I.W.R.M. AND CLIMATE CHANGE: INNOVATIVE WATER SOLUTIONS

IN VENETO REGION, ITALIA

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Abstract

In recent years, an increasing number of settlements have been severely affected by the impact of extreme weather conditions, even if very short in time. Changing climate conditions and extreme rainfall are man-made transformations. It is worth noting that extreme damage is not only caused by over-bank flooding of larger rivers but it can even be caused by a smaller yet dense drainage network of canals. Urbanization in former rural areas has led to vast waterproof areas. The study will present examples of projects and good-practice conducted in the Municipality of Mainland Venice and in the town of Conegliano Veneto in Veneto Region, Italia.

Introduction

The solutions to help resolve the above mentioned extreme risk, fall into two categories: the hydraulic techniques for river management within non-urban areas, and drainage systems within urban areas. Water in urban areas can be managed in several ways, using such methods as: prevention, infiltration, retention or mitigation, reuse (as also foreseen by the IntegratedWaterResourcesManagement portfolio). Moreover, superficial run-off flow deserves attention as an element whose solutions entail not merely the technological sphere but also include architectural, landscape and land use management.

Methods: drainage systems in urban areas

To manage water, urban areas could retrofit different measures/processes: prevention, infiltration, detention/mitigation, and reuse. In turn, each process, depending on its role within the management system, could involve a **variety of different devices** in terms of application, limitations, in their efficacy in reducing hydraulic risk, and in terms of pollution. **A hierarchy of Water Management** includes the following priorities: *prevention,* proper use of planned areas and cleaning measures to prevent floods and or pollution (ie removing dust and particles from parking areas) and reusing the rainwater collected. Generally, maintenance policies are embodied

in local management plans; *local control,* managing floods in proximity to the source (ie tanks, filtration methods, green roofs, filtration surfaces); *managing the surrounding areas,* in proximity of the source (ie transfer of roof water or water from parking areas to large tanks, into detention or infiltration basins); *territorial management,* of extra-urban areas (ie compensation ponds or basins or marshes).

Example of Good Practice in Mestre Settlements

A brief illustration follows with examples of GP in the two residential expansion areas under the plan known as Piano per l'Edilizia Economica e Popolare (PEEP) in the municipality of Mestre-Venice. Considering the previously mentioned point on a territorial land protection system and on water management some legal priorities have emerged also in response to the recent severe weather conditions. A new institutional Actor thus emerged, the *ad acta* Commissioner. The tasks involved include the following:--to have a single regional Authority coordinate the various aspects of land and water management (both from the hydraulic risk perspective and water protection);--to plan urban development in a uniform manner and not in fragmented terms, with focus on the need to enhance the superficial hydrographic network;--to rapidly conclude work related to hydraulic risk and complete the foreseen plan;--concretely activate the rural monitoring, upgrade inspection and land rehabilitation;--to encourage all the required maintenance to enable the water drainage system to function properly;--to encourage the relocation of structures that stand directly or indirectly on watercourses and whenever possible create alluvial areas by introducing instruments as urban compensation or fiscal incentives;--to make the "Water Plan" operational. The Water Plan addresses many of the issues contained in other existing instruments at various levels, from the Regional to the Municipal Environmental Project. If, from an operative perspective, this may suffice for non urbanized rural areas, urban areas, on the other hand, having the crucial problem of reducing and slowing down run-off rainwater as much as possible, and drainage solutions in parking areas, reservoirs etc., require that existing instruments (at all levels) and that the "Water Plan" about to be introduced be examined in greater detail. The introduction of urban surface water drainage techniques, used in many countries abroad as a "system" to reduce hydraulic risk and to improve the quality of water, helps to solve many of the problems in areas that will undergo future expansion, as well as existing ones. As previously mentioned, these techniques have different valencies – one of them being a lower hydraulic risk. One of the goals of Administrations should be to encourage their use, and to protect them, even from the water quality perspective.

