SREDNJA ŠKOLA VRBOVEC

SPHINX

FLOOD IN GUNJA

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FLOODS

Floods are a natural phenomenon that often occur and cannot be avoided, but by taking preventive construction and non-construction measures and responsible behavior, the risks of flooding can be reduced. Floods leave indirect and/or direct consequences in agriculture, transport, energy, infrastructure and facilities and represent a risk for environmental pollution, and thus the life and health of living beings. The causes of floods can be increased amounts of precipitation, precipitation of a longer duration, precipitation associated with the melting of ice and snow, precipitation of great intensity, and damage to water structures caused by an earthquake.

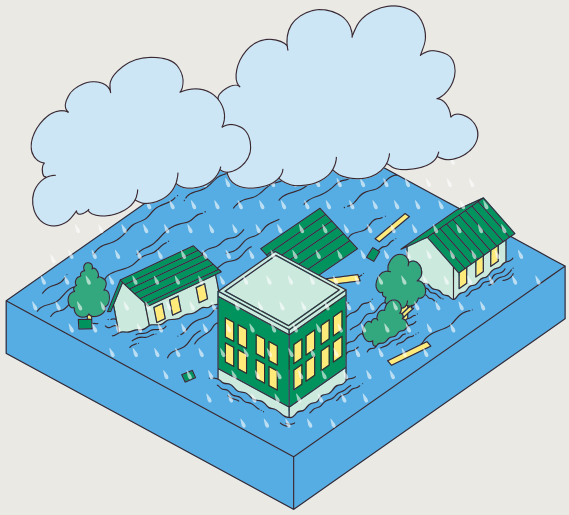


Figure 1: Flood graphic

FLOOD PROTECTION

Flood defense, in the water management sense, belongs to the area of protection against the harmful effects of water, which, in addition to flood defense, also includes the arrangement of watercourses and other waters, ice defense, protection against erosion and floods, removal of consequences and melioration drainage. No matter what hydrotechnical flood defense system we have, there is always a probability of its occurrence, and this probability has two origins. One refers to the probability of the occurrence of a hydrological event that exceeds the design conditions based on which the system was designed and built. The second origin refers to the probability of failure of individual elements of the system, which may occur due to malfunctions of electromechanical and hydromechanical equipment, the human factor, or due to demolition or unacceptable deformations of buildings.

Embankments are regulatory structures outside the main channel whose purpose is to protect the area from flooding by large waters.

Figure 2: Embankment

ŽUPANJSKA POSAVINA

Županjska Posavina is located in a naturally surrounded and separated part of the East Croatian plain, between the Đakovo and Vukovar flag plains in the north and the Sava River in the south, or, as the name itself suggests, around the town of Županja for the most part in the non-flood plain of the Sava River. It belongs to Vukovar-Srijem County - the easternmost Croatian county and consists of the City of Županja and eight municipalities that gravitate to Županja (Bošnjaci, Cerna, Gradište, Vrbanja, Drenovci, Gunja, Štitar and Babina Greda).

The municipality of Drenovci is located in the east of Slavonia, in the southern part of the Vukovar-Srijem County, in the so-called Spačvan basin, and includes the following settlements: Drenovci, Đurići, Posavski Podgajci, Račinovci and Rajevo Selo.

The municipality of Gunja is located on the left bank of the Sava River, right next to the border with Bosnia and Herzegovina.

