Bulletin UASVM Horticulture, 69(2)/2012
Print ISSN 1843-5254; Electronic ISSN 1843-5394

Considerations Regarding the Flood Wave Propagation in Natural River Beds and the Measures that Need to Be Taken Flood Damage Reduction

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Abstract. Flood wave occurs when the flow rate of water supply is greater than the evacuation flow, resulting in transmission along the river bed of variables flows that overlap existing current. Technical solutions that are necessary to control the primary cause of flooding (dangerous rainfall), consist of erosional action on slopes, while achieving the hydraulic systems.

Keywords: flood, flow, inundation, slope, evacuation

INTRODUCTION

Flood or hydrologic phenomenon formed and propagated from upstream rivers, the transit from one section to another, can compare with the power and simultaneous emptying of a vessel on different surfaces depending on their form.

In this work are taken into account maximum flood waves produced on the Mures River in the flood years 1970 and 1975 and their propagation mode in the basin.

To see the evolution of surface leakage that the intensity of rainfall can turn into floods, we follow their proposed distribution scheme based on rainfall (Fig. 1) that according to R. Linsley contains:

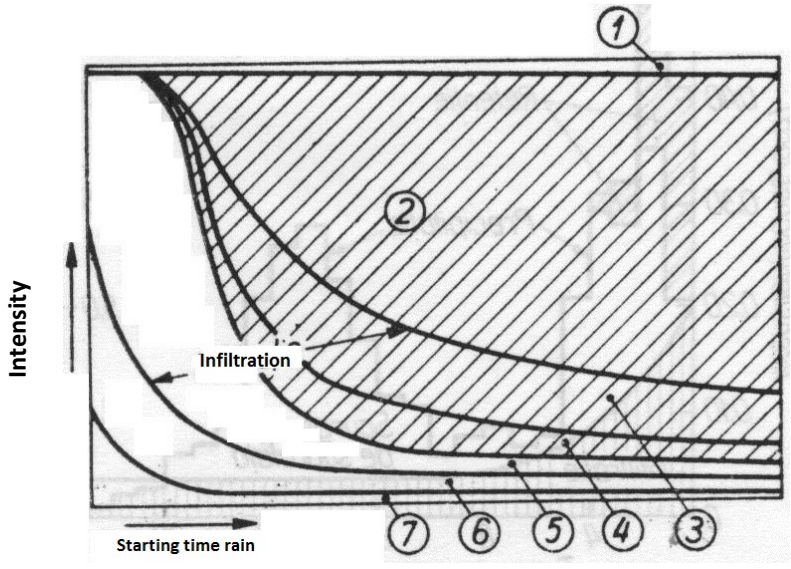

Fig. 1. Uniform distribution of precipitation scheme

Where:

1. - precipitation which fall directly on the mirror of water from lakes and the rivers
2. - is the flow of surface water on revolving the shortest way to the ramifications of the hydrological network, it is collected

3. - intermediate flow (hypodermis or interflow), which represents the flow entering the zone of aeration and revolving through this to the river
4. - base flow or groundwater, which consists of that portion of precipitation that is able to penetrate to the saturation zone
5. - accumulation of water in the aeration zone, which increased soil moisture in the area
6. - water held in the bumps on the surface, which can be evaporated or infiltrated into the soil
7. - water held in special summer tree foliage.

MATERIALS AND METHODS

As it is known, every 10 – 15 years, and lately even in 5 – 6 years, floods in the river courses reached extraordinarily high proportions, they exceeded normal limits major river, river flooding vast areas.

Evaluation of large floods is performed using A parameter (M. Parde - France), as follows:

$$A = \frac{Q_{max}}{\sqrt{F}}$$

Where:

Qmax - is the maximum flood flow in m^3 / s

F – hydrographic basin area in km^2

Ex:

Sena – Paris – F=44320, Qmax = 2316 m^3/s => A ≈ 11

Dunărea – Orşova – F=576000, Qmax= 15938 m^3/s => A ≈ 211

Mures river basin is located in the area bounded by Eastern, Southern and Western Carpathians, which includes the eastern part of the Tisa Plain center (Fig. 2).

Fig. 2. Mures basin

Entire hydrographic basin area is 29,500 km^2, of which 27,890 km^2 in Romania, including full Mures and Alba, and partly Harghita, Sibiu, Cluj, Hunedoara, Arad, Timis and Brasov counties patches, Bistrita Nasaud, Caras Severin.

