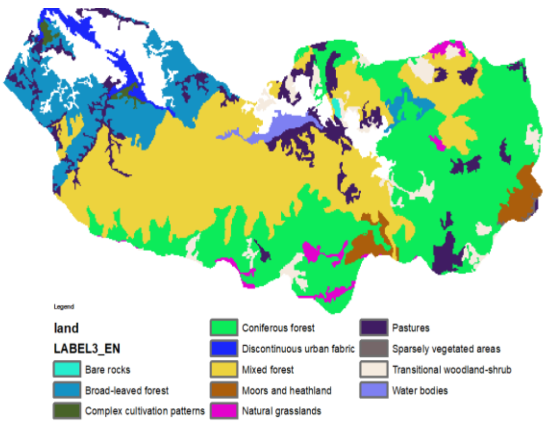

Figure 6. Land cover map

3. DISCUSSION. CONCLUSIONS.

The state of the physio-chemical quality of the water has been achieved for the accumulation lake since 2011. [7]

Based on these data, it can be stated that the water from the lake, from the Colibița river and from the tributaries is a good quality clean water (neutral, weak mineralization, the presence in the water of the dissolved gases from the atmosphere, etc.) Figures 7, 8 and 9)

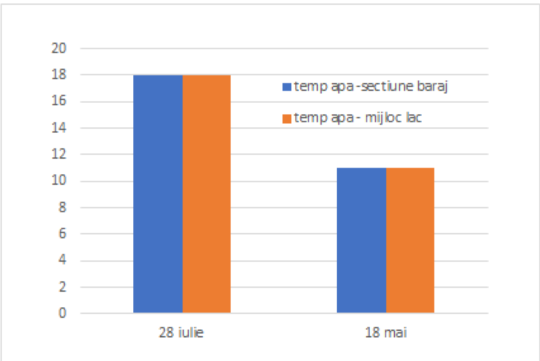

Figure 7. Water temperature in accumulation

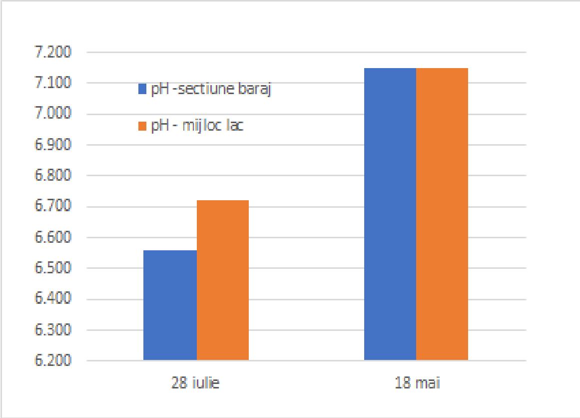

Figure 8. Ph in the accumulation

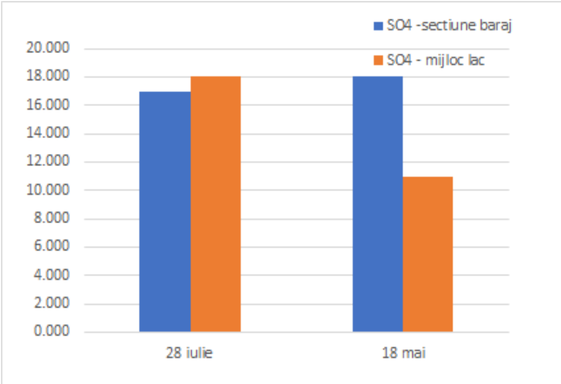

Figure 9. SO_4 in the accumulation

Nitrates (NO_3) and phosphates (PO_4) in water naturally come from manure aquatic animals, from the soil that forms the lake basin or from the decomposition of organic matter specific to the aquifer and the surplus comes from anthropogenic activities.

