Design of detention basin system using distributed hydrologic hydraulic model in a urbanized catchment

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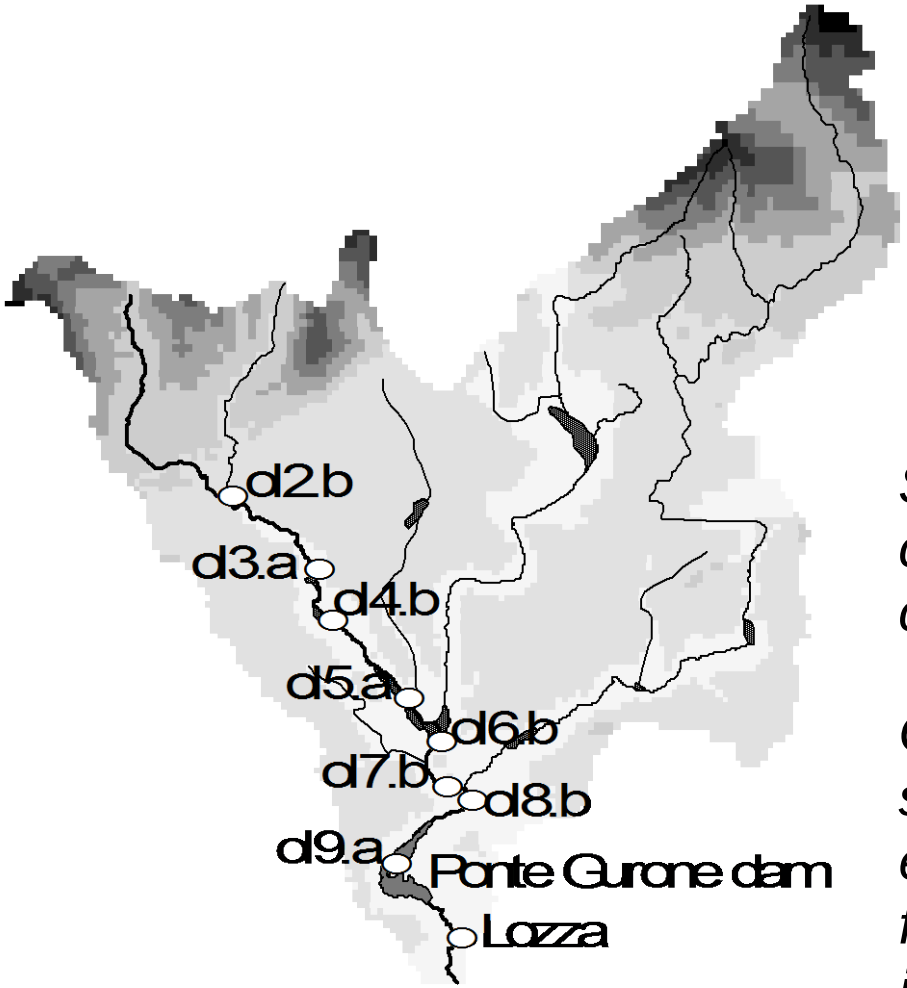
Motivations and Objectives

Urban development alters infiltration capacity and enhances its spatial variability, but also constrains watercourses into narrow channels making them unable to contain the runoff that is generated by relatively small, but intense, rainfall events

Network of detention basins are designed to reduce the flood peak by temporarily storing the excess storm water and then releasing the water volume at allowable rates over an extended period

In this presentation we show the use of a distributed hydrological model for designing a network of detention facilities in a heavily urbanized river basin and for assessing the impact of detention basins on downstream locations