The main affluent of the Mures and their lengths from source to mouth are: Aries - L = 166 km, Tarnava Mica - L = 196 km and Tarnava Mare - L = 1223 km, which unite before shedding Blaj in Mures, Sebes - L = 96 km, Strei - L = 93 km etc.

In the past 50 years the largest floods occurred in 1960, 1068, 1970, 1975, 1981, 1994 – 1999, and the maximum flow recorded the Mures River and its tributaries some period considered were: 1210 m^3/s Mures to Glodeni (Targu Mures) in 1970 that 1225 m^3/ s - 1975, 2450 m^3/ s - Alba Iulia 1970 and 2320 m^3/ s in Arad during floods in 1970 and 1975, 979 m^3 / s - is the Aries River (Turda 1975 and 1995), 1035 m^3/ s - High river Tarnava (Blaj 1975) and 636 m^3/ s Târnava Minor (Târnăveni 1975).

As concerning groundwater resources, river Mures totaling about 764 million m3, of which can be tapped about 527 million m^3. The groundwater resources amount to approx. 215 million m^3 and the depth of about 312 million m^3, is located mainly in the plain Arad and Banat.

RESULTS AND DISCUSSIONS

Given the vast expanse of the Mures river basin (about 27,920 km^2 in Romania), which includes all forms of terrain, from plains to the spectacular gorge located between Deda and Toplita, 50 km long and 80 – 100 m wide, it is considered the third largest among rivers and river basins of Romania.

Considering the floods in 1970, the upper and middle Mures (Giurgeu Depression - Alba Iulia, fig. 3), we find that the center has achieved a high rainfall of 200 mm within 36 hours, accumulated over 15 % of total rainfall on 365 days of a normal year.

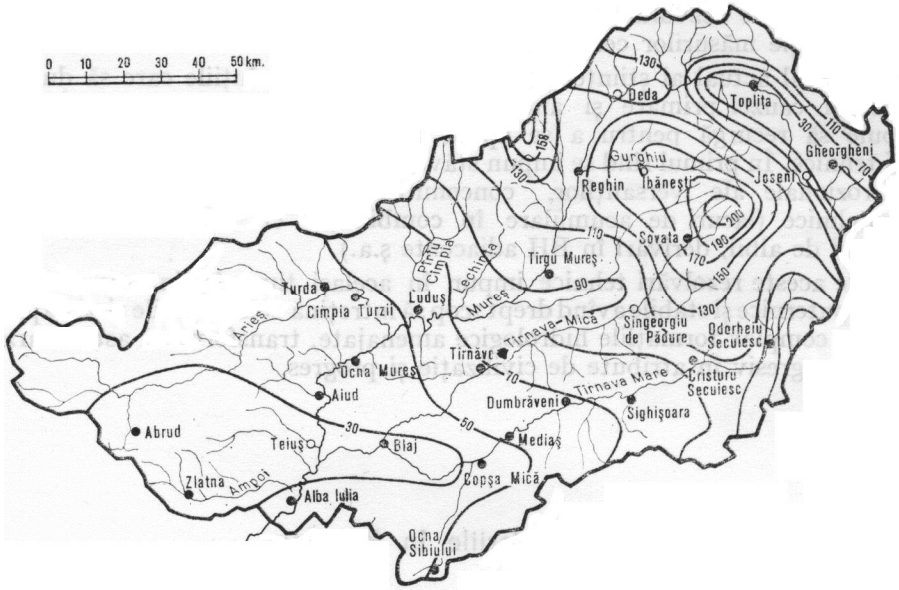

Fig. 3. Mures Isohyetal map - floods of 1970

Flood wave attenuation was achieved by the 31 of which 7 are non-perennial reservoirs with a total of about 73 million m^3 and 24 permanent reservoirs with a total of 611.3 million m^3 of which 473.6 million m^3, the volume normal retention and 119.3 million m^3 total volume mitigation.

Among the most significant works of flood protection are:

- Basin Tarnava Mare - temporary build Vânători, 25 million m^3 and Zetea with a volume of 18.4 million m^3 mitigation.
- Basin Târnava Mică – Bălăuşeri – 24,5 mil m^3 and Bezid on the Cuşmed – 10,2 mil m^3
- Niraj River Basin - 8.1 km adjustments and undersized dams
- River Aries: 6.067 km dikes adjustments 6.96 km, 4.04 km Mihoeşti stockings consolidation and accumulation of defense against flooding downstream towns
- River Mures – 9 km embankments for flood protection in the Iernut. Flow propagation along the watercourse in 1970 was different in a flood parameter A = 9.0 ... 18.3, represented by four successive hydrographic stations: Stanceni, Glodeni Ocna Mures and Alba Iulia (Fig. 4)

