

Evaluation of Possible Flood—Sediment Scenarios for Rjecina River Catchment in Association with Grohovo Landslide

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Rjecina river catchment is located in the northwestern Adriatic part of Croatia. It is a large torrential watercourse typical for the coastal karst zone of Croatia with its river mouth located in the center of Rijeka city. The discharge varies greatly during a year, from 0 m³/s during summer season to the maximum historical record 439 m³/s, calculated on the base of observations during the disastrous flood in 1898.

The central part of Rjecina valley is the most unstable part, with the highest degree of geological hazard. There are historic data of several rockfalls and landslides on both slopes of the valley. In the north-eastern part of the valley Grohovo landslide was reactivated in 1996, It represents the largest active landslide along the Croatian Adriatic Sea region.

The landslide studied has moved several times, the most recent being in December 1996 after a period of intense rainfall.

The historic data showed strong correlation of flood/rainfall events with mass movements (rockfalls and landslides), and indicated a need for estimation of flood and other related hazards in the area (particularly landslide and debris flow hazard).

The paper describes historical rainfall events and landslide occurrence. The biggest past movement happened in November 1898 when the major part of the slope moved toward the Rjecina river. This landsliding happened after the disastrous flood in October 1898. This flood was caused by heavy rain on 19th October 1898 when 222 mm of rain during 3.5 hours formed a catastrophic flood wave with the estimated flow of 439 m³/s, that is, more than 100-year return period high water for the Rjecina

River.

The landslide in 1996 was triggered by longer rainy period that lasted for few months. The regional mean annual precipitation (MAP) for 1996 was 1929 mm, 26 % higher than the average MAP for the period between 1948 and 2009. The autumn and early winter of 1996 were particularly wet in the Rijeka Region. Long rainy period resulted in a cumulative rainfall in the period from October to December exceeding 900 mm, approximately 75 % higher compared to the average cumulative rainfall (519 mm) calculated for the same period (October- December) in the period between 1948 and 2009.

The paper considers possible scenarios in the case of massive scale landslide occurrence: (1) Massive-scale debris flow occurrence toward the main channel if the discharge of Rjecina river channel is high (2) formation of natural dam if the discharge in main channel is small, and potential risk for dam break in main channel. At the city of Rijeka, being located 5 km downstream of the Rjecina river, there is a considerable risk of serious urban flood as a result of further mass movement. Landslide and Debris Flow hazard can be identified by: (i) observation of surface and groundwater flow at the site during the flood events; (ii) development of numerical modeling for debris Flow and mass-scale landslide and (iii) development of integrated early-warning system for the whole Rjecina river Basin. Rjecina river Basin and Grohovo Landslide will be investigated as one of pilot areas in Croatia-Japan Joint Project “Risk identification and land-use planning for disaster mitigation of landslides and floods in Croatia”.