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Urban Flood Management – A Review

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***Abstract*—Urban flooding has become a serious concern in many Indian cities due to rapid urbanization, inadequate drainage systems, and poor stormwater management. The present study focuses on Maruti Chowk, Sangli, a densely populated and commercially active area that frequently experiences waterlogging during heavy rainfall. The main objective of this study is to identify the causes of flooding, analyze the existing drainage conditions, and suggest practical solutions for effective flood management.Field surveys, data collection from municipal authorities, and public interactions were carried out to assess the problem. The study highlights that improper drainage design, solid waste blockage, and lack of maintenance are the major factors contributing to urban flooding in this area. Based on the findings, recommendations such as improving the drainage network, promoting rainwater harvesting, and increasing public awareness have been proposed. The outcomes of this project aim to support sustainable urban planning and reduce the impact of future flooding in Maruti Chowk, Sangli.**

I. INTRODUCTION

Urban flood management is the process of planning, d esigning, and implementing measures to reduce the ri sk and impact of flooding in urban areas. Due to rapid urbanization, natural drainage systems are often repla ced by impermeable surfaces like roads, pavements, a nd buildings, which prevent rainwater from soaking i nto the ground. As a result, even moderate rainfall can lead to waterlogging, flash floods, and severe damage to infrastructure and property.The main objective of u rban flood management is to minimize flood risks, pr otect human lives and property, and ensure sustainabl e urban development. It involves both structural meas ures (such as stormwater drains, retentionponds, and f loodwalls) and non-structural measures (like early wa rning systems, land-use planning, and public awarene ss).

Urban flood management requires coordination amon g urban planners, engineers, environmentalists, and lo cal authorities. It focuses not only on flood control bu t also on managing excess water in a way that benefits urban ecosystems, such as through rainwater harvesti ng, green roofs, and permeable pavements.In summar y, effective urban flood management combines engine ering solutions, environmental sustainability, and com munity participation to create resilient and flood-safe cities.

Consequences: Loss of Life and PropertyUrban flood ing can result in loss of life, damage to property, and displacement of people.Economic Impacts: Flooding can disrupt businesses, transportation, and essential s ervices, leading to significant economic losses.Envir onmental Degradation: Flooding can contaminate wa terways, harm ecosystems, and affect public health. S trategies for Urban Flood Management in Sangali. Im prove drainage system Upgrade and maintain the drai nage system to ensure it can handle excess water. Flo odplain management: Implement floodplain manage ment strategies to prevent encroachment and develop ment in flood-prone areas. Early warning systems: Es tablish early warning systems to alert residents of im pending floods. Green infrastructure Implement gree n infrastructure, such as rain gardens and green roofs , to reduce stormwater runoff.

II. LITERATURE REVIEW

I. NDMA (2010) – “Urban Flooding: Guidelines f or Management” Source: National Disaster Man agement Authority, Government of India. This s tudy defines urban flooding as the result of poor drainage design and encroachment. It recommen ds early warning systems, public participation, a nd proper maintenance of urban drains for reduc ing flood impacts. the major causes of flooding a re inadequate stormwater infrastructure, encroachment on natural drains, and lack of maintenance. Both studies emphasize the need for integrated flood management that combines proper drainage design, early warning systems, and active community participation.

II. Central Water Commission (2017) – "Guidelines for Urban Flood Management in India" Source: Ministry of Jal Shakti, Government of India. Emphasizes the integration of urban planning with flood management, adoption of sustainable drainage systems (SUDS), and periodic cleaning of storm drains to minimize runoffand flooding.

III. Sarkar, S. & Ranjan, P. (2020) – "Urban Flood Management: Challenges and Solutions in Indian Cities" Source: Journal of Water Resource Management. Focuses on how rapid urbanization and impermeable surfaces increase runoff. Suggests green roofs, permeable pavements, and rain gardens to improve infiltration and reduce flooding. They propose the use of green infrastructure such as rain gardens, permeable pavements, and green roofs to restore natural water balance.

IV. Gupta, A., Sharma, V. & Mehta, P. (2019) – "GIS-Based Flood Risk Assessment in Urban Areas" Source: International Journal of Environmental Engineering. Demonstrates how GIS and remote sensing tools can map flood-prone areas, analyze drainage efficiency, and help in planning structural flood management strategies. These tools enable local authorities to identify critical points for improvement and implement targeted flood control measures.

