

Assessment of the Technical Condition of Protective Dams on the Reservoirs and Rivers of Ukraine

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doi: <https://doi.org/10.21467/abstracts.93.54>

ABSTRACT

The problem of protecting territories from the harmful effects of water is very relevant for Ukraine, since 27% of its territory is more or less exposed to flooding. One of the most representative flood protection methods in Ukraine is the construction of flood-control dams. For today, the total length of protective dams in Ukraine is more than 4.0 thousand kilometers. In the future, the length of the dams may increase up to 6.0 thousand kilometers. In accordance with the normative building standards in force in Ukraine VBN V. 2.4-33-2.3-02-2008, the main purpose of the protective dams is to protect the territory and facilities against high floods. These standards when designing and constructing of protective dams require drainage excavation. Unfortunately, most existing dams do not provide drainage. In breach of the requirements of the current standards VBN V. 2.4-33-2.3-02-2008, the crests and the downstream slopes of these dams were constructed without support settings, as well as the upstream slopes and the dam sites along the feet of the dams were made without necessary support settings against the water flow, waves, currents and ice drift. During floods, such dams are subject to deformation and destruction. Therefore, the assessment of their technical condition is an urgent task.

To assess the condition of the protective dams, it is necessary to control the following quantitative (measured using technical means and calculated on the basis of measurements) characteristics:

- vertical and horizontal movements and deformations of structures, their bases (within the active and near-contact zones);
- stresses in structures and their bases (concrete, reinforcement, rock, soil, etc.);
- stresses in the place of contact of concrete structures with the base, with various types of backfill and earthworks;
- filtration water flow (total and for individual sections of structures and their bases) entering the drainage and underground structures or going out on the surface;
- levels of the depression surface of the filtration flow in the earth structure bodies and landfalls;
- piezometric pressures and their gradients in the earth structure bodies and landfalls;
- pore pressure and its dispersion intensity in the water-resistant elements of earth dams and their bases.

One of the promising methods for studying the technical conditions of earth hydraulic structures is the geophysical method of the Earth's natural pulse electromagnetic field (ENPEF), which involves the construction of maps using the ENPEF data and Golden Software Surfer 8 program.

As pilot objects, the dams of the hydraulic structures of the Sanjdjeyske, Baraboyske and Umanske reservoirs on the Baraboy and Umanka rivers were taken for the study. The hydraulic structures of these reservoirs include dams, canals, protective dams, spillways, water outlets, water intake structures and earthen bridges.



The technical condition of the dams of hydraulic structures was assessed based on the study materials. In the course of study some filtration losses and suffusion removal of clay soil particles were detected, which led to local damage of the dams.

To reduce filtration losses and prevent the suffusion removal of clay soil particles in the area where the dams are adjacent to the slopes, a hydro-enclosure in the form of a groundwater cutoff was proposed. In general, for solving the problems of counteracting the harmful effects of water when assessing the technical conditions of protective structures, it should be included: conducting the study on natural and man-made risks; specifying the research methods for hydraulic and hydrogeological conditions of facilities; establishing a system area network for monitoring the condition of protective structures. The methodological approaches to assess the technical condition of protective hydraulic structures tested at Ukrainian facilities can be used in other countries, including Poland, Georgia, Azerbaijan and others.

References

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