

Urban Settlements and Land Use Change and Flood Management with New LID-BMP Approaches (Case Study: of Watershed Affecting Vilashahr City and Islamic Azad University, Najafabad Branch)

Extended Abstract

Introduction: This paper examines the effects of urbanization and land-use changes on natural hydrological systems, with a particular focus on the resulting increase in surface runoff, reduced water infiltration, and heightened risk of urban flooding. The primary objective is to evaluate contemporary approaches for managing urban floods through Low Impact Development (LID) and Best Management Practices (BMPs). This assessment centers on a case study within the catchment area of Islamic Azad University in Najafabad, Isfahan Province. Urbanization, coupled with alterations in land use, profoundly modifies hydrological patterns, particularly in urban environments. Traditional stormwater management strategies are no longer adequate given the escalating scale and intensity of rainfall events in urban settings.

Materials and methods: This study introduces LID-BMP techniques as environmentally sustainable solutions for managing urban runoff. These methods encompass strategies such as rain gardens, permeable pavements, underground storage systems, and green roofs. Their primary goals are to reduce runoff volume, improve its quality, promote groundwater recharge, and mitigate the adverse effects of floods. The study was conducted in the 294-hectare catchment area of Islamic Azad University of Najafabad. This region is characterized by a mixed urban and semi-urban land use, exhibiting diverse topography, vegetation cover, and hydrological features. Geographic coordinates, slope, and land-use changes were meticulously analyzed, and a detailed assessment of the region's stormwater runoff and infiltration properties was performed using Geographic Information Systems (GIS) tools. This research employed a descriptive-analytical approach, involving the collection of data on rainfall, runoff, land use, and topography. Key hydrological parameters, such as the Curve Number (CN) method, were utilized to model and estimate runoff. StormCAD software, in conjunction with the Soil Conservation Service (SCS) unit hydrograph method, was employed to simulate surface runoff flow and evaluate the effectiveness of various flood management techniques.

Results: The findings indicate that the expansion of urban areas within the study region has led to a substantial increase in surface runoff, ranging from 30% to 40%. The conversion of land use, particularly from agricultural and natural areas to residential and industrial zones, has diminished the soil's infiltration capacity and reduced its ability to absorb natural rainfall. However, the application of modern LID and BMP methods yielded promising results in runoff reduction. By integrating rain gardens, permeable pavements, underground storage tanks, and green roofs, runoff was reduced by over 50% in several sub-catchments within the study area. A variety of LID solutions were proposed for the university campus, including 189 potential designs for rain gardens, permeable pavements, and retention basins. These solutions not only reduced runoff but also improved water quality by filtering pollutants before they entered stormwater drains.

Discussion and Conclusion: The results underscore the significant potential of LID and BMP approaches in mitigating urban flooding, especially in rapidly urbanizing regions. By integrating these strategies into urban planning, cities can effectively reduce the negative impact of stormwater runoff on both the environment and local infrastructure. The study also emphasizes the critical importance of incorporating hydrological management into urban zoning and development plans. Implementing these

methods can provide multiple benefits, including reducing flood risks, enhancing surface water quality, replenishing groundwater supplies, and alleviating the burden on traditional stormwater infrastructure.

Keywords: Urban Flood Management, Low Impact Development, Best Management Practices, Stormwater Runoff, Hydrological Systems.