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DANUBE DAMS — NECESSITY OR CALAMITY?

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Abstract. The authors present certain hydrological data of the Romanian Danube and then give the history of the banking, one of the most important state works of the modern Romania. The dams built between 1910-1978, though resisting many floods with minimal damages were brusted during the flood of 2006, inundating 80,000 ha, i.e. 17% of the banked precints. The authors analyse the natural and the man-made causes of burstings emphasizing the lack of the maintainance of the dams being the main cause of their actual state. The optimal measures for the protection of the floodable lands should be neither destroying the banking system, nor to reverting to altenative land use schemes for agriculture and for pisciculture, but restoring and operating the dam system by a responsible agency adequately organised, moreover establishing floodable precints (on the site of former lakes and marsh lands) for the attenuation of the flood wave.

Key words: Danube, floodplain, banking, floods, dam construction, precints, floodable areas

1. INTRODUCTION

The floods caused by the Danube have drawn our attention to the consequencies of banking the lands in the floodplain in the form of damages resulted from the bursting and overflowing of some dams. There appears the question of the alternatives: natural on-flow or banking regime?

Many newspaper articles as well as various TV news or talk shows have incriminated this type of works which triggered a serious restriction of the river, thus reducing floodplain formation and, consequently, leading to dramatic rises in flood levels. According to the opinion of certain „greens", now it is the moment to restore the wetlands that can be found down-stream the Danube from Iron Gate till Black Sea, before the intervention of the bulldozers and excavators. There are voices crying, that the dams were one of the man-made calamities of XX centhury.

Thus, we consider being useful to present here some data as concerning the banked Danube and the present state of its regularising works.

Photos during the Flood, 2006: 1. Galați under waves; 2. Călărași, Public Garden, Juny 2006; 3. Sărbătoarea, Dolj: the Danube before the dwellings'gate; 4. Vânju Mare: saving the home goods.

2. THE DANUBE — THE MOST IMPORTANT WATER FLOW OF THE MIDDLE EUROPE

The total surface of the Danubian hydrographic basin is 817,000 km^2 extending in territory of 12 countries. Our country is the greatest among them, 92% of territory being drained by Danube and its affluents, with 970,000 ha wetland situated in Romania (540,000 ha floodplain and 430,000 ha the Danube Delta).

The total lenght of the river is 2860 km, out of which 1075 km can be found in our country.

The surface protected by banking measures 437,763 ha, within 54 precincts.

The lenght of the protective dams is 1158 km.

As far as the Danube discharge is concerned, the estimations indicate multiannual average rate of flow of 6500 m^3/sec.

In 2006, the maximun rates of flow have been estimated at about 15,000m^3/sec. During the (historical) maximum flood known, that of 1879, the measurements carried out by the Hungarian hydrologists at Iron Gate, Orşova indicated 16,000 m^3/s, while the European Committee of the Danube admitted a flow of 35,000 m^3/sec at Ismail Ceatal (the Deltas' gate).

3. A SHORT HISTORY OF THE REGULATION OF DANUBE IN ROMANIA

The banking of the Danube Floodplain for protecting the lands and for creating new agricultural surfaces has been a permanent concern of the Romanian experts. Thus, one of the first ordonance of King Karl Ist had established the Royal Committee of Banking.

In 1910, 7,122 ha had banked, and at the begining of 1929, using the funds of the War Damage Compensation, the works for another 25,405 ha had been started (Antipa, 1910, 1921).

Within the debates of the Committee for Banking of January-April 1929, which took part under the supervision of Minister Ion Mihalache, with the contribution of 34 experts, several proposals were forwarded by the well known hydrotechnists, i.e.146,660 ha — by Eng. Greceanu; 194,170 ha — by Eng. Vidraşcu, 236,035 ha — by Eng. Georgescu.

At the same time, the construction of some insubmersible dams (pursuant Anghel Saligni's suggestion) with the dam crest situated at 1.5 m above the maximum level reached in 1879.

We mention the fact that this is the greatest flood known up to the present (at Oltenia, the level has reached 784 cm above the „zero" mark of the tide gauge, the high water mark being 17,85 m.

All these dams built in this manner have been satisfactory, resisting many floods (e.g. those in 1940, 1962, 1965 and 1970). Only two unfavourable cases, with local bursting of the dams are known (at Zimnicea–Năsturelu and Gostinu–Malu Roşu, Ciuca, 2001).

