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ASSESSMENT OF THE ECOLOGICAL STATE OF THE SOUTHERN BUG RIVER WITHIN THE BOUNDARIES OF THE CITY OF KHMELNITSKY

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It has been studied that the state of rivers, lakes and groundwater in Ukraine is deteriorating every year. The reason for this is a number of problems: pollution of water bodies by emissions from enterprises, excessive use of natural resources, silting and overgrowing of water bodies. The country's water resources are one of the sources of drinking water for the population. A long-term strategy for the development of water resources in Ukraine would allow Ukrainians to be better provided with drinking water, and the state to save money on water purification. In addition, taking into account the fact that its reserves are distributed unevenly across the territory of Ukraine (the largest are in the west, the smallest are in the southern regions of Donetsk, Zaporizhia, Kherson, Odessa regions), this requires rational use and protection from pollution. According to statistics, the Volyn, Chernihiv, Sumy regions, as well as the northern territories of Kyiv and Poltava regions, are best provided with drinking water. In the industrially developed regions of Donbas and Dnieper, the quality of drinking water has recently deteriorated significantly. But the saddest situation is in the steppe Crimea, where even before the annexation, groundwater pollution was recorded on more than 30% of its entire area. In order to make the difference in the amount of fresh water in different regions of Ukraine less noticeable, 1,103 reservoirs have been built. The six largest are on the Dnieper, and another large reservoir is on the Dniester. In addition, almost 50,000 ponds, 7 large canals, 10 water mains, etc. have been created. Currently, despite the fact that Ukraine has significant total water resources, a large part of them cannot be used. As a result, in terms of their renewable reserves per capita, our country is one of the least well-off countries in Europe.

The article presents the results of research on the hydrological assessment of the water state of the Southern Bug River, which flows within the city of Khmelnytskyi. Water sampling points were analyzed, which exceeded the maximum permissible concentrations of the following indicators: hydrogen pH, ammonium nitrogen, nitrites, nitrates, calcium content and chlorides in the zone of intensive management – household plots, and in the zone of active operation of an industrial facility – the «Ukrelektroaparat» production association.

Key words: *river, pollution, ecological state, concentration, hydroecological indicators, heavy metals.*

Врадій О.І., Алєксєєв О.О., Ковка Н.С. Оцінка екологічного стану річки Південний Буг в межах міста Хмельницький

Досліджено, що щороку стан річок, озер і підземних вод в Україні погіршується. Причиною цього є ряд проблем: забруднення водойм викидами з підприємств, надмірне використання природних ресурсів, замулення та заростання водойм. Водні ресурси країни – одне з джерел отримання питної води для населення. Довгострокова стратегія розвитку водних ресурсів України дозволила б краще забезпечувати українців питною водою, а державі економити кошти на очистці води. Крім того, беручи до уваги той факт, що її запаси розподіляються по території України нерівномірно (найбільші вони на заході,

найменші – в південних районах Донецької, Запорізької, Херсонської, Одеської областей), це вимагає раціонального використання і охорони від забруднення. За статистикою, найкраще забезпечені питною водою Волинська, Чернігівська, Сумська області, а також північні території Київської та Полтавської областей. У промислово розвинених областях Донбасу та Придніпров'я якість питних вод останнім часом значно погіршилася. Але найбільш сумна ситуація складається у степовому Криму, у якому і до анексії забруднення підземних вод фіксувалося на більш ніж 30% усієї його площі. Для того, щоб різниця у кількості прісної води у різних областях України була менш відчутною, побудовано 1103 водосховища. Шість найбільших знаходяться на Дніпрі, іще одне велике водосховище на Дністрі. Крім того, створено майже 50 тисяч ставків, 7 великих каналів, 10 водоводів, тощо. Наразі попри те, що Україна має значні сумарні водні ресурси, велика їх частина не може бути використана. Як наслідок, за їх поновлюваними запасами на одного жителя, наша країна є однією з найменш забезпечених країн у Європі.

