INCREASING THE ACCURACY OF PARAMETERS FOR HYDROTECHNICAL NODES DETERMINATION USING GEOGRAPHIC INFORMATION SYSTEM

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***Abstract**: At the moment on the territory of the Republic of Moldova there is massive evidence, elaboration of technical data sheets and rules for exploitation of lakes / ponds. These regulate the regulation of storage lakes / ponds regulating the general criteria for the exploitation of water accumulations regardless of the type of property built according to the requirements of the normative and legal acts in force for the purpose of their correct and sustainable exploitation and applies to anything natural person or legal entity that owns and manages reservoirs/ponds. For this it is necessary to collect parameters such as: dam dimensions, elevation of the dam, water discharge devices and bottom drainage. Efficient exploitation is achieved if accurate measurements of the area of the water mirror surface are at different levels, such as normal, hard and minimally acceptable, but we also need cadastral and legal data.*

***Keywords:** building monitoring, spatial displacements, structural degradation, geodetic observations.*

1. Introduction

Based on Government Decision no. 977 of 16.08.2016 (GD 2016) regarding the approval of the Regulation for the exploitation of reservoirs / ponds, all aquatic objects must be registered in the register with the data sheet, with the cadastral number and other annexes such as: the geometric plane and the topographical characteristics (Sandulache at all. 2015).

On the territory of the Republic of Moldova (NCM 2003, NCM 2007, CPD 2003) there are almost four thousand ponds and ponds, of which the largest are: on the Costesti-Stinca Prut-basin with the volume of 750 mil. m^3 of water at the normal level together with Romania; on the Nistru River - at Dubasari for 350 mil. m^3, which is managed by the Transnistrian administration; to the north in the Nistrean Hydropower Complex - at Nistrean 2 (Naslavcea) node of 70 mln. m^3 with Ukraine, where the Republic of Moldova did not enter the property after 26 years, but it does not mean the border demarcation line as stipulated by the half-way of the concrete dam, ie from the 163m by 81.5m each.

2. Material and Method

From these large transboundary accumulation basins, only the Costesti - Stinca node performs the measurement of the parameters, as well as with the help of the Romanian part, and now only a modernized information project is being implemented on the Moldovan side. Below are some observations of some parameters, from the set at the node.

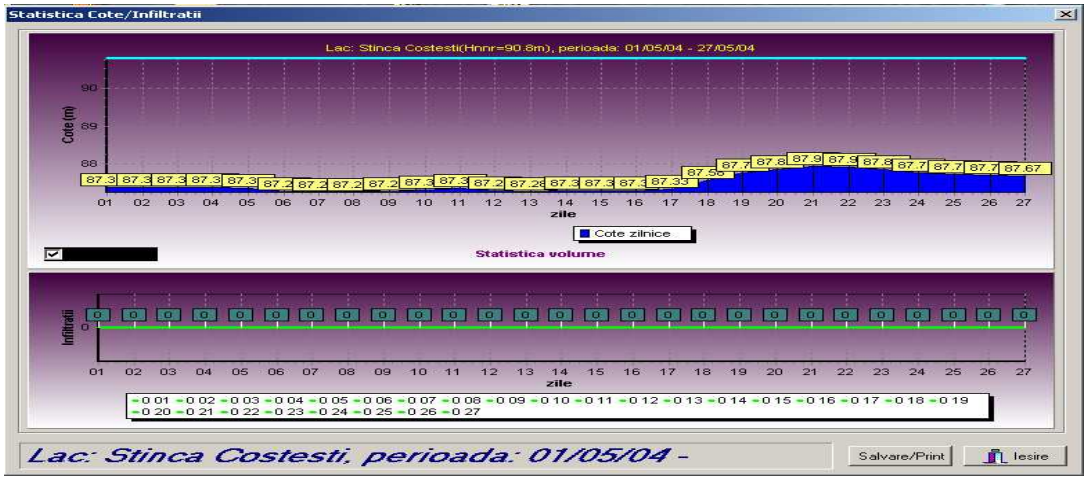

Fig. 1. Variation in daily water rates in the storage lake Stanca-Costesti.

