Summary

Progressive urbanisation, coupled with observed climate change, is leading to increased impervious surfaces in cities and a rise in the frequency of heavy rainfall events. Consequently, surface runoff is increasing, drainage systems are becoming overloaded, and the incidence of localised flooding is rising, with stormwater overflows becoming more frequent. In response to these problems, blue-green infrastructure (BGI) solutions are becoming increasingly important; their purpose is to intercept, retain and infiltrate rainwater at the point of origin, whilst relieving the burden on drainage systems and improving the functioning of the entire urban water system.

The thesis was based on the assumption that the implementation of decentralised blue-green infrastructure solutions (BGI) in urban catchment areas enables a significant reduction in the hydraulic load on stormwater and combined sewer systems by reducing surface runoff, delaying peak flows and increasing local rainwater retention, thereby enhancing cities' resilience to the effects of urbanisation and climate change. The main objective of this study was to assess the impact of blue-green infrastructure solutions on the drainage system's functioning in the town of Bolesławiec and to determine their effectiveness in mitigating hydraulic overloads in the sewerage network under current and projected climate change conditions.

The study was carried out using a hydrodynamic model of a combined sewer system in the EPA SWMM software. The model was based on the actual sewerage network in the town of Bolesławiec. Operational data from the water and sewerage company and spatial data processed in a GIS environment were utilised. The model replicated catchment areas, pipes, sewer manholes, a pumping station, a stormwater overflow, and other infrastructure elements that affect the system's operation. Based on the prepared and appropriately calibrated model, an analysis was carried out of the baseline scenario and alternative scenarios involving the implementation of BGI. Six basic solutions were used in the study: green roofs, bioretention basins, rain gardens, permeable pavements, infiltration boxes and domestic rainwater barrels. Each of these was assessed at four levels of implementation, corresponding to 25 per cent, 50 per cent, 75 per cent, and 100 per cent of the area earmarked for development, respectively. In addition, simulations were conducted for mixed variants, accounting for the combined use of green roofs and selected infiltration and retention solutions. The effectiveness of each solution was assessed using a uniform set of hydraulic indicators, including the total volume of wastewater flowing through the pumping station, the volume of wastewater discharged via the stormwater overflow, and the number of points where overflows from the sewerage network occurred. A key element of the analysis was the assessment of flow hydrographs at the pumping station and storm overflow cross-sections, which enabled determination of changes in flow patterns and runoff dynamics for each variant.

The research demonstrated the effectiveness of BGI solutions in the urban catchment area. It was confirmed that appropriately selected blue-green infrastructure solutions can serve as an effective tool to support the functioning of combined sewer systems and mitigate the negative effects of urbanisation and climate change. The methodology developed is not limited to a single city case study but constitutes a universal approach for assessing the effectiveness of blue-green infrastructure solutions in other combined sewer systems. Consequently, the results obtained can support the planning of climate change adaptation