У статті представлені результати досліджень гідрологічної оцінки стану води річки Південний Буг, що протікає в межах міста Хмельницький. Проаналізовані точки відбору проб води, які мають перевищення по гранично допустимих концентраціях таких показників: водневий показник pH, амонійний азот, нітрити, нітрати, вміст кальцію та хлориди в зоні інтенсивного ведення господарювання – присадибні ділянки, та в зоні активного функціонування промислового об'єкта – виробниче об'єднання «Укрелектроапарат».

Ключові слова: *річка, забруднення, екологічний стан, концентрація, гідроекологічні показники, важкі метали.*

Formulation of the problem. According to official statistics, about 300 million cubic meters of untreated wastewater are discharged into Ukrainian water bodies every year. Unofficial statistics show much worse results. That is why the state of the country's water resources cannot be called satisfactory [2].

In fact, in each of the water bodies, it is easy to record an excess of permissible pollution standards. The average annual data of laboratory measurements conducted by the bodies of the State Agency for Water Resources of Ukraine indicate an increased content of controlled concentrations of heavy and easily oxidizable pollutants in the water. For example, in the Dniester River basin last year, a significant deterioration in water quality was observed, but there are reasons for this. A trend towards a deterioration in water quality according to organoleptic indicators (smell, color, transparency) was noted. This phenomenon is primarily a consequence of the action of natural factors – last year was low-water and hot [4].

In general, high temperatures in the summer period annually cause massive "blooming" of water and, as a result, a decrease in dissolved oxygen in the water to critical values and an increase in indicators characterizing organic pollution. However, other factors also affect it. For example, the water quality in the Danube River does not meet the standards, where manganese and phenol were found last year. Similarly, 90% of samples from the Dnieper recorded an excess of pollutants or indicators of the physicochemical state of surface waters. The main factors affecting the hydrochemical state of the waters of the Dnieper basin are both natural factors (adverse weather conditions, a significant, and even record, decrease in the water content of both the Dnieper itself and its tributaries) and anthropogenic load [5].

What is the threat to rivers in Ukraine? It would be obvious to say – war. Because war not only poses a physical threat through destruction and pollution, as happened with the Irpin, Dnipro, Seim, Seversky Donets, Ingulets rivers, etc. The active phase of hostilities and the concentration of almost all resources on the mobilization of the army puts the issue of water quality far from being in the top 10. War creates a threat of institutional imbalance and fragmentation of policy implementation. Climate change and extensive urbanization are among the greatest threats to the existence of rivers.

Pollution, development of banks, destruction of natural buffer zones, deforestation, spread of invasive species, reduction of biodiversity – all these are components of one cause-and-effect chain of the lack of water policy and institutional capacity for nature-oriented management [1].

Water bodies occupy just over 3% of Ukraine's territory. Centralized water supply covers about 70% of Ukraine's population. At the same time, about 20% of Ukrainians use groundwater for drinking, while the remaining 80% receive water from surface sources, such as the Dnipro, Southern Bug, and Desna rivers. According to the WWF Water Risk Filter, the state of freshwater ecosystem services in Ukraine has reached the level of "high risk" and is approaching the "very high risk" experienced by residents throughout the country [6]. Due to the existence of gaps in the legislative framework, an imbalance in the distribution of water resources systematically occurs in Ukraine. For example, almost every hot summer after the commissioning of a new unit of the South Ukrainian NPP, there is a shortage of water volumes for the Southern Bug River downstream. Studies have shown that an environmentally safe level of water abstraction from the river is 10% of its volume. However, up to 40% of the water in the Seversky Donets basin is being withdrawn, which may cause serious problems in the near future. Today, the frontline regions are facing great difficulties in water supply, which are associated not only with shared water resources with the occupied territories, but also with the lack of opportunities to build a new water supply system [9]. In addition to the lack of resources, the Donetsk region is threatened by destroyed and flooded mines, which increases the pollution of underground water networks. Therefore, at the state level, it is necessary to develop a scheme for improving water supply, prescribe a clear division of responsibilities, and especially regulate land issues. The most important change that must occur is the realization that water is not a free and infinite resource [12].