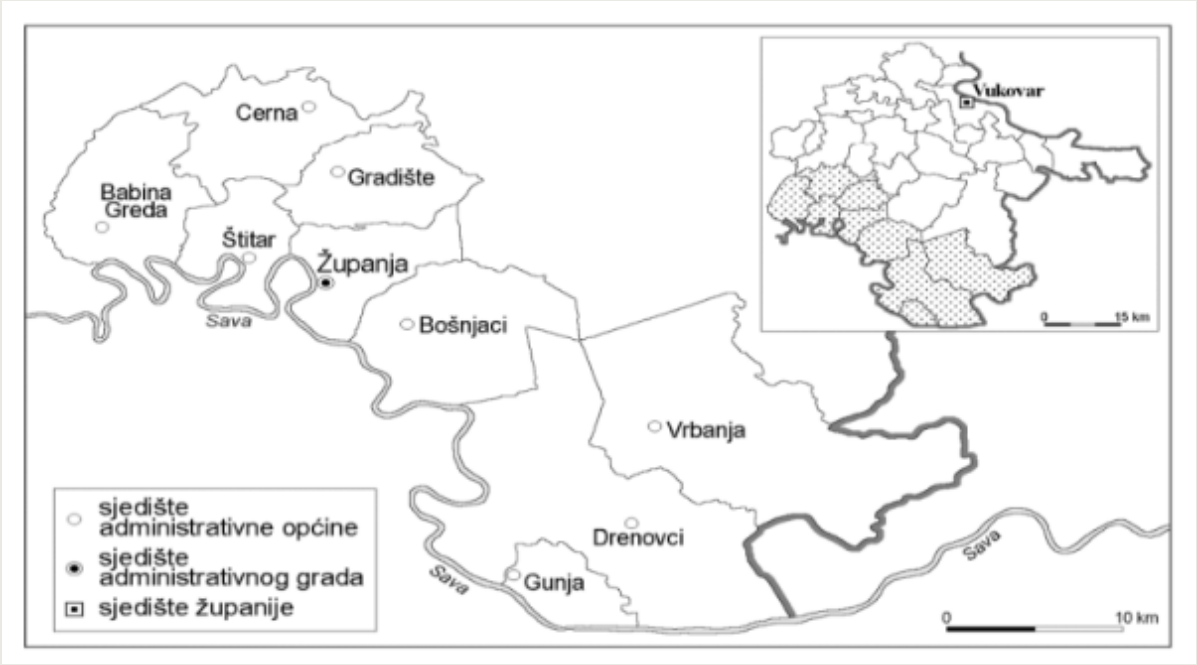


Figure 3: Cartographic representation of Županjska Posavina

CYCLONE DONAT

The weather in the middle week of May was marked by the multi-day influence of Cyclone Donat. It was a front associated with a deep cyclone over the North Sea, and it brought significantly colder air to our region. It affected the northwestern parts of the interior in the evening hours of Sunday, May 12, and then quickly moved towards the east and south of the country. A secondary cyclone formed over northern Italy, which we named Donat. In the night from Tuesday 13 to Wednesday 14 May, the cyclone moved across the Adriatic and Dalmatia over the east of the Balkan Peninsula. In Bosnia and Herzegovina, Serbia, as well as in the east of Slavonia, very large amounts of rain fell, which led to catastrophic floods, the largest in known history.

Figure 4: Map of flooded areas, arrows mark the locations of embankment ruptures

UNUSUAL AMOUNTS OF RAIN

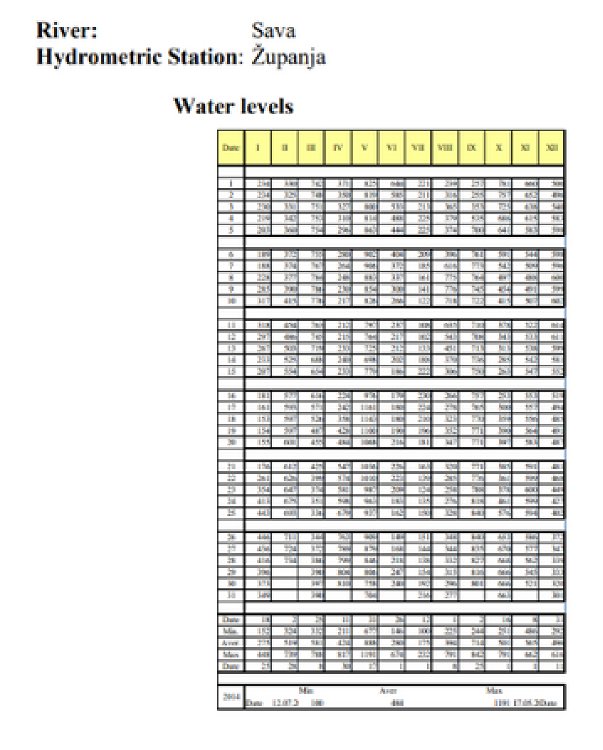
The most rain in Croatia, in the period from May 11 to 18, 2014, fell in Kutjevo, a total of 164 liters of rain per square meter. The fact that in 24 hours (until May 16 at 8 a.m.) more than half of that amount fell, as much as 91 liters of rain, is also extreme.