Upper Olona river basin

Area: 94 km^2

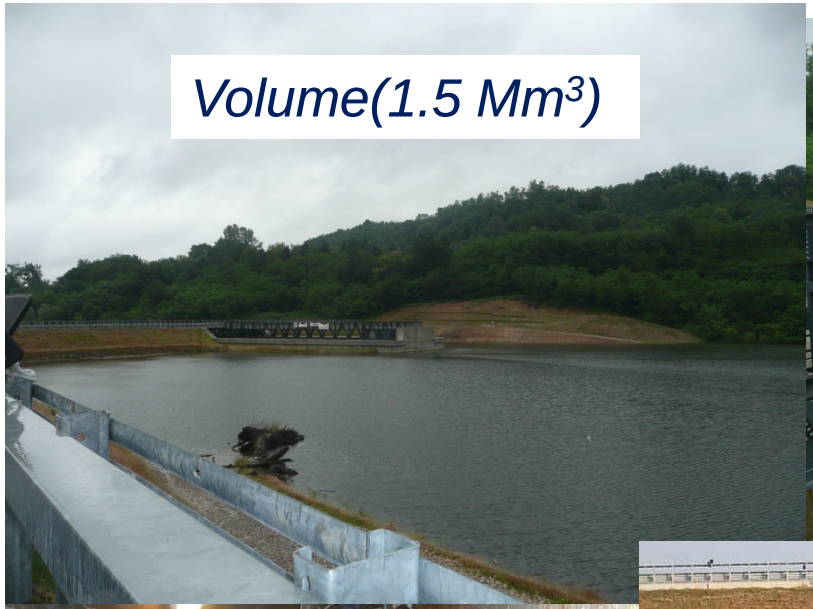
Mean elevation: 455 m a.s.l.

Mean slope: 15.3 %

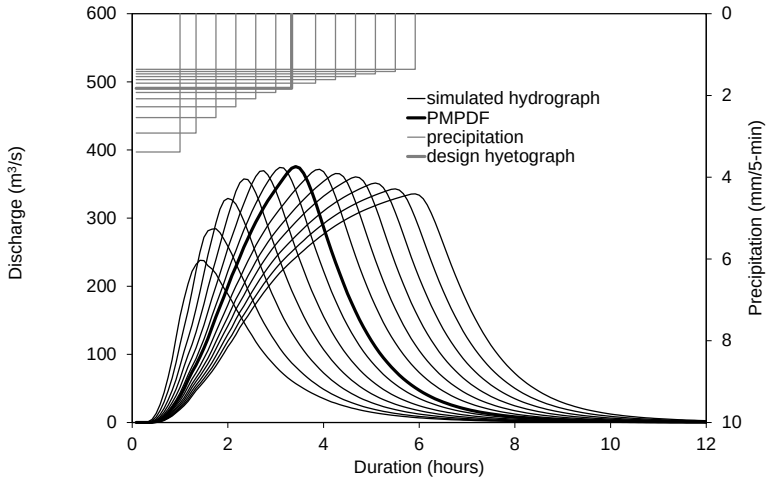
Significant urban development that constrained water course into narrow channel

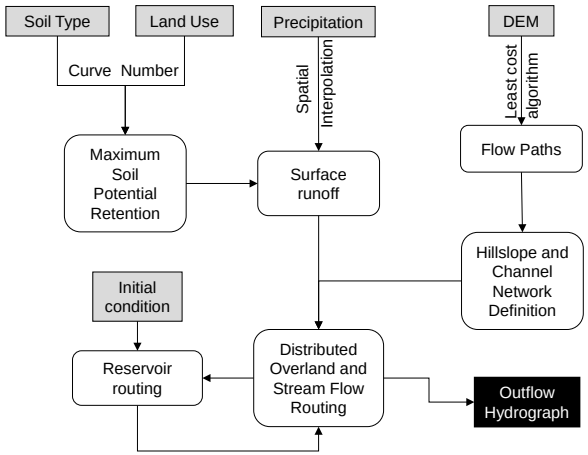
Olona river experienced significant floods since 1584, year of the first reported event, with an increase of flood frequency in recent years (5 major floods in last twenty years).

