FLOOD DISASTER IN SERBIA IN THE SPRING 2006

Zoran ČEKEREVAC*

During March, Serbia faced a problem of bird flu and almost at the same time the problem of landslides. In April, almost nobody mentioned these problems. Those day's priority problems were large floods. A total of more than 30 municipalities had been affected throughout North and Central/Eastern parts of Serbia. A state of emergency was declared in many municipalities. This paper discusses those days' floods day by day, as well as the floods consequences. At the end of the paper some future activities concerning floods prevention are listed.

INTRODUCTION

During March 2006 Serbia faced a problem of bird flu and almost at the same time the problem of landslides. In April, almost nobody mentioned these problems. Those day's priority problems were large floods. The flooding was caused by heavy snowfall late in the season and was intensified by the spring rains that arrived. Between the 14th and the 16th of April, the water level in rivers reached the highest point in 100 years. A total of more than 30 municipalities had been affected throughout North and Central/Eastern parts of Serbia. A state of emergency was declared in many municipalities including Belgrade, the capital city of Serbia.

Figure 1 Map of Serbia (Source: Wikipedia, 2006b)

* Prof. Dr Zoran Čekerevac, Ph.D., Railway College Belgrade, Zdravka Čelara 14, YU11000 Beograd, Republic of Serbia, tel.: +381 11 329 25 16, e-mail: zoran.cekerevac@vzs.edu.yu

To see the different influences on late floods it is necessary to pay attention on some geographic and climate characteristics of this area:

- Serbia is located on the Balkan Peninsula;
- extremely various terrain, from rich fertile plains to the north, limestone ranges and basins to the east, ancient mountains and hills to the southeast and west and a table-land surrounded with extremely high mountains at southwest;
- climate conditions varying from continental climate in the north (cold winters and hot, humid summers with well distributed rainfall) to the continental and Mediterranean climate in the central and the south portion; in the relative small area hot, dry summers, rainy springs and autumns and relatively cold winters with heavy snowfall are revolving;
- Serbia is a country with a lot of water and branchy watersheds; very rare are aridity summers.

1 FLOODS

Towards the end of March the problems with land sliding occurred. Number of landslides appeared in the central and western part of Serbia. In the region of Čačak there were evident more than 70 landslides, in Požega 17, Aranđelovac 30, Valjevo 158. Hundreds of families lost their homes. But, another, very big risk appeared at the same time. Due to thaw of snow and heavy rains creeks and rivers overflowed, as well as the subterranean water soaked fields and cities.

The Zapadna Morava overwhelmed in the region of Požega more than 1000 hectares of fertile land on the March 23rd. At the same day in different places in Serbia due to overgrowing of rivers Kolubara, Jadar and some smaller rivers and canals thousands of hectares were overwhelmed too. More than 600 hectares near the city of Smederevo were destroyed by water from so called Red Water Canal. But it was only the beginning.

Due to heavy rains and rising of water levels of all rivers, mainly in the middle flow of rivers, a number of new lands sliding grew up, so on the March 27th in many regions, the statement of natural disasters was proclaimed. Subterranean waters become a very dangerous enemy. The Sava River grew rapidly and on many places statement of regular or even exceptional defense was declared. In Šabac city 200 family houses were partly under water. But, even on the March 29th, it looked as things were under control. The Velika Morava, which caused a lot of problems to the population, reached the level of 478 cm by Bagrdan, almost the level for the regular defense. Downstream, influence of the Danube was perceived.

Two weeks of flooding in large swaths of central Europe, caused by melting snow and heavy rains, have swelled tributaries draining into the Danube. From day to day water level rose up on all rivers. So on the April 8th, even the country's capital Belgrade started to suffer from Sava’s water. Some low-lying streets were flooded on Sunday, bringing traffic in the city to a halt. Parts of the Belgrade fairgrounds were submerged as the Sava spilled through sewer pipes into the complex, located on the river bank. The pluvial canalization started to conduct water from the river side to the streets near the Belgrade fair, so soon it looked like on the figure 2.

Belgrade braced for the highest water levels in the Danube and the Sava rivers since 1981 on April 10th, 2006 as the country's authorities introduced emergency flood measures after some streets in the capital were submerged over the weekend. Scores of Belgrade's popular riverside bars and restaurants were already closed.

The high water levels were driven downstream into the Balkan republic, where water level peaks were expected midweek. In the northern, Vojvodina province, Serbian emergency crews are shoring up river and canal banks with sandbags as part of government-introduced emergency flood measures. In Novi Sad, Serbia's second largest city and Vojvodina's provincial seat, volunteers were called to fight the flooding.