In Slavonia, 101.3 liters of rain fell in Gradište near Županja in that period. In 2 days, 69 liters of rain fell in Osijek, which is the average monthly amount for May. In total, the cyclone brought 92.5 liters of rain to Osijek. 95 liters of rain fell in Požega, 94.2 liters in Daruvar, and 66.8 liters in Slavonski Brod.

SAVA RIVER

During high water in the Sava River basin, extremely high-water levels were recorded. Thus, a maximum of +1194 cm was reached at the measuring station in Županja, which is an increase of 130 cm compared to the previous maximum (+1064 cm from 1970). Because of this, there was a breach of the embankment and a landslide of the surrounding terrain in the settlements of Rajevo selo and Račinovci, where the greatest consequences were recorded.

River flows, the southern tributaries of the Sava River, amount to record amounts of m^3 per second – Una 1750 m3/s, Vrbas 2000 m3/s, Bosna 3500 m3/s and Drina 4000 m3/s. All the mentioned rivers flow into the Sava at their historical maximums, and because of this the Sava River itself has reached previously unrecorded flows and water level values. The average flow of the Sava River near Županja is 1000 - 1100 m3/s, and at the relevant water meter in Županja on May 16, 2014, a flow of 5500 m3/s was measured.



River: Sava
Hydrometric Station: Županja

Water levels

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Table 1: Water levels of Sava

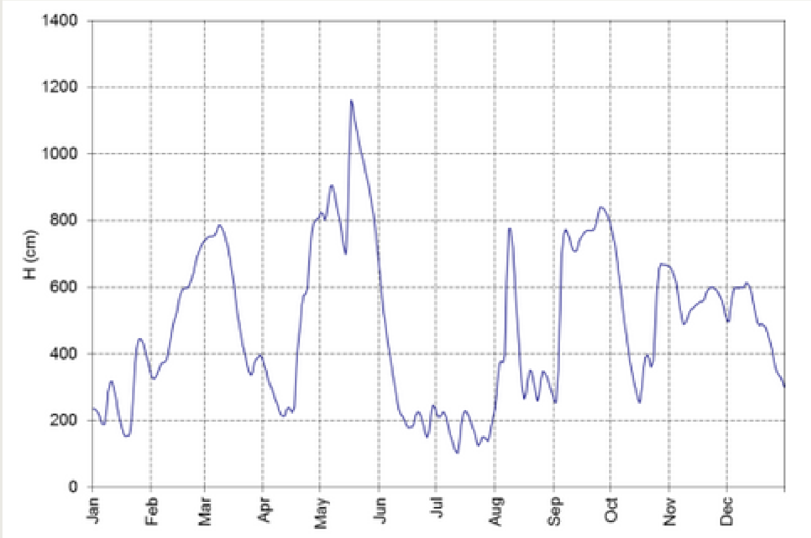
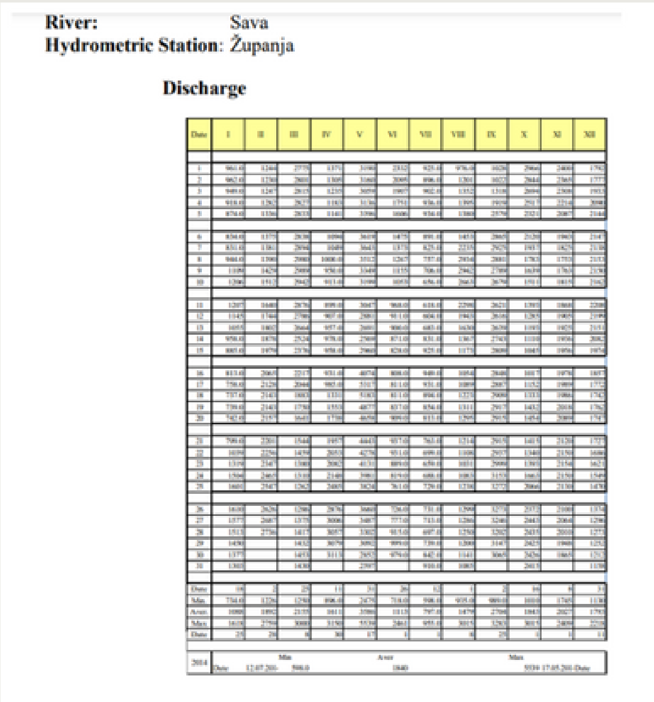