Data	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Q afl.	69.2	64.6	62.3	60	69.2	71.5	70.4	79.9	83.5	105	105	81.1	70.4	66.9	62.3	56.6	75.3
Q uz.	63.6	63.6	63.6	63.6	63.6	69.6	69.6	69.6	69.6	69.6	86.4	75.6	75.6	60	62.4	62.4	62.4
Q g.f.																	
Q dev.																	
Q fol.	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Q ev.	63.65	63.65	63.65	63.65	63.65	69.65	69.65	69.65	69.65	69.65	86.45	75.65	75.65	60.05	62.45	62.45	62.45

Fig.2. Variation of the daily affluent, turbine and evacuation flows at the Stanca-Costesti node

At the hydrotechnical node on the Nistru river in Dubasari, currently RM, has for 25 years no access to the exploitation, because the 48MW hydroelectric power plant and all the operating equipment with shuttering are located on the left side, as well as all the devices for parameter measurement are transmitted by telephone only upstream, downstream and downstream discharge flows to the state hydrometeorological service. Regarding the Nistrean Hydropower Complex, which is composed of three units: Dnestrovsc 1 with a height of 55 m, with a volume of water of 3 ml. m^3 and 720MW power located 20 km upstream of the Nistrean 2 hydrological knot, which has a 14 m fall with a 40.8 MW hydropower plant and a volume of over 70 mil. m^3, which according to the project and operating rules are located in

Naslavcea, Ocnita rayon Republic of Moldova and which must be exploited together after independence.

Between these dams was built by the former USSR, a hydrotechnical node with an electric storage system, with the takeover of the reversed aggregate water from the Nistru River and pumping it upstream at a height of 160 m in a basin with a volume of 40 mil m^3 in time 4 hours. Then, in hours when energy consumption is higher, water under gravity is routed downstream to the same hydrogate in the turbine mode, and the generators produce a power of 330 MW per unit; at present there are already 3 aggregates running around 1000 MW; the future is expected to be 7 aggregates with installed power over 2250 MW. At present, the Ukrainian side has installed a fence on the right side with a barbed wire on the territory of the Republic of Moldova around the dam, which is 4 km below, from the place where the border passes by land on the Dniester River upstream and demands to rent 99 years old, another 20 ha in this sector, believing that this hydropower node is theirs.

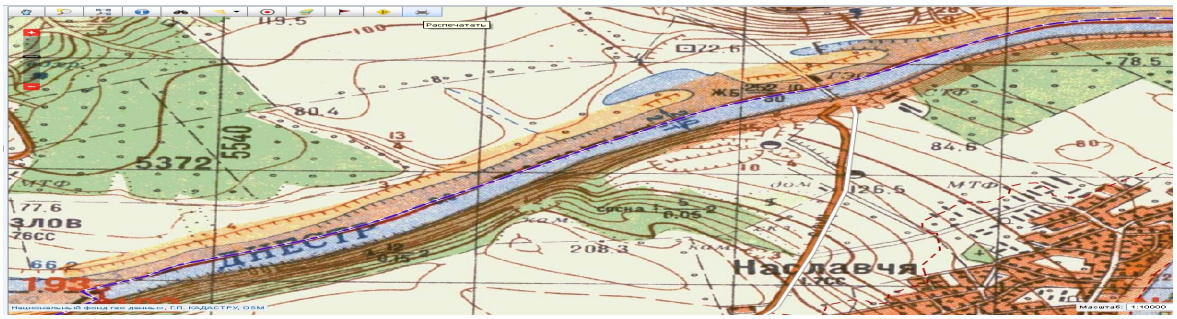

Fig. 3. Situation plan in the Nistrean node 2 area - next to the construction-Naslavcea-rayon Ocnita-RM.

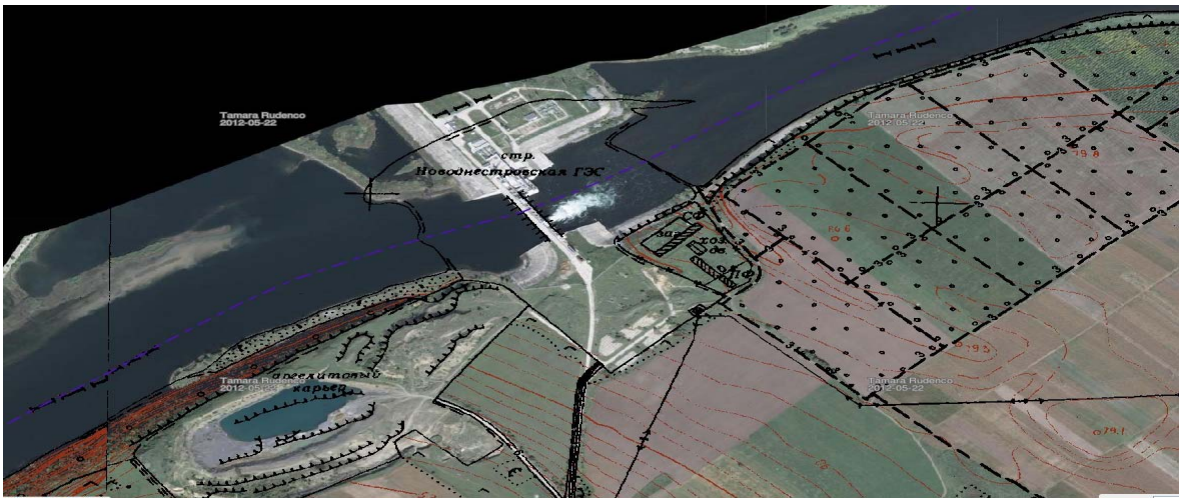

Fig. 4. The orthophotoplan of the Nistrean 2 hydro-technical node during the construction of the border