In 1978, due to modern, mechanised earthworks, following the plans of high-

specialised institutes, all of Danube and the adjacent zones of its affluents were banked.

4. THE ACTUAL SITUATION OF THE DAMS OF DANUBE

There appears the question why in 2006, during floods of the Danube (which were less than the maximum known), more dam burstings and overflows occured.

According to official data, about 80,000 ha were flooded (out of which 60,000 due to natural overflows and 20,000 ha due to controlled overflows meaning the attenuation of the flood), which represent about 17% of the protected surface.

The damage was visible both in the agricultural fields and especially in the case of buildings, many dwellings being laid in ruins. The media presented chocante? images of houses breaking down, of drowned, bloated animal bodies, of domestic goods floating in muddy water and of desperate people ower ruins of their homes.

A first question that needs to be adressed by experts is to find out how many dams had their dam crest overflown and how many were destroyed by the water (we make reference here to the dam based properly and not the provisional ones built mostly from sacks with sand).

A second issue that should be clarified is who manages these dams in present days and who was (and is now) in charge of maintaining and supervising them.

Before 1990, the dams were under the supervision of the Agricultural Ministry; there was an entreprise of their exploitation and maintenance (IELIF: Entreprise of Exploitation of Land Improvement).

This entreprise had, as one of their activities, the task of maintaining and supervising the dams. In order to do these, there was hydrologist assistants (dam keepers) who lived in the watch houses built at the same time with the dams, every four kilometers along its length.

Those dam keepers checked the dam section alloted to them every day, mending them and, during high water periods, closely watching their effects upon the dams, taking the necessary measure in time and notifying the authorities by phone whenever the problems could not be handled by themselves.

At present, all these watch houses are abandoned; in fact, after 1990, nobody took care of maintaining and fixing the dams.

Thus, the water flowing over the dam crest of the dams is due to various natural and man-made causes:

— The reduction of their height as a consequence of the natural phenomenon of earth compaction;

—The erosion caused by rainfalls and wind blowing;

— The subsidence caused by vehicles moving on the dam crest and especially the earth compaction, which resulted in local surface „faults” of various depths

— The bursting phenomena (the breaking of some dams) is due to total lack of maintainance: many rodents (moles, gophers, hamsters, etc.) have found shelter inside the dams by creating holes, which favoured water infiltration. It has been noticed that the higher the water rise, the rodents migrated upward in the dams, leaving traces behind.

— There were cases of use of the dams' material (loam, sandy clay, silty clay) by the nearby inhabitans, digging large „quarries" in body of the dam.

This situation has also been shown in the case of the dams on the Ialomița River and other affluents.

In this situation it is expectable, that these dams, which were subjected to the pressure of high waters for almost two months, they could not resist in the same year.

5. WHAT IS TO DO?

Coming back to our basic problem, that is what we should do in the future, our institutes and professionals shall analyse a few possibilities:

a. To abandone the banking system and to restore the initial state: a range of marches, lacs, tied by natural chanels (so called gârle, japşe), with natural water supply from the Danube.

This „100% ecological" alternative is favourable for the wildlife (as aquatic and aqifauna), could equilibrate the climatic state of the Danube valley, but necessite evacuation (and feeding) of hundred thosents of inhabitants and loss a similar magnitude of agricutural surfaces.

b. The construction of some less high dams (overflow dams, spillways), which could allow the periodic flooding of some precincts at certain, controlled levels (Vidraşcu, 1921).

This measure would allow an alternative „ecological" exploitation of the land through rotation: in some years (with lower level) it could be used for agricultural purposes and in others (with high water levels), for piscicultural purposes. But it seems that the damage that could be done does not justify this measures, because the submersible dams, once flooded, would be washed away by water to high extent and their periodic reconstruction would be very expensive. Similarly, the spillways built within the insubmersible dams would be greatly damaged during each flood (except for the case when they were tightly consolodated through pitchings, which would also involve unjustified costs). Usually, Danube is flooding during April – July and lasts for over 30 days. Consequently, on the lands that are subjected to flooding, all the crops sown in autumn, as well as the ones sown in spring are in full development, some even reaching maturity. The damage would be enormous, the crops being completely lost; moreover, turning these flood plains into agricultural lands would take more than a year as the water needs to be drained first gravitationally, then by pumping it from the lower fields, which also involve supplementary costs;

In fact, this kind of mixed exploitation is not agreed upon in any of the countries where only submersible dams were built (for exaple, 8.000,000 ha are banked in this manner in the USA, 3.700,000 ha in Hungary, 40,000 ha in Bulgaria).