The Ponte Gurone on-stream detention basin

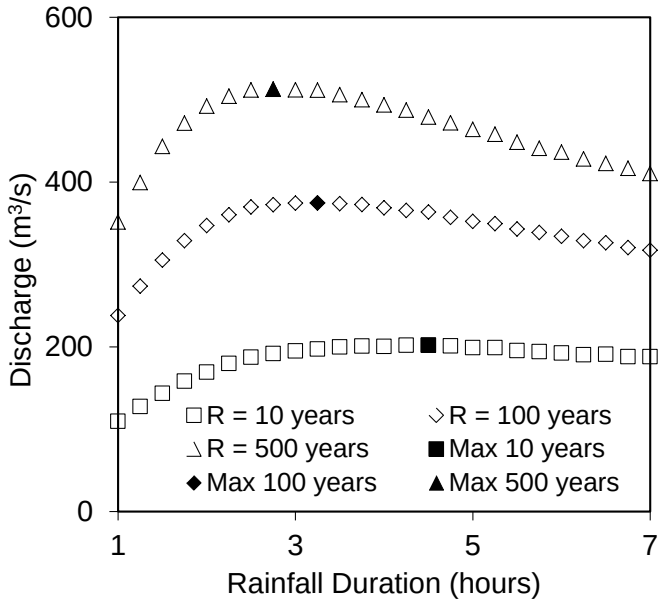


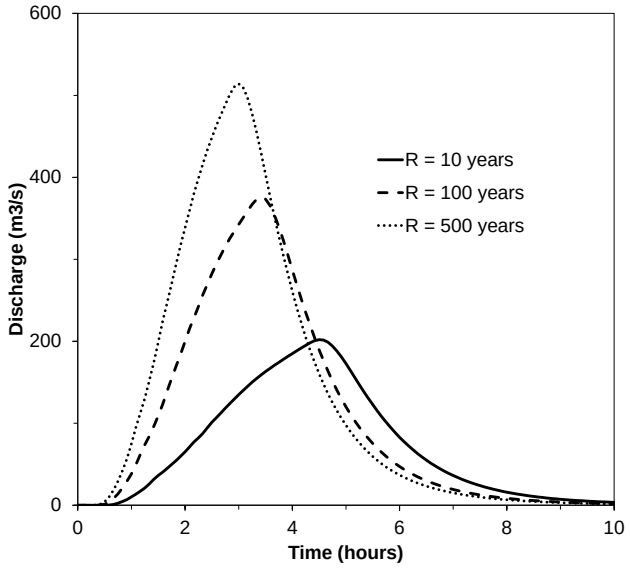
Design hydrograph



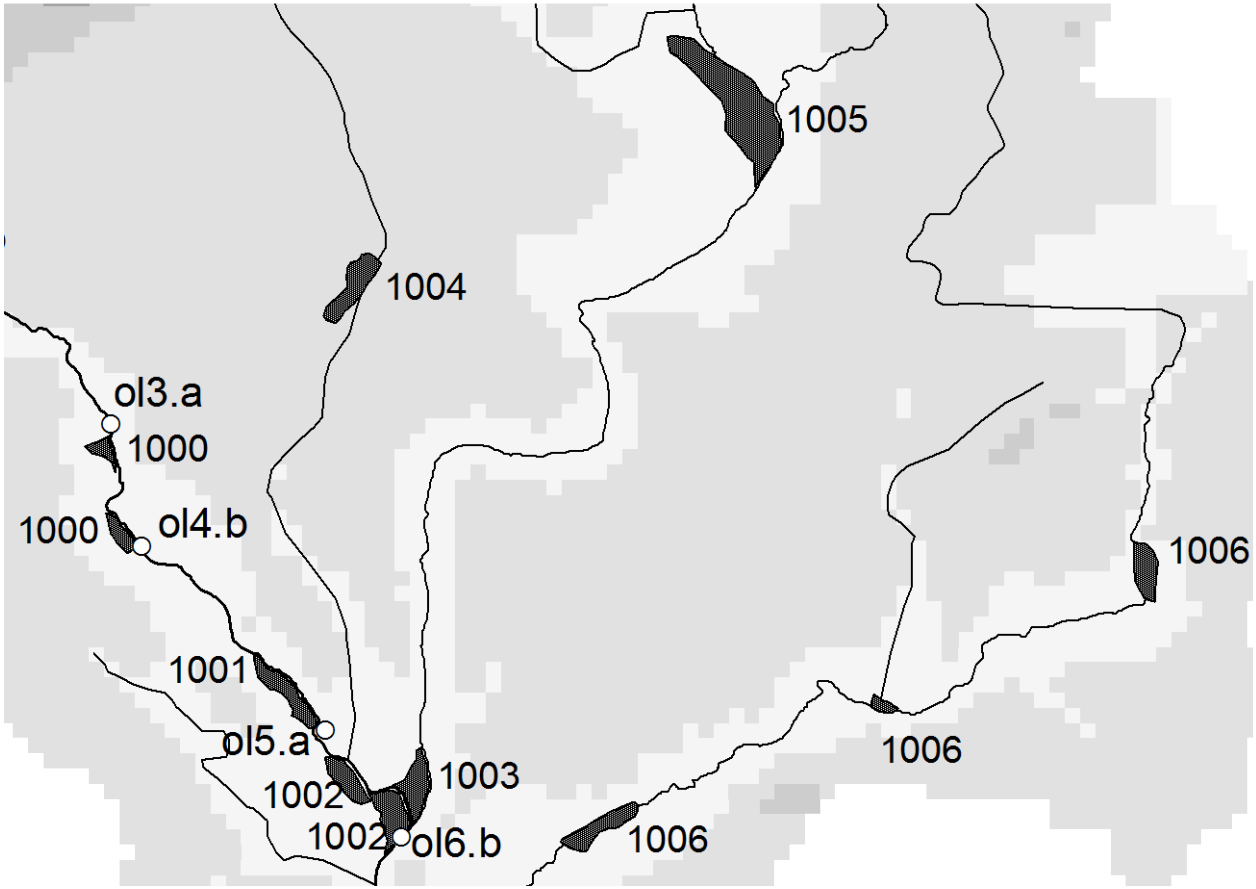


FEST: Flash – flood Event – based Spatially – distributed rainfall – runoff Transformation