The problem of river water pollution in Ukraine has long been a national issue. Most water bodies are approaching classes III and IV in terms of quality, which defines them as polluted or heavily polluted. The most difficult situation is observed in the basins of the Dnieper, Seversky Donets, the rivers of the Azov region, as well as in some tributaries of the Dniester and Western Bug, where the water is classified as "heavily polluted" (class V). The fall in groundwater levels and water levels in water bodies leads to a decrease in the ability of freshwater ecosystems in Ukraine to meet the needs of humans and surrounding ecosystems. For example, in Polissya over the past 100 years, more than 1 million hectares of swamps have been drained, which is a catastrophic indicator. In the last 5 years, under the influence of high temperatures, the rivers of Ukraine have become green, and eutrophication has noticeably increased in cities. In addition to water pollution, this is also due to the fragmentation of our rivers due to artificial obstacles, such as dams and other hydraulic structures [8].

The country's water resources are a source of drinking water for the population. And taking into account the fact that their reserves are unevenly distributed across the territory of Ukraine, this requires their rational use and protection from pollution. Each type of river needs its own natural protection strip, which is a buffer between the urbanized area and nature [12].

Analysis of recent research and publications. Many scientists warn about the disappearance of some rivers and other surface water bodies in Ukraine. The threat is quite real. According to Mudrak O.V., Khaetsky G.S., Mudrak G.V. and Serebryakov V.V. [13], about 10 thousand rivers have disappeared in Ukraine since Independence. The State Agency for Water Resources admits that Ukrainian rivers are indeed drying up, but does not confirm this figure. It is difficult to judge its reliability, because no one kept an

accurate count in the early 90s. And also because no alternative statistics on this topic can be found.

There is also no current official data on the total number of rivers in Ukraine. In May 2017, the Cabinet of Ministers adopted a resolution approving the Procedure for Maintaining the State Water Cadastre and the Regulations on the State Water Agency. This made it possible to introduce an accounting of surface water bodies in Ukraine. It really exists – but only in the form of an online map. Unofficial figures are different. Schwebs G.I. and Igoshin M.I. [17] claim that the media write about 63 thousand rivers, media says about more than 70 thousand, and the reference about Ukraine on Google sites mentions the figure of 30 thousand.

In Europe, Ukrainian water resources are counted in their own way. Thus, on world maps, Ukraine has long been marked as a water-scarce country according to Vasenko O.G. [9]. Ukraine is in 32 place among 40 in terms of drinking water supply in Europe and is included in the list of countries threatened by water shortages. And according to the results of a study conducted in 2019 by order of the World Financial Bank, in terms of the amount of drinking water per capita, Ukraine ranked 125 among 180 countries according to research by Zabokrytska M.R. and Khilchevsky V.K. [14].

Like the rest of the planet, Ukraine is already feeling the effects of climate change. The climate in Ukraine is becoming warmer and drier, which negatively affects the state of water bodies. Water reserves in the rivers of Ukraine are replenished mainly due to precipitation. According to the Ministry of Environmental Protection and Natural Resources of Ukraine, if we compare the periods 1961-1990 and 1991-2020, the average annual precipitation rate (578 mm) has not decreased. At the same time, the tendency towards uneven distribution of moisture throughout the year and geographically is increasing, according to Vradii O. [1]. In particular, in 10 regions of Ukraine from 2018 to 2022, precipitation fell by 7-12% less than the norm. The area of territories with insufficient rainfall (less than 400 mm) in the warm period is increasing. Rivers in these regions suffer the most from low water levels, according to Zabokrytska M.R., Khilchevsky V.K. and Manchenko A.P. According to Mudrak G. [16], another impact of climate change associated with increasing temperatures has been studied. Firstly, the evaporation coefficient from the surface of water bodies is increasing. To put it simply, rivers dry up faster due to abnormal heat. Secondly, at temperatures above 30 degrees, the root system of plants cannot compensate for evaporation losses, so plants need additional moisture – accordingly, during droughts, water intake for irrigation increases, according to Shvebs G.I. and Igoshin M.I.

