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Research Article

WATER RESOURCES MANAGEMENT IN THE REGION OF ODESSA (UKRAINE)

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ABSTRACT

The authors analyzed the current water problems in Odessa region, whose population is experiencing a great shortage of water resources. Modern climate change scenarios suggest that in the coming years, the situation with water supply in this region significantly deteriorate, so the development and implementation of water management systems using basin principle is an important task for the water resources management professionals. Experience and problems of water management in the Odessa region can be used, and other regions and countries, which at present are experiencing problems with water supply of the population with quality drinking water and agricultural irrigation purposes.

INTRODUCTION

Water resources are all the waters of our planet: surface and underground runoff waters, soil and ground waters, ocean water, sea water, atmospheric water, artificial bodies' water and permanent snow water.

Water is the source of industrial and agricultural production, and of human life. The use of water for economic purposes is one of the parts of the natural water cycle.

The main sources of fresh water in Ukraine are runoffs of rivers Dnieper, Dniester and Southern Bug, Seversky Donets, Danube and its tributaries and small rivers of the northern coast of the Black and Azov Seas.

There are a lot of rivers in Ukraine, but the volume of runoff per capita is lower than in Europe and around the world. In addition, the regions having the greatest water needs (south and east), have the poorest runoff. That's why ensuring people and enterprises by high-quality water regardless of their location is the most important task facing the water industry workers.

In order to provide the population and the national economy the necessary quantity of water 1087 reservoirs having total volume on over than 55 billion of cubic meters, 7 large channels at about 2 thousand kilometers long serving more than 1 thousand cubic meters of water per second, 10 large diameter culverts providing water to the arid areas are built in Ukraine [1].

Water supplies in the Odessa region (Fig.1) are distributed irregularly. Northern and central areas are characterized by limited water supplies and extreme southwestern part of the region, including the Dniester and the Danube Rivers, has got large water supplies. The main volume of average annual runoff is formed outside the area and most of it depends on the big rivers.

In the administrative boundaries of Odessa region according to the "Water Fund" catalog [1] there are:

- 1 143 small rivers and streams 7632 km long,
- 15 estuaries covering about 70,000 hectares;
- 30 lakes with covering about 73,430 hectares;
- More than 1,100 ponds and reservoirs covering about 95 000 ha;
- Six medium rivers 541 kilometers long.

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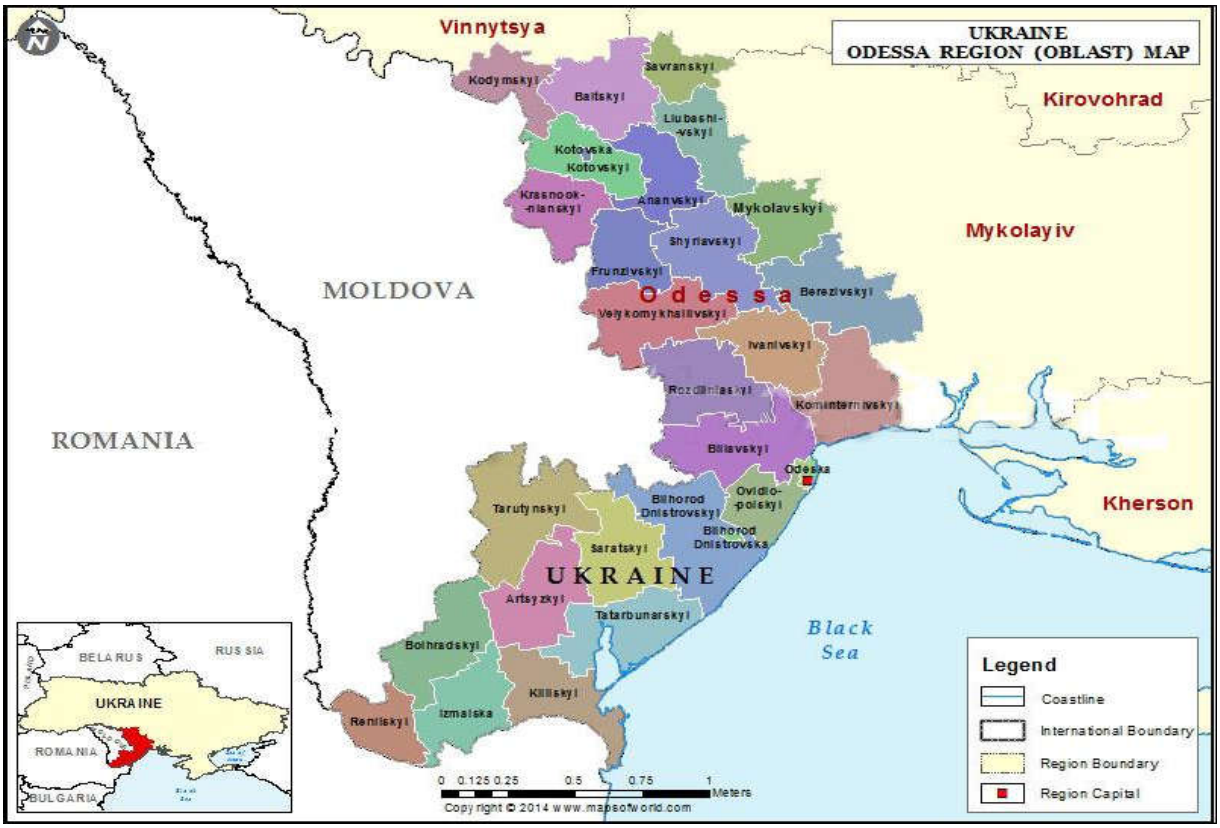