In this situation, the Republic of Moldova loses its participation in the exploitation of the hydrotechnical node, cannot stand alone to handle the water-tankers and no power can be used from this hydroelectric power plant, which is catastrophic for the water supply of 13 pumping stations in water supply and 53 irrigation stations with total flow of 250 m^3 / s.

This is the situation at the Dubasari hydrotechnical node, which is administered only on the left side, by the regime in Transnistria.

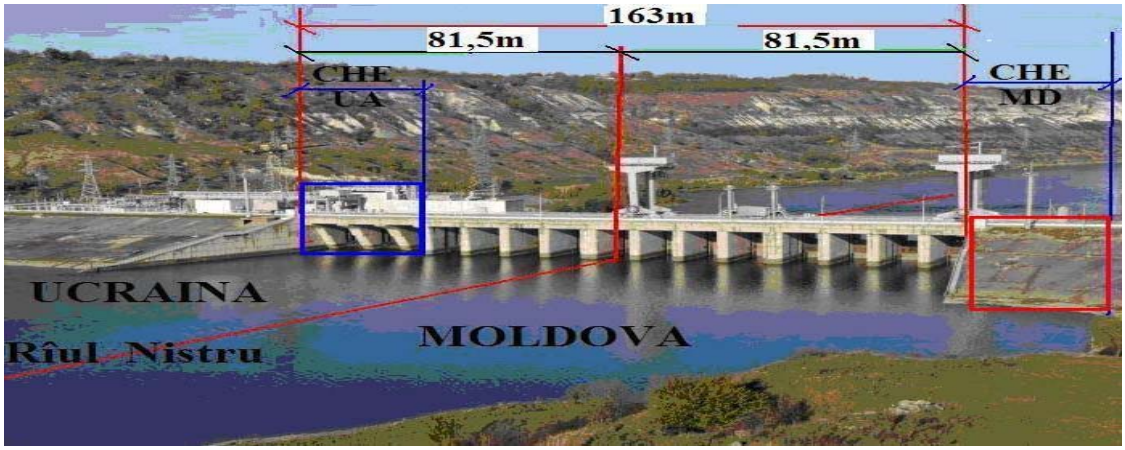

Fig. 5. The variant how to demarcate the border and the ownership of the Nistrean 2 hydrotechnical node between Ukraine and Moldova (Naslavcea) on the Nistru river for energy security and water supply.

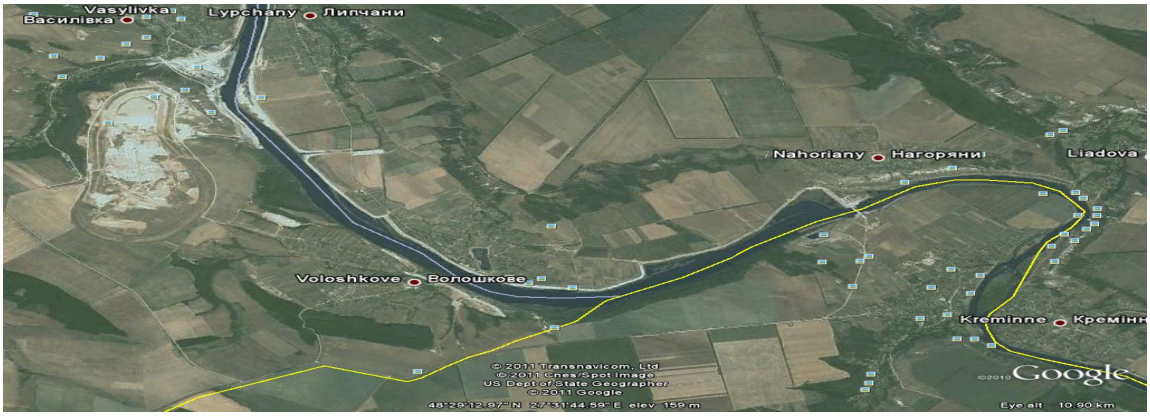

Fig. 6. GIS layout with delimitation the border between Ukraine and Moldova in the area of the hydrotechnical complex with accumulation basin and Nistrean hydroelectric power station 2.

3. Results and discussions

The rules governing the operation of ponds located on inland hydrographic basins provide information such as: scope, main characteristics and data, hydrological and hydraulic operating regime, measures in the organization of operation, aspects of civil protection in case of floods, drought, security technique and other documents as attachments.

