

Assessing the performance of Sustainable Drainage Systems (SuDS) in urban context using SWMM5 modelling scenarios: the example of a typical industrial area in Lombardia Region, northern Italy

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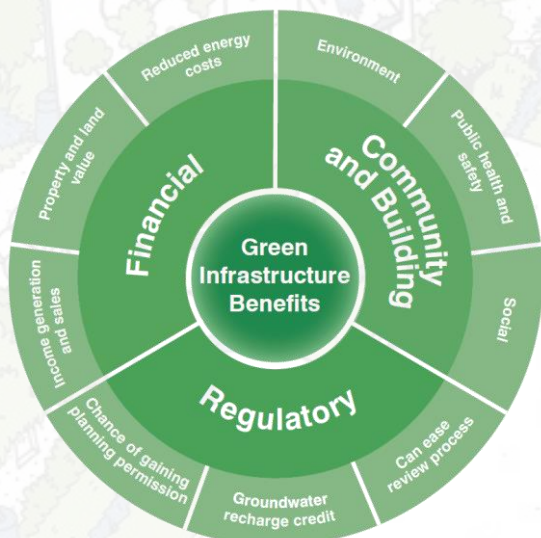
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Recently urbanization dynamics and related increase in the urban impervious surface, forced the administrations to deal more frequently with the inability of the traditional drainage systems to manage stormwater in a sustainable and effective manner.



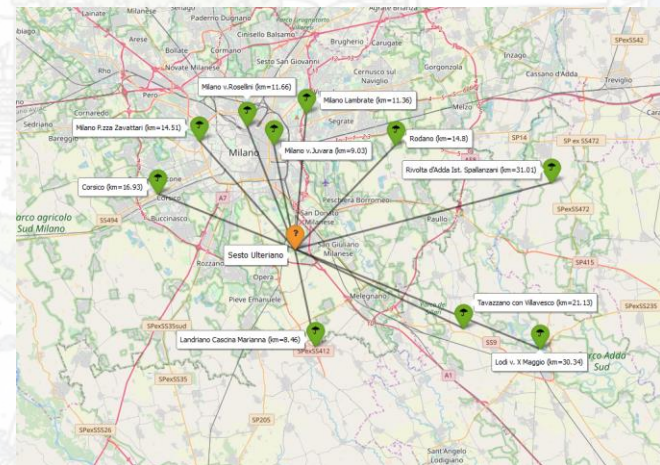
Worldwide, integrated approaches, such as Sustainable Drainage Systems (SuDS), whose basic principle is the management of rainwater at source through the implementation of prevention, mitigation and treatment strategies, are increasingly being developed.

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Our project aims to assess the benefits, in terms of reduction of floods, deriving from the widespread implementation of SuDS in an industrial area of about 300 ha in northern Italy and to analyse their behaviour under local climatic conditions.



Italy and Lombardy region



Rain gauges and their distances from the study region

For this purpose, in absence of rain gauges in the case study area, analyses were carried out to obtain reliable and continuous rainfall data from all weather stations closest to the study area. Therefore, 10 years of rainfall data (2009-2018), recorded at 15 minutes time steps from 10 stations, have been acquired by the Regional Agency for Environmental Protection of the Lombardia Region and Inverse Distance Weighting has been used as a methodology of interpolation to obtain precipitation for the area of interest.