Fig 1 Location map of Odessa region

Modern Status Problems of Water Use in Odessa Region

Rivers of the region are divided into 4 main basins, namely (Fig. 2):

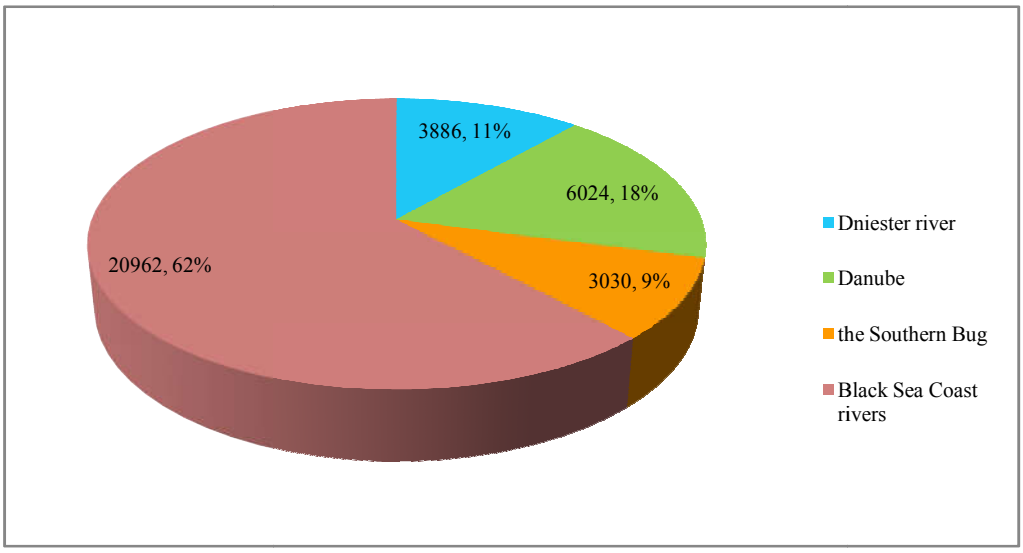

Fig 2 Distribution of the annual runoff and its percentage in the basins of major rivers in Odessa region

- Dniester river,
- Danube,
- the Southern Bug,
- Black Sea Coast rivers**.**

A feature of the hydrological regime of small rivers in the region is that they are shallow; most of them dry up in summer. There are 64 reservoirs with a total storage of 2,106,700,000 cubic meters in the region.

9 of them have more than 10 million cubic meters of total storage [2]. The feature is that the reservoirs include Danube Lakes.

They follow the Danube river flow as show in the Table.1. The transformation of the lakes into reservoirs, made in the 1960s, was first caused by the measures organized to avoid the flooding of adjacent lands and to use them for irrigation. It was achieved by the construction of dams along the Danube.