The management of run-off in the Plan of a former industrial area in the city of Conegliano Veneto

Our different approach has made it possible to plan to build-up an abandoned industrial site in which water run-off is kept on the premises and used as an environmental element for recreational

purposes (a park) as well as for hygienic use, and irrigation etc..This option, (especially in case of heavy rainfall) limits or prevents the discharge of water in areas outside the established perimeter and becomes a way to manage the territory. The reuse of rainwater helps to avoid wasting drinking water which instead ought to be protected from diffuse pollution risks. A former industrial area in the town of Conegliano Veneto is a site which showed interest in managing the various environmental components. To reduce and contrast the damages that may occur after heavy rainfall, the (new) planning framework foresees filtering capacity, and residential houses with roofs are oriented towards the sun for optimal electrical energy production. Water runoff is collected and the processes of infiltration, evapo-transpiration and retention are properly managed to enable water reuse.The buildings in the New Plan Proposal (See Fi.1 Right) allow for a smaller number of dwellers compared to the plan approved by the Municipality of Conegliano (See Fig.1 Left). The choice is based on the consideration that in zone "A", which was built some years ago and foresees a significantly lower number of dwellers than the original, its occupancy amounts to 30-40%. The extension and building volume foreseen in the plan that was approved by the Municipality of Conegliano is therefore unjustified. This claim is reinforced by the low willingness to live in the new housing in zone "A".

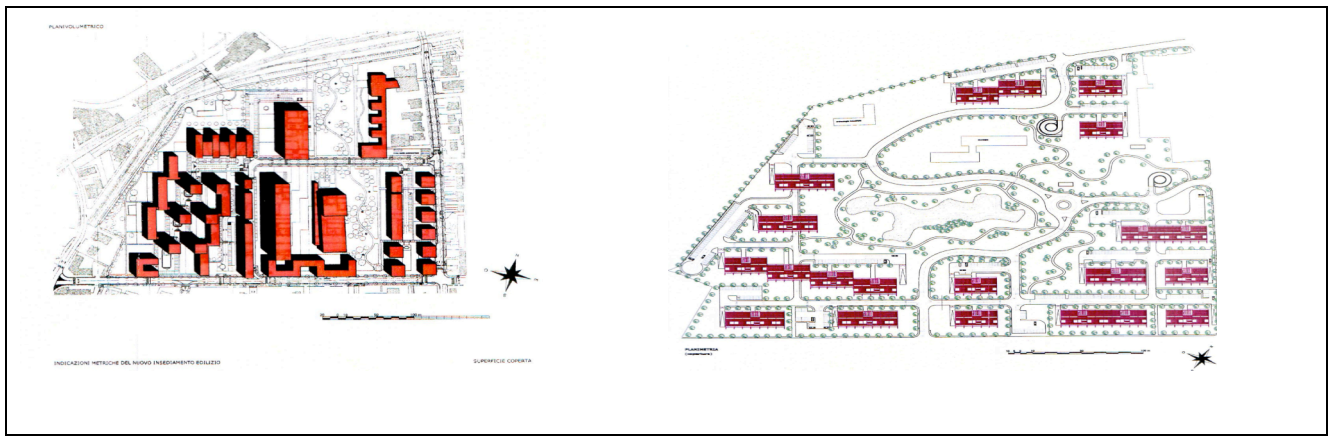

Figure 1. Left:Plan Approved; Right: New Plan Proposal

Considering this motivation, the New housing plan proposed is **1/3 smaller in volume** compared to what was foreseen and approved by the Municipality of Conegliano. The ratio between area extension (study area) and built up surface have yielded the urbanization index of the plan approved by the Municipality of Conegliano and this plan as well. The plan highlighted a **decrease of 10,000 cubic m/year of run-off compared to the plan approved by the Municipality of Conegliano (see Fig.1 Left).** A study on yearly precipitation enabled the calculation of the average quantity of yearly rainfall on the project area and of the efficacy of land depression (small lake) planned on urban park grounds. The basin's volume capacity was assessed by considering not only yearly rainfall but also the quantity of water when it first starts to rain, calculated according to current rules and regulations. The New Plan, evaluates hydraulic compatibility, with a forecast of 15 minutes of stormwater (120 mm/hour). Even in this case, data comparison of the two plans points to a drop in the amount of water that needs evacuation, with 170 l/sec in the plan presented herein.Waterflow

calculation amounted to 0.37 l/s, that is 32,284 l/day, an insignificant quantity compared to the 50 l/s of the river ''Monticano''. Our analysis provides more detailed information on the equipment needed to contrast urban run-off. Analytical data illustrate the way equipment, in the case of stormwater, not only act as a drainage system but also as retention (small underground tanks).

Conclusions

A Water Plan must address many of the issues contained in other existing instruments at various levels, from the Regional to the Municipal Environmental Project. If, from an operative perspective, this may suffice for non urbanized rural areas, urban areas, on the other hand, having the crucial problem of reducing and slowing down run-off rainwater as much as possible, and drainage solutions in parking areas, reservoirs etc., require that existing instruments (at all levels) and that the ''Water Plan'' about to be introduced be examined in greater detail.

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