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Problems of rational use of water resources and conditions of water pollution on an example of Lake Balkhash

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Abstract

Nowadays one of the actual problems of ecology is preservation of disappeared species of biological diversity (BD) on the planet. The earth's green mantle is rapidly reduced in the process of its unrestrained exploitation. Never before in 500 million years of evolution of life on the Earth, was not this cover exposed to such cruel attack. In the past there were the so-called "crises" related to the disappearance of certain species of animals and plants. However, the rate of reduction of biodiversity during these crises was incommensurably lower than the rate of destruction of habitats at present.

The loss of biodiversity on the territory of Kazakhstan persisting due to destruction of natural balance in ecosystems, overexploitation of land and plant resources, changes in the water regime of the rivers and the dumping of contaminated irrigation water, as well as the introduction of alien species into the ecosystem of plants and animals.

Exhaustion of a biodiversity is particularly pronounced in mountain, forest, desert, valley and coastal ecosystems, i.e. in different types of geosystems. All of these issues can be fully applied to the Cis-Balkash area.

The problem of rationale water use is inextricably linked with the protection its quality and quantity. Purpose of this investigation-study the problem of supplying clean water to population and economic sectors.

Keywords: Water pollution, drainage, ecosystem, hydrosphere, sewage.

1. Introduction

Lake Balkhash which is located in a depression of tectonic origin, among semi-deserts of South-Eastern and Central Kazakhstan, takes only part of the vast territory of the ancient lake Balkhash-Alakol that existed during the last quaternary glaciations. In the modern geological period there is a gradual lowering of the West and to a lesser extent the north-west coast of the lake, and rising of the north-east coast.

Accordingly, the western and north-west coast has totally ingression character, and the north-east - regression.

Catch water basin of Lake Balkhash is 413 thousand of km². The most part of the basin is on the territory of Kazakhstan, and head of Ili River is on the territory of China. Dividing line with the pool of Alakol lakes is on the plain (altitude 400 m) between Lake Balkhash and Sasikol.

Basin orography is differed with complexity. On its territory there are high mountain ranges, low mountains, plains and sands of Cis-Balkhash. Cis-Balkhash plain can be divided into two main areas:

1) North Cis-Balkhash (or rather the northern and north-west)

2) South Cis-Balkhash. North Cis-Balkhash is a southern suburb of Kazakh hills.

Average height of it is 400-450 m. The relief is mainly flat with some peakedness knolls, hills, ridges, dissected short valleys of dry logs and intermittent rivers.

Southern Cis-Balkhash is presented by accumulative plain with low (0.003) slope to the Lake Balkhash. A characteristic feature is a wide dissemination of sand masses here ("Kums").

Closer to the lake follows a strip of barchan, hilly and cellular sand. Hilly sands are oriented in a northwesterly direction and ascend above the surrounding plain on 5-10 m.

Lake-alluvial plain is distributed along the lake, formerly occupied by the waters of ancient Lake Balkhash. In some places in these areas there are small sandy hills (Chief Administration for hydrometeorology at the Cabinet of Ministers of the Republic of Kazakhstan,1995).

The south-western coast of Lake Balkhash is occupied by an extensive (8000 km^2) delta of Ili River, in the north of which is an extensive Bakanas takyr clay-sandy plain, cut by numerous dry riverbeds of the ancient delta of Ili River - so-called "Bakanas".

The territory of the Balkhash depression is located in the dry extreme continental climate. The annual average precipitation in average does not exceed 150-200 mm. Vegetation is represented by species typical of semi-desert.

River basin runoff is mainly formed in the mountainous and in the foothill areas of Tien Shan and partly in the southern slopes of the Kazakh hills. Cis-Balkhash plain (especially southern Cis-Balkhash) refers to the drainage area.

2. Drainage in the Southern Cis-Balkhash

The problem of rationale water use is inextricably linked with the protection its quality and quantity. Until recently, pollution of natural waters does not particularly worrisome because the hydrosphere, as a dynamic system was capable to maintain biochemical balance and with normal functioning of water ecosystems possessed large reserves for assimilation waste. However, in recent decades, human activities acquired such scale and intensity, which natural protective forces can no longer cope with the continuous and increasing flow of man-made products. This resulted in significant and highly stable qualitative changes in the environment and, in particular, of water ecosystems. In connection with this, problem of supplying clean water to population and economic sectors has become one of the most important. In the Republic of Kazakhstan, as indeed throughout the world, it is now quite acute. At the present level of technology production, almost any human activity poses a threat of direct or indirect impact on the qualitative state of natural waters. One of the most significant sources of influence on the water is waste waters. Thus, the total drainage of their various objects of human activities in the Southern Cis-Balkhash region currently reaches 709 million m^3, 509 million m^3 comes to water objects, and 200 million m^3 is wasted to lay of land, in stores, on the filtration field, creating conditions for water pollution (table 1).

Table 1. Drainage in the Southern Cis-Balkhash, mln.m^3

Year	**Discharged waste water, mine-ore and drainage collector waters**		
	Total	In natural surface waters	In lay of land, in stores, on the filtration field and etc.
Almaty region			
1995	943,0	686,0	257,0
1997	614,0	482,0	131,2
2002	569,0	388,2	180,8
Taldykorgan region			
1995	202,3	187,6	14,7
1997	192,2	168,0	24,2
2002	140,1	120,6	19,5

There are three main sources of pollution natural waters:
- domestic waste waters;
- industrial waste waters;
- waste waters allocated from agricultural land (collector drainage).