Figure 5: Graphical representation of Table 1



River: Sava
Hydrometric Station: Županja

Discharge

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Table 2: Discharge of Sava

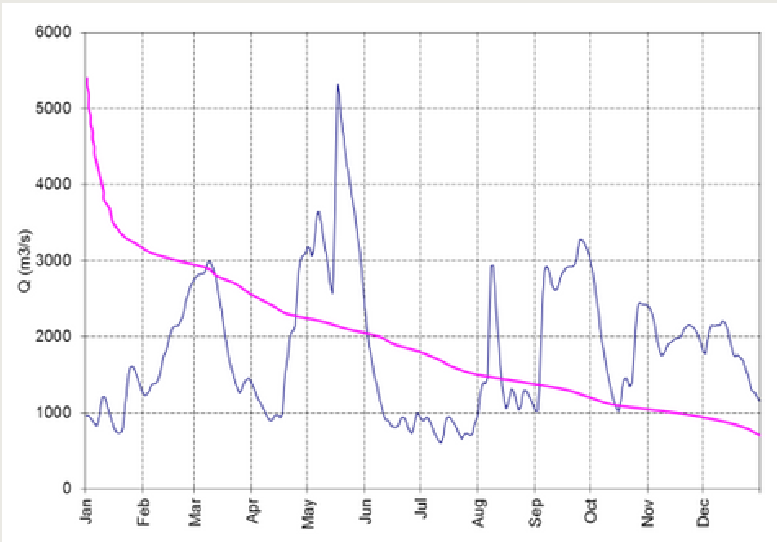

Figure 6: Graphical representation of Table 2

TERRIFYING CONSEQUENCES

Unfortunately, two people lost their lives in the flood and more than 2 500 people's homes were destroyed. The Red Cross has evacuated 8 555 people, and it is unofficially estimated that ten thousand people have left their homes. Also, 10 828 domestic animals were evacuated and 7 854 hectares of arable land, mainly corn, wheat and soybeans, were destroyed.

WHO'S GUILTY?

Although Nedjeljko Šimundić, chief engineer of Croatian waters and head of works on the construction of the pre-dyke near the flooded Rajevo Selo, said that the bursting of the dike was a combination of unfortunate circumstances and accidents, the County State Attorney's Office in Vukovar and the County State Attorney's Office in Osijek, in the period from June 2014 until January 2018, 2 467 natural and legal persons filed criminal charges against unknown natural and legal persons, for criminal offenses of abuse of position and authority and serious criminal offense against general security. The Constitutional Court rejected the criminal complaint.

Although the state invested over 80 million euros in the reconstruction of Posavina, it could not prevent a drastic decrease in the number of inhabitants. According to the last census, Gunja's population dropped to 2 666, and in 2001 there were 5 000.

Figure 7: Flooded houses

Figure 8: House saying "YOU FORGOT TO RENEW ME"

Figure 9: River overflow

Figure 10: Damage caused by flooding

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