According to the State Water Agency of Ukraine Mudrak O.V., Khaetskoy G.S., Mudrak G.V. and Serebryakova V.V. [13], during 2021, 48.5 thousand tons of harmful substances of the second and third hazard classes (highly hazardous and moderately hazardous) were discharged into surface waters in Ukraine. According to officials, the largest polluters are municipal enterprises, which discharge more than 60% of the total volume of contaminated wastewater. The negative impact of housing and communal services should not be denied, but the real situation looks a little different. Official statistics do not take into account how negatively the agricultural sector affects the water environment. Official data that agriculture in Ukraine consumes only 20% of water resources does not coincide with the indicators of other countries. In the EU, about 40% of water is used for these needs, and in the world in general up to 70%, according to Mudrak O.V., Khaetsky G.S., Mudrak G.V. and Serebryakov V.V. [16]. As stated by Alieksieiev O.O. and Vradii O.I. [3], most of the pollution and water use by farmers is not recorded, because the pollution here is scattered over a large area and there is no conventional pipe where one

farm could measure how much emissions are made. At the same time, the real impact of agriculture can be seen from the results of monitoring the quality of water in rivers. Thus, the Ministry of Environmental Protection and Natural Resources of Ukraine in February showed the results of screening the Dnieper basin. It revealed an excess of nitrates, phosphates and pesticides in water bodies, and even agricultural chemicals banned back in the 60s of the twentieth century. Studies conducted by Ryzhov K.I. [11] prove that monitoring is carried out only on large rivers. The ecological situation of small rivers, which are the most vulnerable to all threats, is simply not officially taken into account. According to Bedunkov O.O., Stetsyuk L.M. and Yefymchuk O.B. [7] the agricultural sector affects the state of rivers in various ways. In particular, nitrate pollution occurs as a result of excessive exploitation of black soil and irrational use of fertilizers. Over the past 20 years, the use of nitrogen fertilizers has increased 7.5 times, and mineral fertilizers – 4 times. Thus, land owners are trying to increase productivity – to compensate for soil depletion with fertilizers, causing serious damage to both land and water resources. In addition to the above examples, the causes of river degradation and disappearance can be considered coastal development, plowing of meadows, sand and peat extraction, the establishment of illegal floodplains, excessive water intake for agricultural and industrial needs. All these barbaric actions fall under the definition of «improper management». The situation with rivers will improve if these processes are stopped, order is restored on the banks of the rivers, control and responsibility for violations are increased, in a word, "incorrect" management is made correct, as stated by Alieksieieva O.O. and Vradii O.I. [4]. According to Vasenko O.G., Vernychenko-Tsvetkova D.Yu., Kovalenko M.S., Kovaleva O.M. and Poddashkina O.V. [9], for industrial polluters, in addition to increasing responsibility for violations, it is necessary to establish incentives to reduce emissions and install modern treatment equipment. From the point of view of Zabokrytska M.R., Khilchevsky V.K. and Manchen A.P. [14], modern eco-standards and environmental supervision must be established in the agricultural sector. Also, invest in the necessary infrastructure for the safe handling of livestock waste and agrochemicals. Make the implementation of environmental standards at agricultural enterprises a mandatory condition for receiving state support. Timchenko V.M. and Oksiyuk O.P. believe that all these things should be done by the Ukrainian authorities today, maintaining a dialogue with entrepreneurs. Other states have already faced similar problems and successfully solved them. So there are enough established methods and schemes here – it's easier with this. But as for climate factors, everything depends, in particular, on each of us. While governments, together with corporations, will solve global problems, each individual can start with the simplest thing – save water, do not litter the coast, support initiatives aimed at restoring and saving water bodies.

The purpose of the study is to investigate the ecological state of the water of the Southern Bug River within the city of Khmelnytskyi.

Materials and methods of research. The experimental part of the study involved the sampling of water from the Southern Bug River within the city of Khmelnytskyi in three designated locations from a depth of 0-20 cm from the water surface: 1 km upstream in the forest plantation zone (background), which allows establishing the background level of hydrochemical indicators of river water; 1 km downstream in the zone of intensive management, household plots, which allows determining the magnitude of the anthropogenic impact of the economic and household activities of the population of the settlement on the ecological state of the water and another 1 km away, where an industrial facility is actively operating – the «Ukrelektroaparat» production association. The following indicators were investigated here (Table 1).

