

## THE 2003 -2007 MINIMUM, MAXIMUM AND MEDIUM DISCHARGE ANALYSIS OF THE LATORIȚA-LOTRU WATER SYSTEM

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**Abstract.** - *The 2003 -2007 minimum, maximum and medium discharge analysis of the Latorița-Lotru water system* From a functional point of view, the Lotru and Latorița make up a water system by the junction of the two high hydro energetic potential water flows. The Lotru springs from the Parâng Massif with a spring quota of over 1900m and an outfall quota of 298m, which makes for an altitude difference of 1602m; it is the affluent of the Olt River, has a course length of 76 km and a minimum discharge of 20m<sup>3</sup>/s. Its reception hollow is of 1024 km<sup>2</sup>. Latorița springs from the Latorița Mountains, it is a small river with an average discharge of 2.7m<sup>3</sup>/s and is an affluent of the Lotru. Together, the two make up a high hydro energetic potential system, valorized in the system of lakes which serve the Ciunget Hydro-Electric Power Plant. Galbenu and Petrimanu are two reservoirs built on the Latorița River and on the Lotru, we have Vidra reservoir, Balindru, Mălaia and Brădișor. The discharge analysis of these rivers is very important in view of a good risk management, especially consisting in floods and high level waters, even in the case of artificial water flows such as the Latorița-Lotru water system.

**Keywords:** Lotru, Latorița, water system, discharge, risks.

### 1. General consideration

The Lotru basin is the largest hydrographic basin, with a big water discharge and tremendous energy. The Lotru's spring originate in the Parângul Mare Massif, in the glacial lake Câlcescu. From the main crest of the Lotru Mountains, the river gets the majority of its effluents almost entirely oriented from North to South. The Lotru "gathers" the waters from the entire Latorița hydrographic basin with the help of the

latter, thus drastically increasing its discharge. The high discharge and energy of the Lotru River, determined by the great differences in the flow level, have constituted the premises of building one of the biggest hydro central in our country. In order to analyze the discharge of the Lotru River we have included in our study the data gathered from the hydrometric stations Voineasa, Gura Latoriței (on the Lotru), Mălaia and Valea lui Stan, and for Latorița, the station from Gura Latoriței (on the Latorița). However, we must note that, given the fact that we are dealing with an artificial system, the discharges measured may not reflect the natural outflow. We shall, therefore, analyze the situation of the outflow between the 2003-2007 period.

## 2. Medium discharge

The medium annual outflow of the rivers from the Lotru hydrographic basin is primarily influenced by the amount of precipitation, evapo-transpiration, the water's retention and subsidence and last, but not least, the geologic conditions of the studied region,

**Table 1** Medium discharge

Year/medium discharge (mc/s)	Voineasa	Gura Latoriței (Lotru)	Mălaia	Valea lui Stan	Gura Latoriței (Latorița)
2003	0,36	1,91	16,8	1,31	1,91
2004	0,61	3,15	20,2	3,2	3,15
2005	2,03	3,96	33	2,79	3,96
2006	0,81	2,42	27,4	2,07	2,42
2007	0,85	2,46	21,6	2,85	2,46

\*source: Romanian Waters, Vâlcea

Considering the situation of the medium discharges within the 2003-2007 period we can observe a discharge growth until the year 2005, [2.03 m<sup>3</sup>/s at Voineasa, 3.96 m<sup>3</sup>/s at Gura Latoriței, 33 m<sup>3</sup>/s at Mălaia, 2.79 m<sup>3</sup>/s at Valea lui Stan and 3.96 m<sup>3</sup>/s at Gura Latoriței (Latorița) specific values for 2005] when we record the highest values, mainly because of the huge quantity of precipitations within the Lotru hydrographic basin but also because of the low evaporation rate. On the other hand, in the following years, 2006 and 2007, the discharge variation is going to decrease, being influenced by droughty periods (Table 1).

After an analysis of the medium discharge for the Latorița River we can observe the same situation, a progressive growth starting with the year 2003 until 2005 when we record the peak of the medium discharge values (caused by abundant precipitations), followed by a decrease in the years 2006 and 2007.