At the same time series of regulatory structures were created on the channels that connect the reservoirs to the river.

The total length of channels that provide water exchange between the Danube and reservoirs reaches 66 km, the number of floodgate controllers is 21. Water regime of reservoirs depends on fluctuations in water levels in the Danube River.

Table 1 Project characteristics of the Danube reservoirs

Name	level of water, m	total storage, million m^3	usable storage, million m^3	area, km^2
Cahul	3,5	250,7	144,2	101,3
Kartal	2,8	35,6	27,0	23,3
Yalpuh-Kugurluy	2,8	888,0	421,0	270,0
Saf'yan	2,8	6,85	4,05	4,2
Katlabuh	1,7	131,0	68,5	68,5
Kitay	1,5	111,9	49,3	60,0

The operational regime of the reservoirs is based on the rules of exploitation: water is provided to them when water levels in the Danube increase [3].

When the water level of the river decreases, the floodgate controllers close. When the Danube water level rises much, there is an opportunity to provide more water in the reservoirs and accordingly to increase the turnover. When the water levels are low it is almost impossible. Monitoring, provided by the Danube Basin Department of Water Resources, allows toset the volume of water that enters the reservoirs and spill them.

One of the problems of water management is a state of dams on the left bank of the Danube River (its Ukrainian part). Their total length is 225 km. In addition, a series of dams 90 km long is built along the channals' and the reservoirs' banks [3].

Water resources of Odesa region are used in complex: production needs - 18% household and drinking needs - 35% agricultural water supply - 4%, irrigation - 27%, pond-fish industry - 15% and other purposes - 1%.

Another problem in the Odessa region is household and drinking water supply, which applies to the majority of localities including the regional center.

Drinking water supply in the region is is provided by surface water (about 72%). Therefore, the quality of water in surface water bodies is determinative for population's sanitary and epidemic conditions. Total surface river runoff in the region reaches 208.52 km^3 per year of average water content, only 0.46 km^3 of which are formed within the region. Specific average resources of local runoff make 0.183 thousand m^3 per capita or 13.8 thousand m^3 per 1 km^2 of the area. However, most river basins can be classified as contaminated and very polluted.

Surface sources suitable for drinking water supplies are the Dniester and Danube rivers, flowing along the boundaries of the region, so they are distant from the main water consumers. The level of water preparation on the treatment facilities of the

Odessa water pipes in generally ensures the compliance with regulatory requirements for drinking water quality on the basic parameters.

Odessa intake is located on the left bank of the Dniester River on the southern outskirts of Bilyayevka. Now, in addition to Odessa, the water from here is provided to Bilyayivka, Chernomorsk, Belgorod Dnestrovsky, Ovidiopol.

Some cities of Odessa's region takes water from the Danube River or groundwater sources located nearby. Thus, Reni is supplied with water taken from the wells under the floodplain of the river Danube. The same situation is in the Izmail.

The problem of water supply of rural areas is still complicated, especially in the south of the region. More than a hundred and fifty villages of Odessa region are forced to use imported water so far. To solve this problem, the construction of Kiliya's (in 1989) and – Tatarbunar's group waterpipes (in 2001) began. Despite the difficulty of funding at the end of the year 2006 Kiliya's group water pipes was set. Water intake is made from the Danube on the top outskirts of Kiliya. The sluice to the fifteen villages of two districts.

The water management system of Odessa region is provided by the Odessa Regional Department of Water Resources, established in 1949, that is a state budgetary organization with the right to provide paid services. The Odessa Regional Department of Water Resources operates in the field of management of the State Water Resources Agency of Ukraine and ensure the problems of using, conservation and recovery of water resources, the provision of population and economic sectors with water resources, including the exploitation of state amelioration systems to supply water for irrigation and exploitation of water pipes group for the Odessa region.

The water management system of Odessa region is provided by ten subordinate organizations, having the total number of employees about 2.5 thousand people.

The priority of the Odessa Regional Department of Water Resources is to provide the population and economic sectors of water resources of good quality in the required quantity.

Droughts, observed in the Odessa region every three years, determine that the greatest efforts in the field of land amelioration and water management are taken in the south of the region, where most irrigated lands are concentrated. Now the area of irrigated lands in the Odessa region is 226.8 thousand ha.