Table 1

Scheme of research of hydrochemical parameters of the Southern Bug River within the city of Khmelnytskyi

Factor A – sampling location	Factor B
1 – 1 km upstream – forest plantation zone (background)	Hydrogen pH
2 – 1 km downstream – zone of intensive management, household plots	Ammonium nitrogen
	Nitrites
	Nitrates
	Calcium
	Chlorides
	Overall hardness (stiffness)
3 – 1 km downstream, where the «Ukrelectroaparat» production association operates	Mineralization (dry residue)

The obtained indicators were compared with the standards – maximum permissible concentrations of pollutants in water. Laboratory studies were conducted in the certified and accredited Scientific Measuring Agrochemical Laboratory of the Educational and Scientific Institute of Agrotechnologies and Environmental Management of Vinnytsia National Agrarian University. Based on the results obtained, conclusions were drawn regarding the reasons for changes in the indicators of the hydrochemical state of the Southern Bug River water within the city of Khmelnytskyi and environmental protection measures were developed to reduce river pollution.

Presentation of the main research material. The Southern Bug is the main waterway of the city of Khmelnytskyi. It belongs to the large rivers of Ukraine. Its length within the city is 7.1 km. The area of the water mirror of the Khmelnytskyi reservoir, located on the riverbed, is 140.4 hectares, the greatest depth is 7.1 m, the average depth is 3.6 m (Fig. 1).

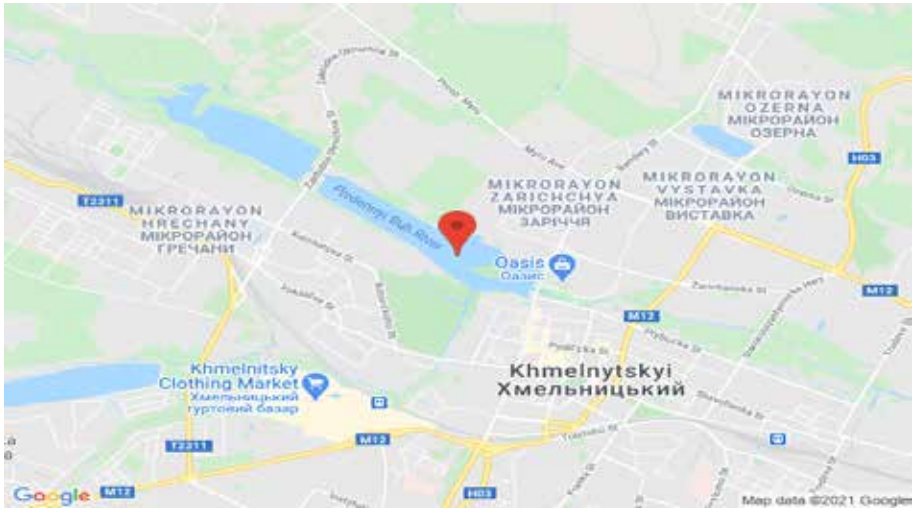

Fig. 1. The Southern Bug River within the city of Khmelnytskyi

The main factors determining the quantitative and qualitative indicators of the Southern Bug River within the city of Khmelnytskyi are the city's domestic wastewater and water intake, which belong to different quality categories. In structural terms, the largest polluter of the reservoir is the city's industry (58% of the total volume of discharges), the housing and communal services of the city of Khmelnytskyi (32%), and agriculture (10%).

We conducted an assessment of the hydrochemical indicators of the Southern Bug River within the city of Khmelnytskyi at three water sampling points: 1 km upstream in the forest plantation zone (background), which allows us to establish the background level of the hydrochemical indicators of the river water; 1 km downstream in the zone of intensive farming, household plots, which allows us to determine the magnitude of the anthropogenic impact of domestic activities; 1 km downstream from the zone of intensive agricultural activity – near the production association of the UK «Ukrelektroaparat». The first sampling site of the Southern Bug River within the city of Khmelnytskyi allows you to establish the background level of river water quality indicators. The second sampling site shows the results of the economic and household impact of the city's population on the state of the river, and the third – the state of its pollution from industrial activity. The results of laboratory studies are presented in Tables 2, 3 and 4.