In this region, the volume of waste waters is generally correlated with the amount of water used for certain purposes. A small proportion of the total waste water is for collector drainage waters (59.5%), slightly lower (40.4%) is for share of domestic and industrial wastes (Republican Scientific and Production Information Centre "Kazecology", 1999).

The degree of wastes influence on the quality of surface waters considerably depends on the substances contained in them, coming from residential and public buildings, as well as from domestic premises of industrial enterprises. Pollution usually determines the harmfulness of these waters for the human body, influencing on it a chemical, biological or physical impact.

In domestic waste waters in the most cases there are flare pollutants containing physiological isolation of people and animals, as well as domestic that contains waste and refuse, appealing from the washing food, kitchen utensils, laundry, cleaning houses and streets. The constancy in time of pollutant per one inhabitant of the settlement, regardless of local conditions allows deducing the average norms of pollution volume of domestic waste waters.

Pollution intensity by organic substances in this category of waste water is determined by the amount of oxygen consumed by biochemical oxidation of the substances contained in them. Gross value of biochemical oxygen demand (BOD) for non-clarified liquid is 75 g of oxygen per person per day, for clarification - 40, and BOD_5 - respectively 54g and 35 g/day. Phosphates in the wastewater at the rate of per capita produced up to 3.3 g/day, chloride - 9 g, surface-active substances - 2.5 g. Total weights of suspended solids in domestic wastewater reaches more than 65g.

Domestic waste water contains also biological contaminants including bacteria, and pathogens. These effluents are particularly dangerous and therefore are assigned outside the residential area and are related to the corresponding processing of wastewater treatment plants.

3. Waste water

Depending on the amount of impurities contained in industrial waste waters, are distinguished uncontaminated or normative-clean and dirty waters. Normative-clean sewage water is usually considered water, the composition and properties of which allow wasting their water objects or sewage systems without treatment. This category includes most of the waste water enterprises of Almaty region, coming to the surface water of River Ili. So, for example, directly to River Ili are wasted the normative-clean water of Kapchagai hydropower used for cooling turbine, and in the River Bes-Agach come normative-clean water after cooling of Talgar distillery equipment. In the total volume of wastewater discharged in 2002 to water facilities of Atmaty region, the share of the regulatory clean waters were 99.8% (Table 2).

Table 2. Sewage, ore and collector-drainage water waste (mln. m²) to natural water objects in 2002 by type of treatment.

Water wasted						
Total	Polluted, without treatment, insufficiently treated	Normative-clean without treatment	Normative-clean			
			Total	Treatment		
				Biological	Physicochemical	Mechanical
Almaty region						
388,13	0	387,54	0,59	0,06	0,53	0
Taldykorgan region						
120,63	0,43	87,71	32,49	22,72	0	9,77

In Taldykorgan region this percentage is lower - 72.7%, here is about 30% of wastewater are polluted and require treatment. As a rule, they pass through the local treatment plant, and then discharged into water objects or municipal sewerage system for further purification together with domestic wastewater (Lvovich A.I.,1977).

The optimal construction of biological treatment is aeration in various versions, on its work depending effectiveness and stability of work of whole biological wastewater treatment station. The main disadvantage of modern biological wastewater treatment station is the low efficiency of nutrients disposal. Therefore, in some cases purification of sewage is necessary,

which can be produced in biological ponds, on sand filters and in agricultural fields of irrigation (AFI). From the cities of the South Cis-Balkhash which have a sewer system, directly into water objects only wastes of Tekeli River and Taldykorgan River comes. After biological treatment, they wasted in Karatal River. The volume of mixed water in Taldykorgan River is exceeded the number of domestic sewage of Tekeli River almost four times and reached in recent years 17 million m^3 in a year (The National Academy of the Republic of Kazakhstan, 1993).

River water entered suspended substances (up to 260 tons / year), oil (0.67 tons/year), surface - active substances (5.23 tons / year), ammonia nitrogen (11.7 tons/year), and etc. This has a direct impact on the quality of surface waters. Of course, filtering fields for its intended purpose adapted for biological treatment of waste water by filtering them into the ground. They play an important role in the pollution of groundwater both directly under them and in the adjacent territory. A similar function has ponds - storage and septic tanks, which accumulate waste water and concentrate pollutants. The most pure pollutants fluids flow into groundwater occurs above as a result of continuous or periodical seepage through the unsaturated zone. It is also possible via a direct overflow through karstic channels, absorbing mining, borehole, which revealed underground water or connecting the exploited horizons from above - and the underlying horizons. In the process of exploitation of underground water deposits pollutants may be released through "hydraulic windows" in separating impermeable layers, as well as through the lateral boundaries of the reservoir and from surface water sources.

4.Conclusion

Ecological and geographical location of this area is poor, because there are high concentrations of contaminants around here. Natural factors amplify the adverse ecological conditions. However, the diversity and richness of biological diversity of the area gives great scientific potential as far as the flora and fauna here is widely represented, and the region is characterized by the difference in environmental conditions.

The area is well studied in the geographical and biological terms, the made analysis of study of the region indicates of it. It is accepted to make an environmental-economic evaluation of biological resources to characterize the ecological conditions of the region.

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