V. Maharashtra State Disaster Management Authority (2021) – "Flood Risk Assessment and Mitigation Strategies" Source: MSDMA Annual Report, Government of Maharashtra. Highlights that urban flooding in Maharashtra is aggravated by climate change and land-use changes. Recommends community-based management and improved drainage networks.

VI. Jain, S.K. & Kumar, V. (2018) – "Hydrological Analysis of Urban Flooding in India"Source: Indian Journal of Hydrology. Explores rainfall-runoff relationships in cities and identifies the need for upgrading stormwater infrastructure to match current rainfall intensities.

VII. Sharma, R. & Patel, D. (2022) – "Impact of Urbanization on Stormwater Drainage in Indian Cities" Source: Journal of Urban Environmental Studies. Examines how urban expansion without proper drainage design increases flood risks. Suggests incorporating climate resilience into city master plans.

VIII. Singh, A. & Tiwari, S. (2016) – "Sustainable Drainage Systems (SUDS) for Flood Control" Source: Water and Environment Journal Describes the role of SUDS techniques like infiltration trenches and detention ponds in managing excess surface runoff in urban areas.

IX. Patel, N. & Deshmukh, R. (2021) – "Assessment of Flood Vulnerability Using GIS Tools" Source: International Journal of Civil and Environmental Research. Uses GIS-based modeling to identify vulnerable flood zones and recommend structural improvements to reduce waterlogging.

X. Ahmed, F. & Khan, M. (2015) – "Urban Floods: Causes and Mitigation Strategies" Source: Journal of Disaster Risk Reduction. Analyzes urban flood causes like poor waste disposal, encroachment, and blocked drains. Suggests awareness campaigns and waste management improvement for flood prevention. the combined impact of climate change and urban encroachments, recommending a balance between engineering interventions and community-based strategies.

XI. Rao, P. & Iyer, R. (2014) – "Urban Drainage Planning for Flood Mitigation" Source: Indian Infrastructure Journal. Emphasizes scientific drainage planning with proper gradient and capacity design to prevent urban flooding during heavy rainfall events.

XII. Field Survey (2025) – "Primary Data Collection at Maruti Chowk, Sangli" Source: Author's Field Observation. On-site study conducted to identify waterlogging zones, evaluate drainage performance, and interact with residents. Confirms that blocked drains and poor maintenance are major flood causes in Maruti Chowk.

III. SUMMARY

The reviewed literature highlights that urban flooding has emerged as a significant environmental and infrastructural challenge in Indian cities due to rapid urbanization, poor drainage systems, and unplanned land use. According to NDMA (2010) and the Central Water Commission (2017), the major causes of flooding are inadequate stormwater infrastructure, encroachment o n natural drains, and lack of maintenance. Both studie s emphasize the need for integrated flood managemen t that combines proper drainage design, early warning systems, and active community participation.Sarkar a nd Ranjan (2020) and Sharma and Patel (2022) discus s how increasing impermeable surfaces like roads and pavements reduce infiltration and accelerate runoff, le ading to waterlogging. They propose the use of green infrastructure such as rain gardens, permeable paveme nts, and green roofs to restore natural water balance. S imilarly, Singh and Tiwari (2016) and Jain and Kuma r (2018) highlight the importance of Sustainable Drai nage Systems (SUDS) and stormwater modeling to co ntrol runoff and prevent flooding during intense rainfa llStudies by Gupta et al. (2019) and Patel and Deshm ukh (2021) emphasize the role of Geographic Informa tion Systems (GIS) in mapping flood-prone zones and assessing the effectiveness of existing drainage netwo rks. These tools enable local authorities to identify cri tical points for improvement and implement targeted f lood control measuresAhmed and Khan (2015) and R ao and Iyer (2014) focus on non-structural approaches , such as public awareness campaigns, solid waste ma nagement, and periodic drain maintenance, to reduce urban flood risks. The Maharashtra State Disaster Ma nagement Authority (2021) also stresses the combine d impact of climate change and urban encroachments, recommending a balance between engineering interve ntions and community-based strategies.Finally, the fie ld study (2025) conducted at Maruti Chowk, Sangli c onfirms many of these findings on a local scale. The s urvey revealed that poor drain maintenance, solid was te blockage, and insufficient slope design are the main reasons for flooding in the area.In conclusion, the lite rature collectively supports that effective urban flood management requires a holistic and sustainable appro ach, integrating technical solutions, urban planning, G IS mapping, and community participation. Applying t hese principles to Maruti Chowk, Sangli can significa ntly improve flood resilience and promote long-term u rban sustainability.

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