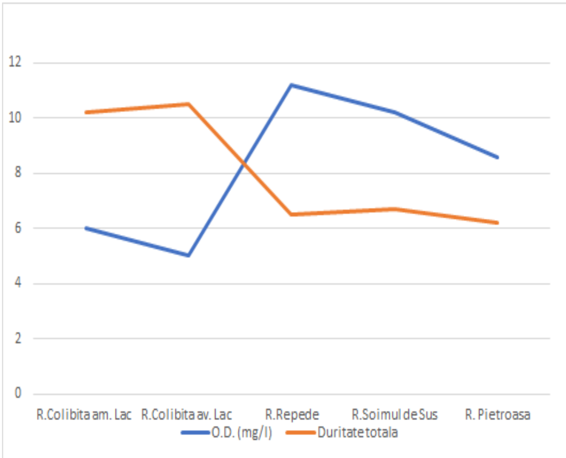

Figure 10. Dissolved oxygen (O.D.) and total Hardness

By creating the Colibita accumulation, a series of changes appeared in the morphology of the riverbed and the slopes in embankments and implicitly changes in the flow regime.

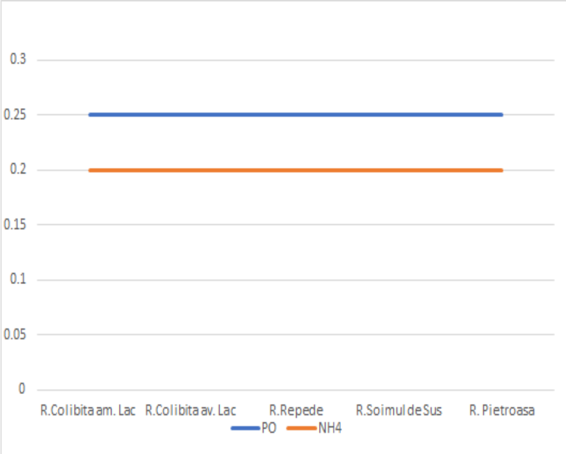

Figure 11. NH_4 and PO parameters

One exception is water immediately downstream of the dam with a relatively low concentration of dissolved oxygen, probably due to its origin in the hypolimnion of the accumulation lake (bottom emptying by-pass pipe).

Apart from this mentioned parameter, from the dam downstream station, all the other data fall within the values of a 1st quality water.

Regarding the effects on water quality, it is found that a category 1 quality water is maintained, both in the accumulation lake and in the downstream portions where the rheophilic character of the river and its tributaries is preserved; an exceptional situation appears only immediately downstream of the dam where dissolved oxygen values of 5 mg/1 and a relatively poor benthic fauna structure were found, with elements characteristic of stagnant water ecosystems (Figure 10).

Organic substances, of natural or artificial origin, areas for water the main pollutant. They consume oxygen from the water both for development and in during their decomposition. The increase in the amount of organic matter in the water is synonymous with water pollution with germs that usually accompany these substances.

Their presence favors the long-term persistence of germs, including those pathogenic.

REFERENCES

[1] Gh. Crețu, 1976, Economia apelor, Editura Didactica si Pedagogica, Bucuresti

[2] M.E. Madar, 2007, Cercetări privind renaturarea corpurilor de apă puternic modificate, Teză de doctorat, Editura Politehnica, Timişoara

[3] * * * * * – 2000, „Directiva Cadru a Apei 2000/60/CE”, pe www.ec.europa.eu

*[4] * * * * * – 2004, „Legea Apelor 310/2004”, Monitorul Oficial, Bucureşti*

[5] * * * * * – 2007, „Directiva pentru inundaţii 2007/60/CE”, pe www.ec.europa.eu Bigg GR. 1991. Kriging and intraregional rainfall variability in England.International Journal of Climatology11: 663 – 675

[6] *****, 1975, Studiul climatic privind bayinul hidrografic al raului Bistrita

[7] ******, 2011, Raport anual privind starea mediului în judeţul Bistriţa-Năsăud

[8] E. B. Welch, K. Cooke, 2005, Lake Reserv. Manage., 21, 209–217

[9] J. Kohler, S. Hilt, R. Adrian, A. Nicklish, H. P. Kozerski, N. Walz, 2005, Freshwat. Biol. 50, 10, 1639–1650