Tables 2

Hydrochemical composition of the water of the Southern Bug River in the forest plantation zone (background)

Hydrochemical indicator	Unit of measurement	Actual content	Maximum permissible concentration
Hydrogen pH	pH units	6.3	6.5-8.5
Ammonium nitrogen	mg/l	0.1	0.5
Nitrites	mg/l	1.4	3.3
Nitrates	mg/l	22.7	45.0
Calcium	mg/l	56.0	180
Chlorides	mg/l	112.1	350
Overall hardness (stiffness)	mg-eq./l	1.1	-
Mineralization (dry residue)	mg/l	23.0	-

In a sample of water taken from the Southern Bug River within the city of Khmelnytskyi 1 km upstream in the forest plantation zone, the pH value was 6.3 with an optimal value of 6.5-8.5 pH. Thus, the water reaction is favorable for aquatic organisms. The ammonium nitrogen content was 0.3 mg/l with a maximum permissible concentration of 0.1 mg/l, which is a safe level and 5.0 times lower than the maximum permissible concentration. The nitrite concentration in the water of the Southern Bug River within the city of Khmelnytskyi 1 km upstream in the forest plantation zone was 1.4 mg/l with a maximum permissible concentration of 3.3 mg/l, which is 2.35 times lower than the maximum permissible concentration and is safe. The nitrate content in the water was 22.7 mg/l at the MPC of 45.0 mg/l, which is 1.98 times lower and, accordingly, safe. Also, no excess of calcium content was observed in the water of the Southern Bug River within the city of Khmelnytskyi – 56.0 mg/l at the MPC of 180 mg/l and chlorides – 112.1 mg/l at the MPC of 350 mg/l. Thus, the calcium and chloride content was lower than the MPC by 3.21 and 3.12 times, respectively.

The total hardness of the water was 1.1 mg-eq./l, and the mineralization was 23.0 mg/l. However, these indicators are not standardized and do not affect the ecological state of the water in the river. Thus, the content of all studied pollutants in the water of the Southern Bug River within the city of Khmelnytsky 1 km upstream in the forest plantation zone was lower than the maximum permissible concentrations, no pollutants were detected there.

In the sample of water taken from the Southern Bug River within the city of Khmelnytsky 1 km downstream in the zone of intensive farming, household plots, it was subjected to organic pollution and had much higher indicators than in the forest plantation zone. In particular, the hydrogen pH was 8.6 with a norm of 6.5-8.5 pH and was higher than the norm (Table 3). The content of ammonium nitrogen was 0.9 mg/l and was 1.8 times higher than the maximum permissible concentration. The concentration of nitrites was 4.4 mg/l and was 1.3 times higher than the MPC.

Tables 3

Hydrochemical composition of the Southern Bug River water in the zone of intensive management

Hydrochemical indicator	Unit of measurement	Actual content	Maximum permissible concentration
Hydrogen pH	pH units	8.6	6.5-8.5
Ammonium nitrogen	mg/l	0.9	0.5
Nitrites	mg/l	4.4	3.3
Nitrates	mg/l	81.0	45.0
Calcium	mg/l	120.4	180
Chlorides	mg/l	191.5	350
Overall hardness (stiffness)	mg-eq./l	3.4	-
Mineralization (dry residue)	mg/l	88.8	-

The concentration of nitrates in the water of the Southern Bug River was 81.0 mg/l, which was 1.8 times higher than the maximum permissible concentration. The calcium content in the water was 120.4 mg/l, which is 1.49 times lower than the maximum permissible concentration. The same applies to chlorides: 191.5 mg/l – 1.82 times lower than the maximum permissible concentration.