The annexes include: the pond datasheet and the records of observations on the level of pond water and water quality, provisions and evidence of pond services, safety technical training, exploitation rules and recording cases of breach of exploitation rules, comments on state of construction, bucket and deformation of the pond, maintenance and reconstruction repairs and maintenance, technical information of the water inlet, pumping stations.

This regulations for the operation of aquatic objects regulates the basic requirements for the exploitation of water accumulations, regardless of the type of property, built according to the requirements of the normative acts and the legislation in force, for the purpose of their correct and sustainable exploitation.

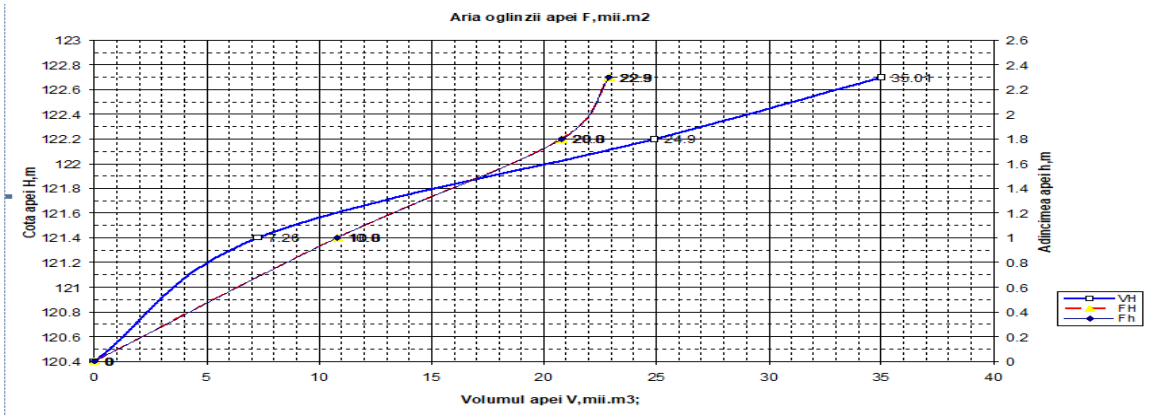

Figure 7. Topographic features of the hydrotechnical node determined by applying GIS

The aspects of the exploitation of the ponds are determined by their parameters and volume, by the composition of the main hydrotechnical constructions, the conditions and tasks of river flow regulation, by the technical geological and morphometric conditions of the cuvette. If the main characteristics of water basins with a volume of water over one million cubic meters, which are on the territory of Moldova, about one hundred, with sufficient exploitation documentation, then those aquatic objects with a volume of up to 1.0 million. m^3 falls into the category of ponds, the situation is more difficult and requires the completion of the documentation with cadastral, legal, hydrotechnical and exploitation aspects, which is not complete or missing at this moment. For this purpose, according to the norms in force, the state agency "Apele Moldovei" will develop and register at the cadastral offices, in the mayoralties, every aquatic object according to the requirements elaborated.

First of all, the category of importance of the hydrotechnical construction is determined, which is determined by its class and falls into class IV according to NCM D.01.03-2007. Other aspects for completing the requirements of the operating rules and the technical data sheet are elaborated on the basis of the norms presented in the bibliography. Specification of the dam elements, such as the elevation, the water mirror elevation, the elevation threshold of the large water tank, the downstream characteristic points for the dam height and the axis of the drainage pipe axis is determined on the basis of measurements with modern GIS appliance (Lepadatu et all. 2014 a, Lepadatu et all. 2014 b, Lepadatu et all. 2016, Morariu et all. 2017).

Determining the depth of water is based on measurements based on the watertight methods on the boat or on the application of floating boats with remote routing and data processing on the computer. Then, based on these data, minimum, normal and maximum levels are calculated, mirror areas and corresponding volumes. The minimum ecological and maximum water discharge rates shall be established according to the requirements of the relevant regulations and shall be indicated in the technical data sheet of the developed regulation.

4. Conclusions

1. The leadership of the Republic of Moldova should elaborate directives regarding the common and efficient exploitation of the water and energy resources of the hydro-technical nodes on the Nistru river with Ukraine and at Dubasari with Transnistria, this results from the need to ensure state security with these important resources.

2. Application of the Operation Rules for all aquatic objects will increase the efficiency of ponds exploitation with ownership, evidence and safety of flood protection and

the provision of levels, minimal upstream volumes and minimum ecological flow required downstream after the dam.

3. Specification of hydrotechnical node parameters can be done on the basis of measurements with GIS application, which also have the possibility to determine the coordinates of the position of the axes of the dam X-Y.

5. References

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