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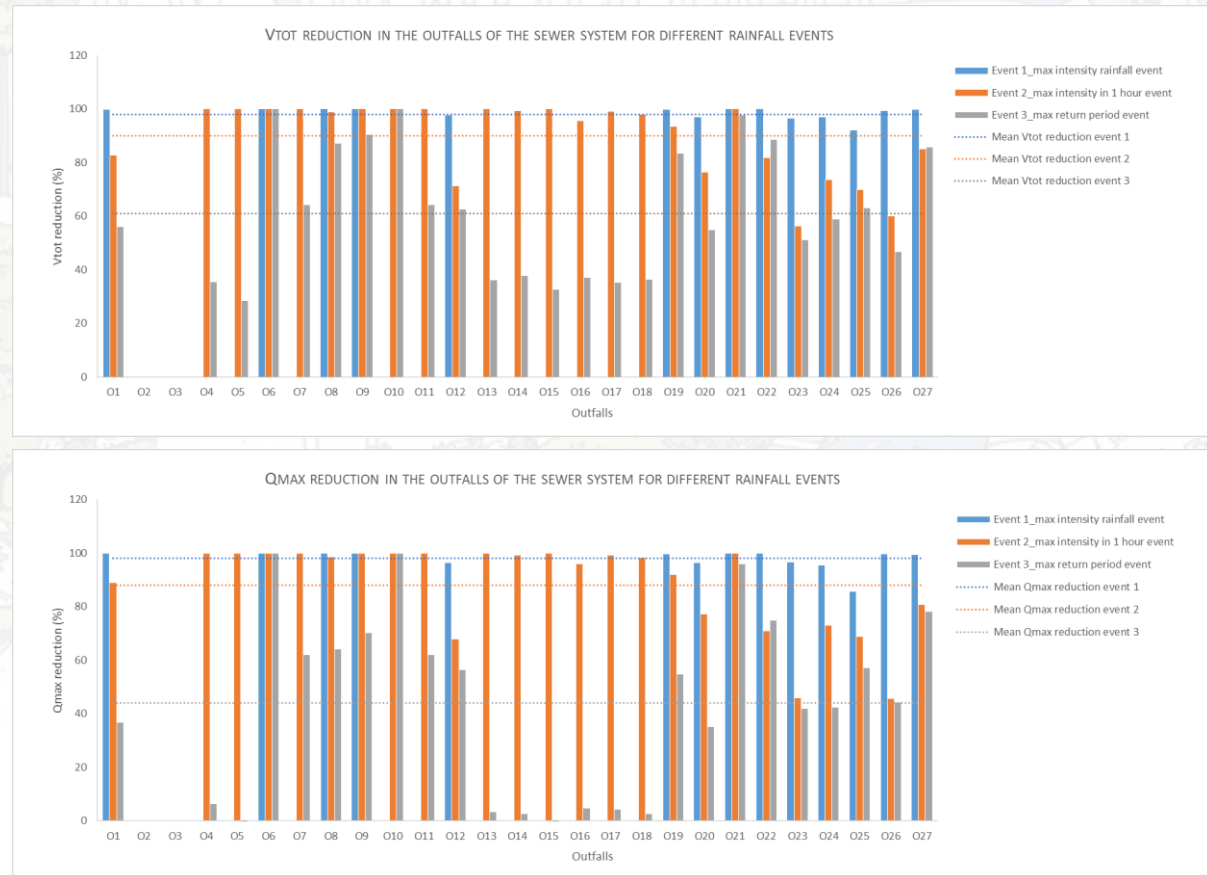
Critical precipitation scenarios have been identified to evaluate the performance of SuDS during significant rainfall events. For this reason, it was considered appropriate to extract from the complete dataset three types of events: the rain events with the maximum intensity in an hour, with the maximum overall intensity and with the highest return period (T=5). While the latter can be considered an almost “critical” rainfall event, the first two, despite the intensity, are characterized by “common” values of total rainfall volume and duration.

SENSOR	Distance (Km)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Corsico	16.93	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Landriano	8.46	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lodi	30.34	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Milano Juvara	9.03	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Milano Lambrate	11.36	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Milano Rosellini	11.66	X	X	X	✓	X	✓	✓	✓	✓	✓
Milano Zavattari	14.51	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Rivolta	31.01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rodano	14.80	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Tavazzano	21.13	✓	✓	✓	✓	X	✓	✓	X	X	X

SWMM5 modelling allowed a comparison of the performance of the studied sewer system (overall 1148 nodes, 1141 pipelines for a total of 36 km of network) of a “traditional” situation, without integrated strategies, with a scenario after implementation of green infrastructures. These systems have been located in the basin in accordance with the current structure of the urban agglomeration and involve the 10% of the study area.

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This analysis is product of improvements made on the SWMM5 hydrological model introduced in the abstract. In particular both the runoff of the surrounding impervious and pervious area conveys now in the sustainable infrastructures placed into the urban fabric. The results here presented, assessed in terms of reduction of Maximum Flow (QMAX) and Total Volume (VTOT) in the outfalls of the drainage system following the implementation of SuDS, suggest in the first instance that these sustainable infrastructure can give a real contribution in the management of stormwater.



Nevertheless, their performance seems to be affected by the severity of rainfall events (i.e. the rainfall event with the highest return period shows the lowest VTOT and QMAX reductions!).

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As future aspects, this research strives to assess the performance of sustainable drainage systems under long period rainfall scenarios and to establish, through an analysis of the climate change effects and the creation of rainfall data projections, the performance of these systems also over time.



CHANGE CLIMATE CHANGE



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THANK YOU!

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