

Assessing of the Water Reservoirs Impact on the Environment and Population Safety

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Engagement of a water reservoir in the natural environment due to the silting and elevation of its beds, leads to the following outcomes: increased anthropogenic impact on micro-climate; activation of the landslide and suffosion processes; an increasing deficit of the beach-constituent drift in the sea coastal area; a permanent increase in the risks of flooding of the headrace areas and people living there.

Despite the negatives, the scales of the water reservoir building have increased drastically. The global climate change and uncontrolled population growth (so called “demographic explosion”) result in the global increasing deficit of freshwater and electrical power, reduction of the irrigation farming, etc., what has given a strong impulse to the construction of water reservoirs all over the world.

The designs of water reservoirs tended to ignore the probabilities and risks of flooding of the headrace, their devastating impact on the sea coastal areas, threatening the population and infrastructure in the coastal zones by wave abrasion. The knowledge about the major issues of the hydrology of water reservoirs is not sufficient and complex methods to evaluate the impact of the water reservoir on the environment and population safety are necessary to develop.

The goal of the project is to develop the methods to assess the negative impacts of water reservoirs and identify the ways to prevent or mitigate them.

A new type of a mathematical expression $I = f(H_k, D_m, R_i)$ to calculate the probability of the impact of water reservoir on the population and infrastructural safety will be used for the first time. Such formulae show the dependence of the inclination of the tributaries in the headrace on maximum drift diameter, hydraulic radius and height of the water reservoir outlet sill.

- The impact of the water reservoir on the climate will be evaluated on the background of ongoing climate fluctuations by using analog and mathematical statistical methods
- The impact of the water reservoir on the sea coastal zone will be evaluated by using the drift balance method used to determine the annual drift volume and identify the ways to eliminate the deficit.
- The impact of the water reservoir on the ground water volume and regime will be evaluated by using the filtration and water reservoir water balance methods. These methods can be adapted to concrete water reservoirs by means of monitoring of filtered water.
- To date, there is no method to assess the probability or risks of the safety of the headrace population and infrastructure. A method of “predicting the balance bed” will be developed, which can be used to evaluate the hazards of heightening the beds of the tributaries.

For the first time in the national and international practice, the work (theory, instrument as complex methods) allowing avoiding wrong decisions when selecting a water reservoir location and type of regulation and location of the settled areas will be developed. The obtained results will serve as a basis for the new modernized method to calculate the volume of the boundary water reservoir silting and duration of exploitation. The present methods do not consider the volumes of the drift deposited in the tributaries leading to a $\geq 20\%$ error of their calculated values.

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