c. For attenuating and finally eliminating the effects of the floods, the following measure could be considered:

— The construction of some precincts for controlled flooding, i.e. the lands that are located at lower levels, thus creating some „polders". These lands could be mainly the former ponds and lakes. We have remember that their draining and turning into agricultural land use was more of a constraint, imposed by the political regimes of

those times, when the slogan was „to subdue Nature by Man!" In this years, Gh. Gheorghiu-Dej (1952) and Al. Moghioroş demanded that corn crops on wetlands should be extended to the maximum by drainage of the ponds and lakes in the areas of Dăbuleni, Greaca. Boianu–Sticleanu, Călăraşi pond and Brateş and Măcin lake.

— The necessity to built new compartmentalizing dams meant to separate the agricultural lands from the floodable ones, which would also have piscicultural use;

— The accomplishment of some aditional channels for draining and evacuating the water infiltered into the adjacent agricultural fields;

— The analysis of the possibilities of supplying these „polders" gravitationally if they are to become piscicultural objects. This is due to the fact, that over significant periods of time the level of the Danube waters does not allow gravitational water supply.

We mention that in 2004, the Ministry of Water and Environment Protection (through the National Institute of the Danube Delta Research–Development) developed a project for the ecological restoration of 3200 ha in the Călăraşi-Răul precinct by building some embrasures in the existing dam, for gravitational water supply of the pond, their floor level being situated between 8-9 m above sea level. But the analysis of this project has shown, that the land proposed for piscicultural improvements has an average level of 9.80 m ASL, with variations between 8.30 and 11.00 m. As a consequence, it has resulted that gravitational water supply is possible at low and medium levels only for few years and for short periods of time.

— Another aspect has to be taken into consideration: in the area of the former ponds and lakes there are hydrotechnical works for their drainage and irrigation, spillways, delivery pipes, drains, pumping stations, bridges and their rustic types, terraces, dwellings etc.). What will happen with these goods? It has to be analysed (will they be demolished or flooded?) as their value is more than billions of RON.

Taking into account of the facts mentioned above, we could conclude the following:

The insubmersible banking of the agricultural lands in the Danube Floodplain is still necessary. For this, there are necessary the following requirements:

a. Re-analysis of the high water marks, their duration and frequency, taking into account of the new hydrological data (depth and geometry of the section of the riverbed) and the floods in the past starting with 1879;

b. New surface mapping (in-line and transverse profiles) of the dams, to reflect their present condition and the reparations which will be necessary;

c. Revision of the dam crest assurance level, that is if the usual ones of 10% to 5% are still effective by comparing them with the maximum level known, the one in 1879, as well as with one of 2006;

d. Establishment of centrally and locally coordined institution (entreprise or plant) for planning, maintaining, executing and supervising these works, envolved with necessary personal and means,

e. Replanning of the equipment suitable to these earthworks (in the past, the best one proved to be the scraperof various sizes, which dug, transported and laid the soil in layers; it also compacted it, reaching high speed on any terrain). We consider the actual system inadequate for these works as it consists of scoop shovels, tip lorries

and scrape dozers wich spread the soil without settling it satisfactory;

f. Studying again the boundaries of the floodable area of the Danube and passing adequate laws stipulating the type of buildings that are suitable for the area (adobe houses built here proved to have generated significant damage).

g. Creating some „polder"-type surfaces to discharge and attenuate the floods, especially in the low areas (the former lakes and ponds), which can be used for piscicultural aims, also creating the high demanded „green corridor" along the Danube, without dislocating settlements and people and with minimal loss of the agricultural surfaces. For achieving this, the present precincts will have to be fragmented by new compartimentalizing dams.

6. INSTEAD OF CONCLUSIONS

We consider that a general analysis of the Danube floodplain would not be a mistake, despite to the fact that the territory is extremly complex.

We think, that parallel with a general analysis, an individual analysis should be performed for each precinct, taking into consideration the existing works, the new hydrological data, the value of the existing investments etc. Only doing so could a viable, possible and optimal solution be found and the dams will be a *real necessity*, no a calamity.

Finally, we mention the opinion of Eugenio Nazzani (1979), professor of hydraulic engineering school, Rome: „the choice of the banking system has been an issue among the technicians and even today there is still a heated debate concerning the usefulness and effects upon maximal waters". Nazzani also rightfully says that „banking has not been the result of some theories, but only the creation of the civilization".

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