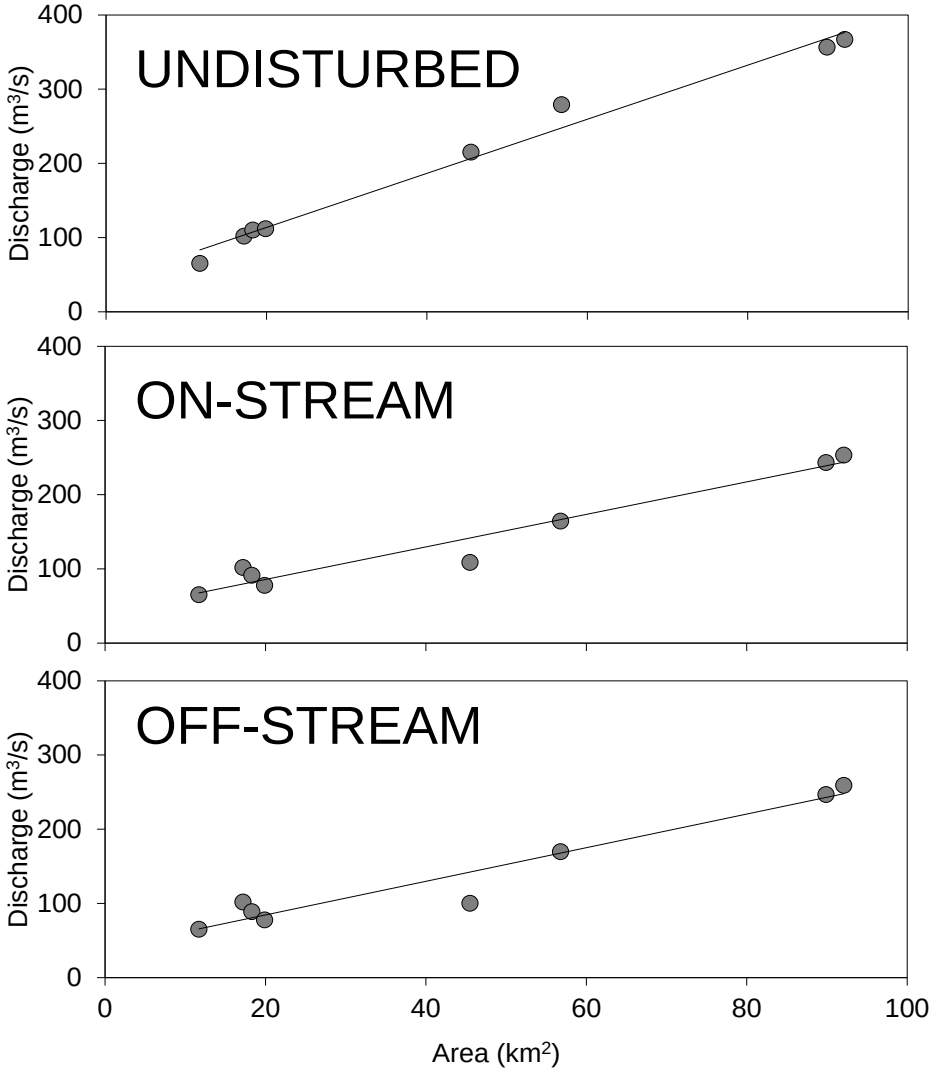
Detention basins under design



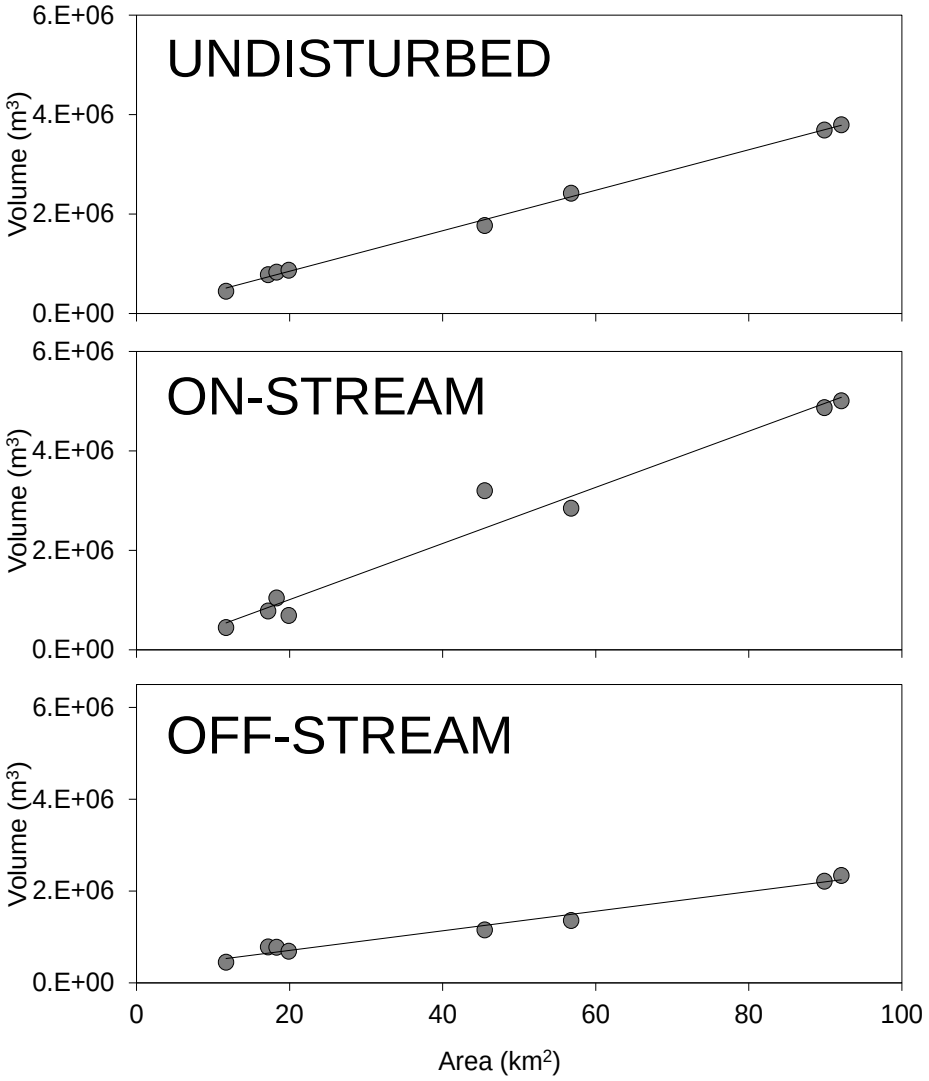
Id	Area (m^2)	Volume (m^3)
1000	39000	97500
1001	55000	137500
1002	75000	187500
1003	55000	137500
1004	60000	150000
1005	230000	575000
1006	100000	250000
Total	**614000**	**1535000**