Regarding the medium season-based outflow repartition we will observe that during the cold season the medium outflow reaches values of about 20% from the total and is influenced by the quantity of precipitations but also by the thermal air regime. Spring is the season with the most important outflow, mostly due to snow melting, a large quantity of liquid precipitations but also, because of low evaporation. Although precipitations are abundant, during the summer time the medium outflow decreases dramatically, especially because of increased evaporation. During this time of the year approximately 20% of the annual outflow takes place. During the autumn the medium outflow percentage revolves around 15% mainly because of large quantities of precipitations and a relatively low evaporation.

### 3. Maximum and minimum discharge

In reference to the minimum and maximum discharges recorded within the Lotru-Latorița water system we have to specify that these

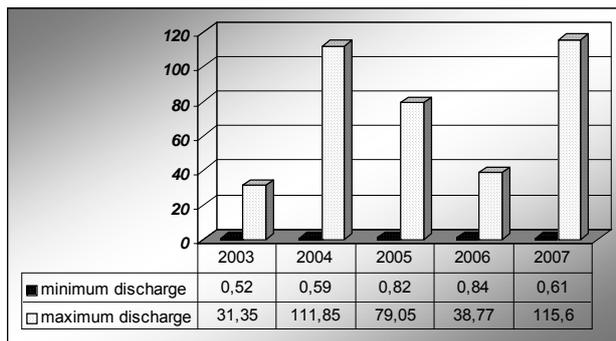
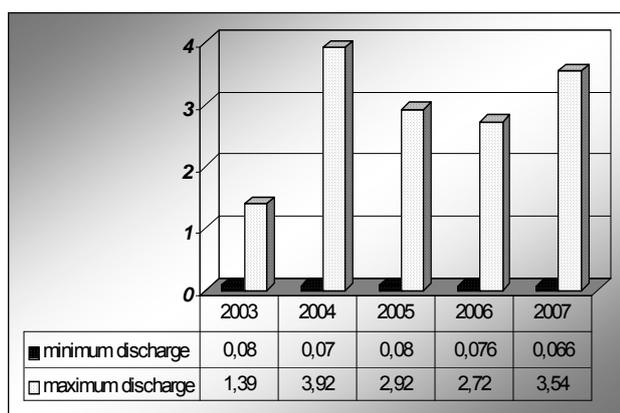


Fig. 1 Lotru River – maximum and minimum discharge

“irregularities” are the cause of articular situations. What we are talking about here are the maximum discharges which have been influenced by high quantities of precipitations in a short period of time, or minimum discharges as consequence of long droughty periods. We do observe that the difference between the maximum and minimum discharge during a year is remarkable. For the Lotru River, the biggest difference value was recorded in 2004, when the difference was of over 100 m<sup>3</sup>. In the case of

the Latorița River the differences are somewhat smaller due to lower general discharges. We will note that the highest difference was also recorded in the year 2004, a year where periods of excessive rains and drought alternated thus granting the climatic factor a great impact on the hydrographic basin.

The maximum discharge is the most important phase in a river's discharge regime because, in order to execute and use hydro technical facilities, we must keep in mind that there is a possibility of having destructive effects as consequence of floods and deluges. Generally, this phase occurs at the end of the cold season, when the melting of snow is accompanied by high precipitation levels.



**Fig. 2** Latorița River - minimum and maximum discharge Latorita

Minimum discharge is recorded both during winter and summer. During winter, it is because of the fact that most of the precipitations in the water pool take on a solid form and are quartered in the snow mantle, or because of long term low temperatures, followed by the frost, which, in the case of some smaller rivers turns into a complete frosting of the river flow. On the other hand, during the warm season it is due to high evaporation and it can have serious consequences which can recoil on the population's water supply as well as on the economy.

Returning to the minimum and maximum discharges recorded on the Lotru and Latorița, we can observe very high values in the years 2004 and 2007, two years with long periods rich in precipitations, while the minimum discharges are recorded in the year 2003, characterized by a pluviometric residue. The same situation is recorded in the case of Latorița, the biggest recorded discharge within the given period of time was in 2004 and the lowest in 2003 (Figure 1 and 2).