Figure 2 Boulevard near the Belgrade Fair

On April 13th, new record! The situation was at its worst in the northern province of Vojvodina, near Hungary, where flooding had driven hundreds of people from their homes. It was the same water that had ravaged parts of Hungary, Germany, Austria and the Czech Republic the week before. Danube, Sava, Tisa, Tamiš and their tributaries had all flooded. Soldiers and civilians had been battling a natural enemy. In northern Serbia they had been building barricades of sand bags to keep the ever rising waters at bay. Rain was still falling.

Serbian government introduced emergency flood measures. On April 17th the main priority was to keep the embankments stable. The Danube has reached record highs in Serbia, Romania and Bulgaria in the past few days, flooding towns, villages and farmland. The level of the Danube near Veliko Gradiste, a town 90 km east of Belgrade and close to the Romanian border, reached an all-time high of 965 cm. A strong southeasterly wind was reported to have picked up, threatening sandbag barriers. In the eastern town of Smederevo, authorities drafted all men employed in the municipal services to flood-fighting crews on the Danube. Dozens of Smederevo residents were evacuated to a refugee center and 2 000 hectares of fertile farmland surrounding the town were flooded. The problem was that few Serbian towns and cities, except Belgrade, had the necessary heavy machinery required to fight floods around the clock. Military assistance was the only solution to help the town, because the volunteers were tired, and it was hard to keep up the tempo day after day.

In the northern Vojvodina province the flooding and heavy rains swelled several Danube tributaries, completely submerging some 10 000 hectares of farmland and turning 200 000 hectares more into mud and slush that could threaten crops.

On April 19th, the Tisa River level reached 806 cm and the worse situation was near Žabalj Bridge. There was a lot to do to save the embankment. Military forces and volunteers filled up barges with sand and corrected the embankment even from the river side.

Figure 3 Barge on the Tisa River

The Tisa reached 815 cm, and the Danube near Veliko Gradište reached its absolute maximum 919 cm. By Smederevo the Danube reached 803 cm with further growth to expected 811 cm. The railway traffic was broken because begs filled with sand were placed over the rails to protect downtown.

Figure 4 Scenes from Smederevo fortress

Figure 5 Railway in Smederevo a) April 13th,2006 b) April 17th,2006

On April 21st, the Tisa reached 944 cm by Novi Kneževac, the Sava reached 626 cm by Sremska Mitrovica and the Danube 828 cm by Smederevo. It seemed that the peak level was reached and on some places water level was for a few centimeters lower than before. The next day, situation was stable on all rivers and tendencies were “slight falling” and “stagnation”. At that time it could be said that the water level would not rise up, but the possible problem could be wet and squashy embankments.

Figure 6 Danube – Details from the quay in Zemun (April 22nd, 2006)

2 FLOODING INFLICTS MILLIONS OF LOSSES IN NORTHERN SERBIA

Consequences of the current floods are still immeasurable. Some analyses show that:

- Serbia has seen the highest water level in the past 100 years;
- the Serbian government declared a state of emergency in nine municipalities for fighting the flooding, which was caused by melting snow and heavy rain;
- more than 240 000 hectares of land in northern Serbia were flooded, or threatened by underground waters and landslides; out of the 240 000 hectares, more than 122 000 hectares

are flooded, more than 112 000 hectares were threatened by underground waters and landslides threatened more than 5 500 hectares of arable land;
- according to the reports, the most threatened areas were the district of southern Backa with more than 50 000 hectares and central Banat with 42 000 hectares under water;
- the 35 million EUR, allocated from the budget to compensate damage from floods, had been spent in the April and that the real damage would be known when the water withdrew and later;
- the state of emergency and defense measures against floods remained in force even during the May; it was necessary more than six weeks the water level was dropped;
- after the rivers reached their maximum, the underground waters were a far greater danger.

3 CONCLUSION

Bearing in mind geographic characteristics of watersheds and very restricted area for building big accumulations for the control of high-waters, it seems that for the defense of some vital areas in the Republic of Serbia (Vojvodina, Mačva, Srem, Donja Posavina, Belgrade and Pomoravlje) could be used only the measures from a group of passive types. It is necessary to adopt these measures to the real demands and conditions. The principle of protection with accumulations could be effective, but in the case of Serbia too expensive.

In the future activities special attention is to be paid to the:

- non-investment measure of protection;
- permanent analysis of the situation, the conditions and measures for flood protection;
- adopting to the current conditions according to the principle of tenable development;
- systematical and quality maintenance, reconstruction and control of the existed objects;
- intensive international cooperation;
- exploration of new methods and technical solutions for the population and the properties protection.

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