

# PROBLEMS WITH WATER IN CITIES

It takes only a few minutes of a sudden downpour to paralyze not only the traffic in the city, but also to flood houses, cellars, or public buildings. The cost of removing the losses is enormous. One of the tasks of the Silesian Water Centre, a unit at the University of Silesia, is to search for solutions of these problems and to indicate ways to mitigate and eliminate the effects of such phenomena.

Due to climate change, extreme weather phenomena are becoming increasingly common in various regions of the world. Not only farmers suffer from drought, which destroys crops, since excess water is a problem as well. This is particularly true in large cities and agglomerations.

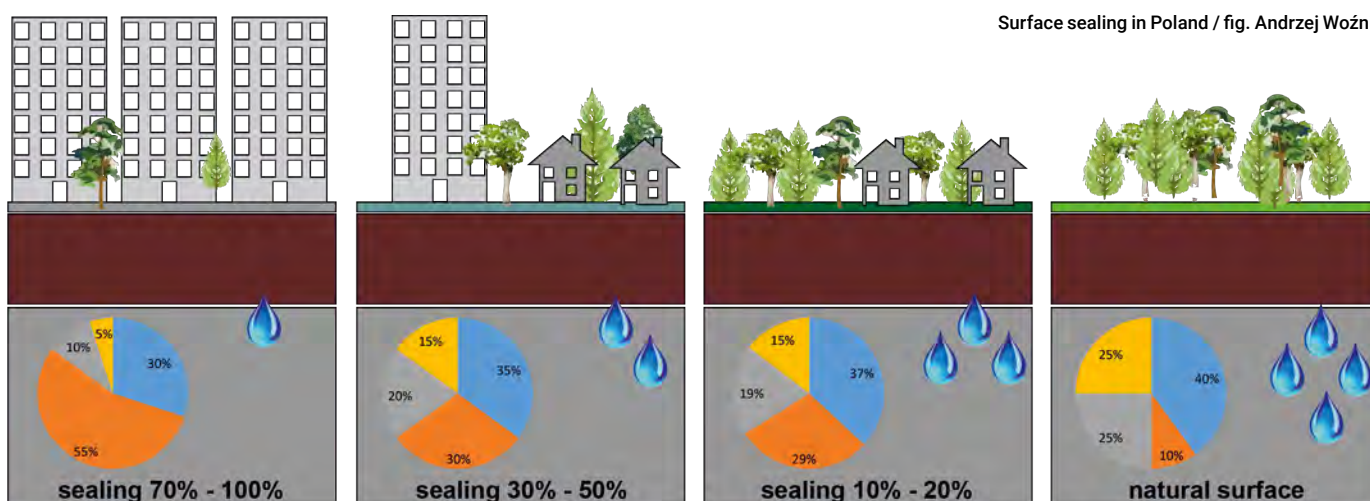
Since the dawn of history, cities have been built near rivers and water bodies, but water was managed in a more sustainable way. Today's cities are characterized by a high density of buildings, roads, concrete squares, and car parks, i.e. a large part of impermeable surfaces and urban heat islands. At the same time, they feature a small proportion of green areas.

Particularly in the Silesian Voivodeship, many cities have a strong surface sealing, which poses a serious threat, since it becomes difficult for precipitation to infiltrate groundwater and, consequently, groundwater cannot rapidly flow into surface waters. For this reason, the risk of urban floods occurring during sudden and heavy rainfall increases. Other problems are posed by mining activities in Silesia which result in land subsidence, which affects the occurrence of local floods. Additional issues are poor water quality, concreted river beds, their reduced cross-sections, and lack of floodplains. Currently, these problems are becoming intertwined with the threats resulting from global warming. According to

climate change scenarios, it should be assumed that we are threatened by alternating waves of heat, cold, drought, and intense rainfall and flooding.

The complex problems of climate change can be alleviated by introducing a so-called blue-green infrastructure. Its main aim is to protect and restore the urban environment in the context of ecosystem services, i.e. the numerous and different benefits people derive from the environment and properly functioning ecosystems. Such ecosystems include, for example, agro-ecosystems, forest ecosystems, meadow ecosystems, but water environments fulfill particularly important ecosystem functions. The city's water bodies are important because they provide services such as water filtration, nutrient circulation, carbon fixation, control of erosion, flood, and water resources. Moreover, they are habitats of protective importance. Thanks to these services, water bodies influence the environment, i.e. they improve water quality, regulate local temperature, prevent floods, and preserve habitats and species. As a result, society derives specific benefits from these services: it has access to clean drinking water and attractive places for recreation. Moreover, the effects of warming are reduced, and the costs of damage to property, e.g. as a result of flooding, can be avoided.

Surface sealing in Poland / fig. Andrzej Woźnica





Concrete riverbed of Rawa in Katowice / photo: Agnieszka Sikora

Around the world, attempts are made to mitigate the effects of heavy rainfall using appropriate urban and architectural solutions. Increasingly, cities are trying to deal with these problems by planting trees and shrubs, giving up mowing lawns, and establishing flower meadows or even gardens on roofs. The next step should be to collect rainwater from the roofs of houses, shopping malls, car parks, and roads. Assuming that during a single cloudburst about 100 mm of water falls, a total of over 20,000 m<sup>3</sup> of water will pour down on the sealed surface around the shopping mall Silesia City Center in Katowice. This amount fills a pond of 20,000 m<sup>2</sup> surface and 1 m in depth. The solution can be sustainable rainwater management. For instance, runoffs could be stopped at the place where the rainfall occurs and returned to the ecosystem by means of retention and subsequent infiltration to the ground. In order for this to happen, new methods must be introduced along with the application of traditional rainwater drainage systems, e.g. the so-called sustainable drainage, which consists in replacing impermeable surfaces with permeable or semi-permeable ones, which results in prolonging the outflow time and limits its size. Perforated paving slabs, gravel surfaces, or openwork concrete slabs with grass coverings can be used for this purpose. Thanks to the use of such ma-

terials, it will be possible to restore the natural circulation of water in urban spaces and at the same time to relieve storm drainage.

Some of the risks resulting from climate change, i.e. an increase in flood risk, reduction of water consumption, or an increased risk of extreme temperatures and fires can be avoided. Many of the solutions that can be used for this purpose are related to water management, such as the construction of retention tanks, small retention systems, systems that limit the rapid flow of water from impermeable surfaces, water tanks for fire protection or watering urban greenery.



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