The Implementation of the Principle of Basin Water Management

The water management system of Odessa region is realized in the context of object using the basin principle. The basin management principle is a modern approach to water management, according to which the basic unit of management is the river basin area.

The importance of such formation as The Basin Council is, first of all, in the implementation of the principles of basin water management. It is the goal of the Water Framework Directive (accepting it, Ukraine realizes the intention of joining the EU)[4]. The main aim of the Council is implementing the principles of integrated water resources management in river basins by taking coordinated decisions on water management policy for the basin with involvement in the management of local authorities in the use and protection of water resources, public and environmental organizations and research institutions.

Presently, Basin Water Management Departments (BWMD) of Southern Bug, Dniester and Danube rivers are established and function.

Because of the sudden deterioration of the ecological and hydrological condition of water bodies of Kuyalnik estuary's basin, at Odessa Regional Council session, held in May 2010, it was decided to take measures concerning the preservation and recovery of water resources in the Kuyalnik estuary's basin. The Odessa Regional Department of Water Resources was charged to establish the Kuyalnik estuary's Basin Council and to develop a regional program of Kuyalnik estuary's conservation.

The Odessa Regional Department of Water Resources signed Agreements with Basin Water Management Administrations to cooperate on ensuring the balance of using, protection and recovery of water resources of the Dniester, Southern Bug and Danube river basins.

Basin water management is carried out by in such areas:

- the development and participation in the implementation of state, interstate and regional water use, protection and recovery of water resources program's;
- the organization of work to satisfy the population's and economic sectors needs of water resources;
- the interaction with Dniester and Prut Basin Water Management Administration, Southern Bug River Basin Water Management Administration and the Danube Basin Water Management Administration;
- the hydrochemical monitoring work organization of water bodies complex purposes, of intersectoral and agricultural water supplies systems;
- the work organization of the implementation of measures of environmental improvement of surface water and their care;
- to keep state tabs on water using and state water cadastre;
- to control the flow of all budget payment for the water bodies rent;
- the consideration and drafting of water management permits;
- the communications spreading organization to explain the functions and activities of the Odessa Regional Department of Water Resources and public involvement.

International Activity of Odessa Regional Department of Water Resources is primarily focused on the fulfillment of Ukraine's duties to the transboundary water resources management and their quality control[5]. It is carried out under the Agreement between the Government of Ukraine and the Government of the Republic of Moldova on joint use and protection of transboundary waters signed on the 23 of November in 1994.
Within the framework of intergovernmental agreements the meetings of Deputy Commissioners authorized by the Governments of the Republic of Moldova and Ukraine, meetings of experts from the Ukrainian-Moldovan water-ecological monitoring and water quality control working group are annually held concerning the water management of the Dniester river basin, the Danube and the Danube Lakes.

The main document regulating the activities of water management organizations at the Ukrainian-Romanian boundary waters, is a bilateral agreement between the Government of Ukraine and the Government of Romania about the cooperation in water management of boundary waters signed on the 30 of September in 1997[6].
The Odessa Regional Department of Water Resources executes the program of Industrial water management Monitoring according to the Cabinet of Ministers of Ukraine regulation № 391 " On Approving of the state environmental monitoring system" signed the 30 of March in 1998 and the State Water Resources Agency of Ukraine's order № 310 " On Approving of the state program of surface water monitoring" signed the 30 of December in 2011. The program of observations is referred to the Dniester, the Turunchuk river, the Kuchurgan Reservoir, 16 small and medium rivers and the Sasyk reservoir (Fig. 3).