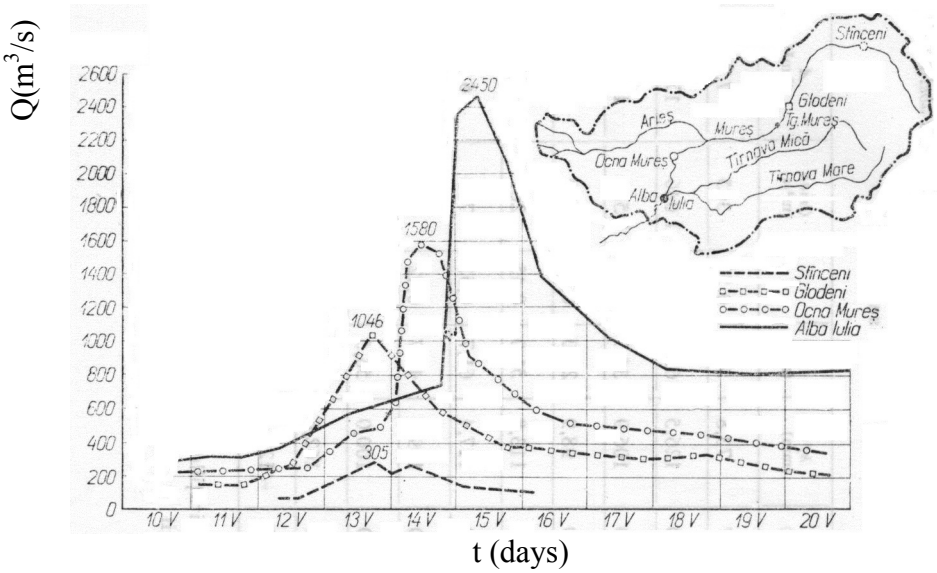

Fig. 4. Flood mitigation on the upper river Mures (successive hydrograph)

In terms of erosion on agricultural land in the Mures river basin was found to occur on about 654,000 ha of which have about 70% erosion surface, approx. 18% erosion depth and about 12% of total landslides were largely stabilized.

Torrentiality Heritage Forest is an area of 220,000 ha, and the most vulnerable areas are Aries middle and upper plateau Târnavelor, right side of Mures between Alba Iulia and Deva, the upper and middle basin Stream and most of the basin Cerna river.

On the Mures River Basin have been identified 292 torrential basins and perimeters for improving the degraded terrain comprising 383, torrential formations with works performed on an area of 80,103 ha of forest which occupies 56.7%.

Also a very dangerous phenomenon is landslides which pose a high risk, especially in Târnave basin, Mures basin, between cities Reghin and Alba Iulia, the lower basin of the Aries River, downstream from the town of Turda, lower row of Mures river between the towns Cugir and Deva and the interfluve area Mures-Deva on the sector Zam-Paulis, Arad county.

These phenomena particularly dangerous are controlled largely by numerous works afforestation, protection of banks on the rivers of the basin and torrent correction works performed on 141 km.

CONCLUSIONS

Mures basin viewed as a whole, stands primarily through landscape diversity and the huge potential available in industrial and civil sites concerning.

For better management of the supply network must be refurbishing existing derivations and design new uses energy, water and irrigation on the Mures River and its tributaries.

As far as the purge stations (from the 349 – 40 % are malfunctioning), we think that urgent investment in existing ones and performing other stations properly sized in order to remove pollutants, as some cases have phenomenon of "biological destruction ".

- Tarnava Mare downstream of Sighisoara and especially downstream of Copsa Mica;
- Arieş downstream of Baia de Arieş;
- Amoi: downstream of Zlatna etc.

By exploiting the often uncontrolled ballast resource in the over 180 ballasts of the Mures river basin, it was in many places to sip Mures river thalweg lowering a part of its tributaries, about 2-2.5 m and the minor riverbed widening. These operations lead to reduced groundwater aquifer used as a source for water supply, imposing controlled operation or stopping the operation, especially in water catchment areas (eg. Paglisa - Alba Iulia, Simeria capture, Deva capture etc.).

In terms of tourism and leisure potential of this river basin, it is worth valuing therapeutic potential groundwater resorts: Baile Turda, Sangiorgiu Forest, Rastolnita, Sovata Geoagiu Bai, mines Sibiu Lipova and Lunca Bradului etc.

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