In a sample of water taken from the Southern Bug River within the city of Khmelnytskyi 1 km downstream in the area of the industrial facility of the UK “Ukrelektroaparat”, it was subjected to even higher organic pollution and had the highest indicators among the 2 previous samples taken. In particular, the hydrogen pH was 10.8 with a norm of 6.5-8.5 pH and was higher than the normal limits (Table 4).

The ammonium nitrogen content was 1.56 mg/l and was 3.12 times higher than the maximum permissible concentration. The nitrite concentration was 6.8 mg/l and was 2.06 times higher than the maximum permissible concentration. The nitrate concentration in the water of the Southern Bug River was 96.5 mg/l and was 2.15 times higher than the maximum permissible concentration.

The calcium content in the water was 176.2 mg/l, which is 1.02 times lower than the MPC. The same applies to chlorides: 321.4 mg/l – 1.08 times lower than the MPC.

A comparison of the water quality indicators of the Southern Bug River in the background and in the pollution zone showed that the ammonium nitrogen content

increased from 0.1 mg/l to 1.56 mg/l and exceeded the maximum permissible concentration (Fig. 2).

Tables 4

Hydrochemical composition of the water of the Southern Bug River in the area of the industrial facility of the UK «Ukrelektroaparat»

Hydrochemical indicator	Unit of measurement	Actual content	Maximum permissible concentration
Hydrogen pH	pH units	10.8	6.5-8.5
Ammonium nitrogen	mg/l	1.56	0.5
Nitrites	mg/l	6.8	3.3
Nitrates	mg/l	96.9	45.0
Calcium	mg/l	176.2	180
Chlorides	mg/l	321.4	350
Overall hardness (stiffness)	mg-eq./l	5.7	-
Mineralization (dry residue)	mg/l	94.7	-

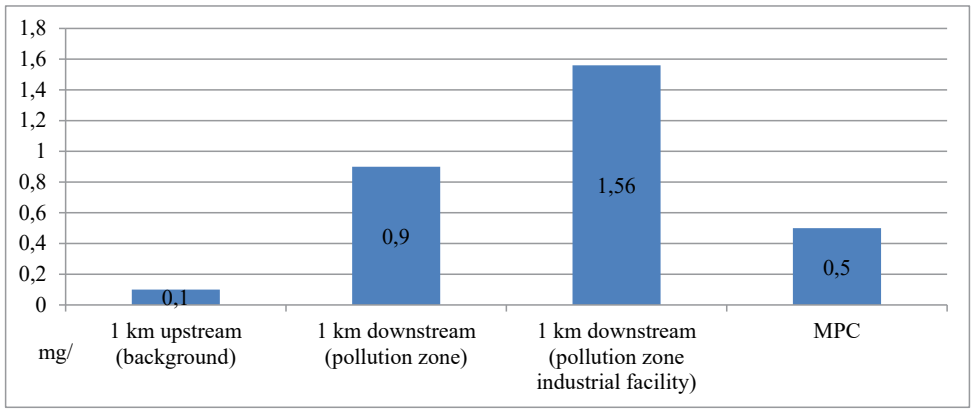

Fig. 2. Dynamics of ammonium nitrogen concentration in the water of the Southern Bug River within the city of Khmelnytskyi

The nitrite content also increased along the stream from 1 km upstream in the forest plantation zone to 2 km downstream in the pollution zone – from 1.4 mg/l to 6.8 mg/l and exceeded the maximum permissible concentration (Fig. 3).

The concentration of nitrates during the specified period of the river flow increased: from 22.7 mg/l to 96.9 mg/l and exceeded the maximum permissible concentration (Fig. 4).

Thus, it was established that the impact of economic and domestic activities and industry of the city of Khmelnytsky pollutes the Southern Bug River within its borders and is determined by the inflow of nitrogenous substances, which lead to an increase in the concentration of ammonium nitrogen, nitrites and nitrates. The source of nitrogen

inflow to the river water is the washout of surface runoff and the development of soil erosion processes from adjacent shorelines used for homestead farming and industry.