Impact on design flood

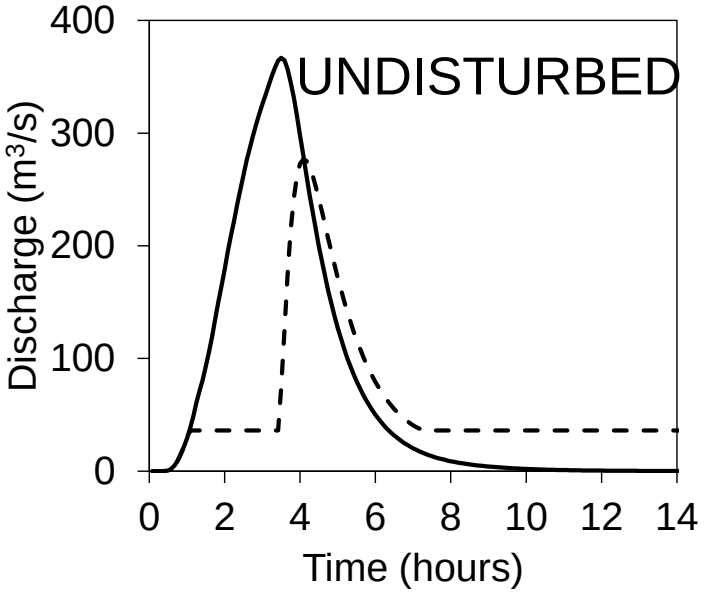
PEAK FLOW



FLOOD VOLUME

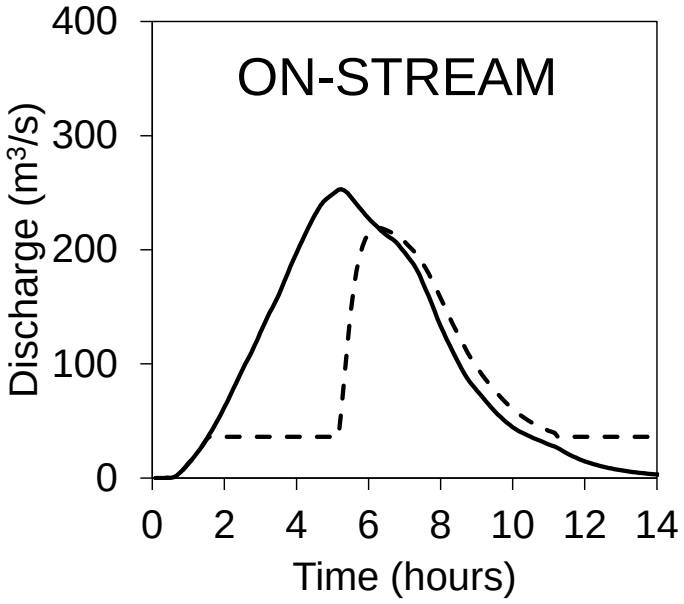


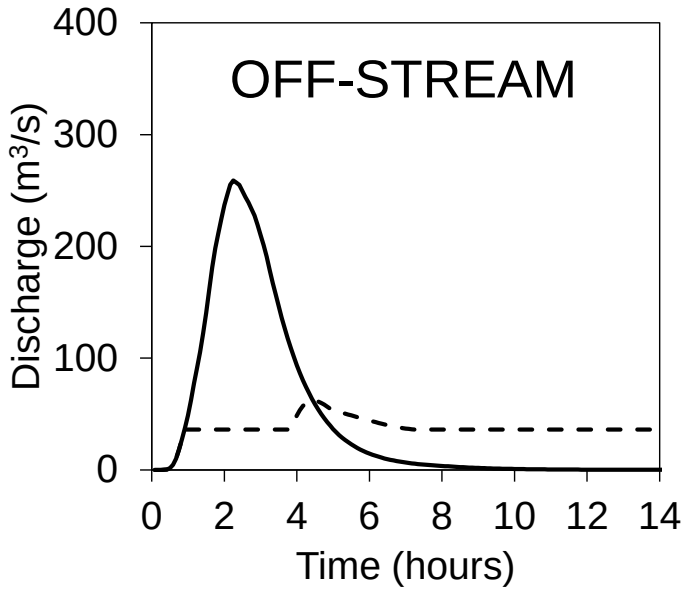
Impact on downstream existing basin



Inflow Hydrograph

Outflow Hydrograph





Conclusions

A procedure for the assessment of the impacts of detention basins on downstream locations is presented

The distributed hydrological model FEST was used to assess design hydrograph and, in parallel to design the seven detention basins optimized for the specific purpose of maintaining the flow rate within the range of the maximum allowable discharge

In case of off-stream detention basins the hydrograph volume grows linearly with the area of the river basin with a lower rate than both undisturbed and on-stream facilities conditions.

The undisturbed hydrograph is the one with the greatest impact on Ponte Gurone dam. The Ponte Gurone detention basin is not able to reduce the peak flow in the case of on-stream detention basins, too. Assumption of operating the seven detention basins as off-stream structures, leads to the most favorable result

Acknowledgments

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THANK YOU FOR YOUR ATTENTION !

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