

Mitigating Urban Flooding through Spatial Planning Interventions: A Case of Bhopal City

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Abstract : Flooding is one of the waterborne disasters that causes extensive destruction in urban areas. Developing countries are at a higher risk of such damage and more than half of the global flooding events take place in Asian countries including India. Urban flooding is more of a human-induced disaster rather than natural. This is highly influenced by the anthropogenic factors, besides metrological and hydrological causes. Unplanned urbanization and poor management of cities enhance the impact manifold and cause huge loss of life and property in urban areas. It is an irony that urban areas have been facing water scarcity in summers and flooding during monsoon. This paper is an attempt to highlight the factors responsible for flooding in a city especially from an urban planning perspective and to suggest mitigating measures through spatial planning interventions. Analysis has been done in two stages; first is to assess the impacts of previous flooding events and second to analyze the factors responsible for flooding at macro and micro level in cities. Bhopal, a city in Central India having nearly two million population, has been selected for the study. The city has been experiencing flooding during heavy rains in monsoon. The factors responsible for urban flooding were identified through literature review as well as various case studies from different cities across the world and India. The factors thus identified were analyzed for both macro and micro level influences. For macro level, the previous flooding events that have caused huge destructions were analyzed and the most affected areas in Bhopal city were identified. Since the identified area was falling within the catchment of a drain so the catchment area was delineated for the study. The factors analyzed were: rainfall pattern to calculate the return period using Weibull's formula; imperviousness through mapping in ArcGIS; runoff discharge by using Rational method. The catchment was divided into micro watersheds and the micro watershed having maximum impervious surfaces was selected to analyze the coverage and effect of physical infrastructure such as: storm water management; sewerage system; solid waste management practices. The area was further analyzed to assess the extent of violation of 'building byelaws' and 'development control regulations' and encroachment over the natural water streams. Through analysis, the study has revealed that the main issues have been: lack of sewerage system; inadequate storm water drains; inefficient solid waste management in the study area; violation of building byelaws through extending building structures either on to the drain or on the road; encroachments by slum dwellers along or on to the drain reducing the width and capacity of the drain. Other factors include faulty culvert's design resulting in back water effect. Roads are at higher level than the plinth of houses which creates submersion of their ground floors. The study recommends spatial planning interventions for mitigating urban flooding and strategies for management of excess rain water during monsoon season. Recommendations have also been made for efficient land use management to mitigate water logging in areas vulnerable to flooding.

Keywords : mitigating strategies, spatial planning interventions, urban flooding, violation of development control regulations
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