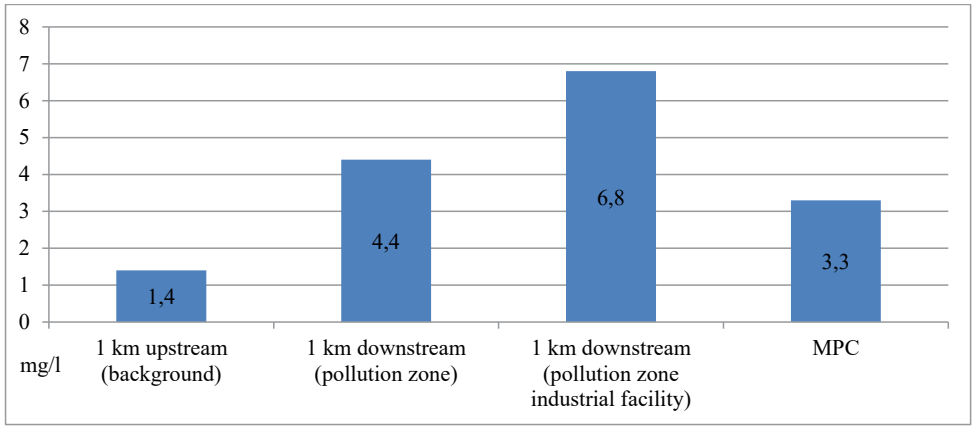

Fig. 3. Dynamics of nitrite concentration in the water of the Southern Bug River within the city of Khmelnytskyi

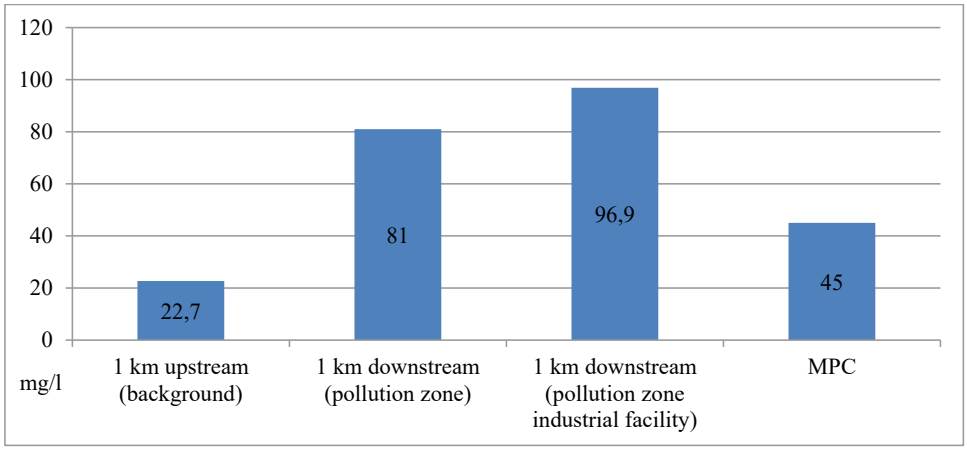

Fig. 4. Dynamics of nitrate concentration in the water of the Southern Bug River within the city of Khmelnytskyi

Conclusions and suggestions. The city of Khmelnytsky is a powerful industrial city, which is also engaged in agro-industrial production, including those that are potential sources of pollution of the Southern Bug River, which flows within its borders. The content of all studied pollutants in the water of the Southern Bug River within the city of Khmelnytsky 1 km upstream in the forest plantation zone was lower than the maximum permissible concentrations; no pollutants were detected there. In a sample of water taken from the Southern Bug River within the city of Khmelnytsky 1 km downstream in the zone of intensive farming, household plots, it was subjected to organic pollution

and had much higher indicators than in the forest plantation zone. But the water samples taken at the third point have extremely high excesses in all indicators, which proves that the operation of the industrial facility of the UK «Ukrelektroaparat» is dangerous for the hydrological state of the Southern Bug River within the city of Khmelnytskyi. The main proposals for reducing the anthropogenic impact on the hydrological ecosystem of the Southern Bug River, which flows within the city of Khmelnytskyi, are: improving and modernizing municipal and industrial wastewater treatment technologies, as well as reducing the level of chemicalization of agricultural production.

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