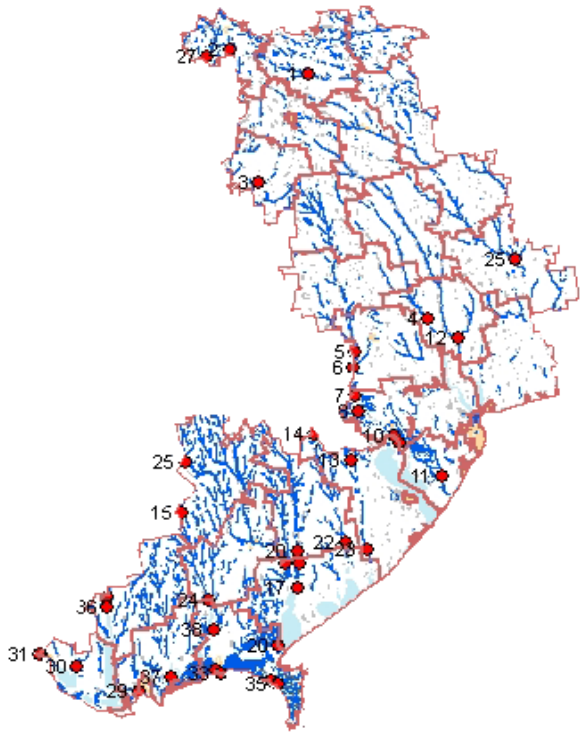

Fig 3 The Scheme of monitoring of surface water in the Odessa region

According to the procedure of interaction concerning the water resources management in the Danube, Dniester and Southern Bug river basins in accordance with the Dniester and Prut Basin Water Management Administration, Southern Bug River Basin Water Management Administration and the Danube Basin Water Management Administration and to ensure the implementation of the principle of basin water management the Regional Department of Water Resources monthly and quarterly reports the Basin Water Management Administrations about the quality of water, the volume of their use, the state of implementation of environmental protection measures and so on.

Odessa Hydrogeological Amelioration Expedition is a part of a working group according to the cooperation agreement between Moldova and Ukraine. Observation of hydrochemical, hydrometric and environmental indicators are made quarterly and include the inspection, the water sampling, the water loss and temperature metering. The data are used to control the quality of environmental condition and to minimize the negative impact of boundary waters on the environment. As a result of these observations a report approved by the

Authorised Representative of Ukraine and Moldova Governments is annually prepared.

According to the State environmental monitoring program and to implementate the Agreement between the Government of Ukraine and the Government of Romania concerning the cooperation in water management of boundary waters (observation over the quality of boundary waters) the laboratory of Danube Basin Water Management Administration monitors the water quality of 13 surface water bodies in 18 control gauging stations.

CONCLUSION

Assessing water resources, we must consider some circumstances that complicate the use of surface water. A negative factor limiting the use of available water resources is a water quality deteriorating because of wastewater discharge in water bodies, resulting the water contamination, its loss of useful qualities and often unsuitability for certain uses. The big problem in terms of deterioration of water quality in Odessa region reservoirs is wastewater discharge into water bodies. Wastewater discharges into surface water bodies is realized by 66 water users, including the 40 discharging the contaminated wastewater.

Because of the fact that the Black Sea Coast rivers basin covers about 60% of the area of river basins of Odessa region and currently Basin Department is not create the Odessa Regional Department of Water Resources functions via the Odessa Hydrogeological Amelioration Expedition, which controls the water bodies condition, assesses the irrigated lands, controls the flooding of farmlands and villages, and carries out the hydrochemical and radiological control of boundary water bodies by agreement between the governments of Ukraine and Moldova.

The system analysis of the current status of river basins in Odessa region and the organization and management of water resources permitted to outline the most actual problems that need to be soluted, namely:

- the Expansion of activities of basin water management and its approach to water use within the Framework Water Directive;
- the work improvement concerning the water quality control in rented reservoirs;
- the monitoring of condition of lakes, lakes-estuaries, taking into account the geological, hydrogeological, engineering-geological, hydrogeochemical and environmental component;
- the participation in the Black Sea basin's medium and small rivers certification
- the study of possible excessive water loss from the reservoirs. It explains causes, consequences, solutions and minimizes the flow of public and private funds (Koziysky, Nerushaysky, Dmitrovsky and Baraboysky reservoirs).
- the adaptation of current legislature to the conditions of transition to state water management by basin principle and adaptation of regulations concerning the transboundary flood forecasting as well as dry years and of accounting and water monitoring regulations;
- the development of necessary regulatory and methodological documentation concerning the new administration, and the reform of existing ones;
- the Drafting development of state, basin (including interstate) and regional programs concerning the water use and protection;
- the development of the draft management plan of water use, protection and recovery of water resources.
- at present global and regional climate change is increasingly evident in all areas, including the hydrological regime of rivers, so their the program of strategic development within the Odessa region, which is currently absent, must be developed**.**

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