Why it is important for us to know these special river discharges situations? Because, if we were to face critical situations, whether it is about deluges, big water levels, floods, or low water levels, these situations must be dealt with as quickly as possible and with less possible damage. Risk assessment, in the case of rivers from the Lotru- Latorîța water system, involves a monitoring activity of all medium, maximum and minimum discharges from every hydrometric station within the system, data interpreting and taking measures for preventing or

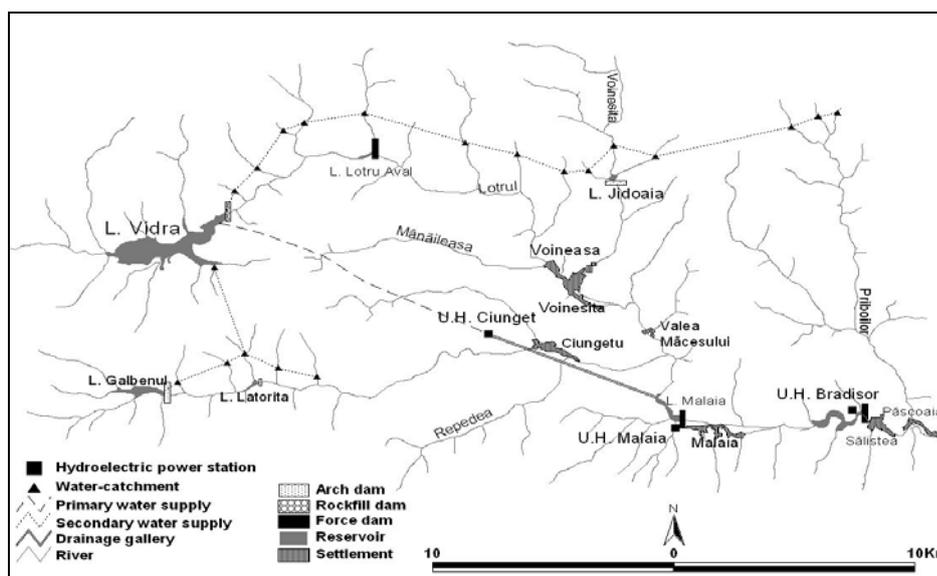


Fig. 3 Lotru hydro-electrical plant (according to Pop, 1996)

eliminating special situations. In order to do so, a first and primary condition is to have good collaboration and communication between hydrometric stations so that the best measures to be taken in the shortest of time. Along the course of the Lotru River four hydro energetic facilities have been built, which, together with the ones on the Latorîța serve the Ciunget Hydro Electric Power Plant (Figure 3). For both of the named rivers we are dealing with waterfall systems. The water coming from the rivers' discharge, from their effluents, but also from precipitations is stored in the barrier pool and the water there is a source of energy for the pool downstream. Since we are dealing with artificial water flows the problem of devastating floods is less probable, the deluge

is taken over by the barrier pool. However, in the case of long drought periods the river discharge can drop to such a point that it can no longer sustain the hydro energetic system. In order to eliminate this type of problems a new caption system has been introduced which can bring forth a water infusion from outside the system.

#### 4. Conclusions

What characterizes the hydrographic aspect of the study area is the special energy of the rivers which present important differences of level between their sources and their effusion point, but also a rich and constant discharge. This energy has been valorized mostly by the barrier pools system, caption, the hydro central and the hydro electric power plant.

The discharge analysis of the Lotru and Latorița rivers is highly important as it allows us to anticipate special situations, to make a forecast on various circumstances and phenomena and, last but not least, to take appropriate measures and see that we eliminate any critical situation that might come up. The water outflow of the rivers from the Lotru-Latorița water system must be monitored accordingly precisely in order to diminish the risks it can provoke. So, this hydrographic system acts as a catching factor for this region (especially the west part of Loviștea Land), mainly by the location of settlements, by supporting the food needs of the population (fish resources), but narrowly, as we mentioned above, because the critical situations.

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