INTERNATIONAL JOURNAL FOR LEGAL RESEARCH AND ANALYSIS

Open Access, Refereed Journal Multi Disciplinary
Peer Reviewed

www.ijlra.com

ISSN: 2582-6433

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ISSN: 2582-6433

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ISSN: 2582-6433

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ISSN: 2582-6433

URBAN FLOODING IN INDIA: LEGAL CHALLENGES AND POLICY PATHWAYS FOR RESILIENT CITIES

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ABSTRACT

Urban flooding has emerged as one of the most drastic environmental and governance challenges to encounter Indian cities in recent decades. The significant increase in vulnerability of urban areas to intense rainfall and waterloging because of rapid and unplanned urbanisation, negligent land use, encroachment of natural drainage systems and inadequate infrastructure. This paper examines the legal and policy dimensions of urban flooding in India while focusing on the effectiveness of existing legislative frameworks such as Disaster Management Act, 2005, the Environmental (Protection) Act, 1986 and various other bylaws and regulations. It highlights the gaps in urban planning, enforcement, and coordination among multiple agencies responsible for flood management. Through a critical review of current legal instruments and policy initiatives, the study explores the need for integrating climate resilience, ecosystem restoration, and sustainable drainage systems into urban development plans. The paper further proposes legal reforms and institutional mechanisms to strengthen accountability, promote participatory governance, and enhance the adaptive capacity of Indian cities. By aligning urban policy with environmental sustainability and disaster risk reduction goals, India can move toward building resilient and flood-secure cities capable of withstanding the growing impacts of climate change and extreme weather events.

KEY WORDS: Flood, Anthropology, Urbanisation, Industrialisation, Climate Resilience, Sponge city, Infrastructural designs etc.

INTRODUCTION

The term urban flood is not new to the human civilization but it is known to the human since ancient times.In our history there was a well developed and well known civilization that existed, known as Harappan Civilization. Although there is no specific cause for the decline of the Harappan Civilization, according to British hydrologist *Robert L. Raikes* and archaeologist

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George F. Dales prolonged flooding is one of the reasons causing the Indus River to back up and submerge cities for extended periods, disrupting their agricultural base and economy. The urban flooding is a problem of ancient as well as of today. Therefore, Urban flooding has emerged as a significant climate induced disaster in India, driven by climate change patterns and unplanned urban growth.

The concept of urban flooding is arising out of the failure of disaster management. Urban flooding refers to the inundation of land or property of highly populated areas due to the excessive rainfall or the overflow of rivers and draining systems. Hence, unlike riverine flood, urban flooding disrupts densely populated areas, causing several severe economic, infrastructural and human losses. The special feature of the Indian monsoon is that the rainfall is comparatively massive. There are other weather systems also that bring in alot of rain; storm surges can also affect coastal areas, sudden release or failure to release water from dams can also have several impacts on urban flooding.

Urban flooding in India is a growing problem with increased frequency and severity in recent decades. It is a very devastating problem and the major cities in India are affected because there has been an increasing trend of urban flooding disasters in India over the past decades. The most notable examples among them are Hyderabad in 2000, Ahmadabad in 2001, Delhi in 2002 & 2003, Chennai in 2004, Mumbai in 2005, Surat in 2006, Kolkata in 2007, Jamshedpur in 2008, Delhi in 2009, Guwahati and Delhi in 2010, Chennai in 2015 etc., the result of these flooding is completely distinctive and hundred thousand millions of people get affected. In recent years India has faced urban floods in Mumbai (2023), devastating floods in Delhi (2023), Bengaluru in 2022, Chennai floods in 2021 etc.

The problem of urban flooding has turned out to be both widespread and severe for India's major cities, resulting from rapid urbanisation, lack of proper drainage infrastructure, climate change and unplanned development. Flood disasters are a major source of life lost, damage to infrastructure and disruptions to economic activities far into the future that reveal shortcomings in India's current legal and policy regime for managing floods in urban areas. Key instruments including the Disaster Management Act 2005, National Guideline for Urban Flooding, Municipal laws and building codes are intended to handle these issues, yet they are held back by institutional fragmentation, poor inter- agency coordination, outdated legislation, and weak enforcement. Those most at risk, including the poorest who live in informal settlements, are

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the most affected by these systemic failures.

This is a crucial issue as it helps to scrutinize the institutional and legislative gaps that impede efficient flood management in the era of India's rapid urban expansion and growing climate risk. Studying the past templates could provide valuable lessons for the policy makers, urban planners, and disaster managers to be used for their better effectiveness and limitations.

The present paper intends to critically analyze the existing legal and policy mechanisms for management of urban floods in India in terms of their effectiveness, limitations and implementation constraints. It looks at constitutional provisions, legislation acts, institutional structures, and national policy responses in disaster management, urban planning, and climate adaptation. The scope ranges from judicial intercessions to case studies of the most significant urban flood events to the function of local governance. The paper assesses deficiencies in coordination, enforcement and community involvement, and argues for reforms to build a robust urban flood management system in India, which is becoming increasingly inundated in the face of climate change.

CASE STUDIES OF URBAN FLOODS IN INDIA

1. Hyderabad urban floods (2000, 2008, 2020)

A fast growing metropolis which historically featured over 400 lakes and drainage channels, on the Deccan plateau. The population grows with the similar pace of growing of metropolis from 1.8 million (1971) to 6.7million (2011) causing massive strain on civic infrastructure along with environmental degradation, shrinking water bodies and encroachment of natural flow paths.[1]

There occurred various flood events in Hyderabad. However there are few of them which caused great havoc, which disturbed the daily life of living beings.

- The 2000 flood event- The rainfall of 263.6mm and 246.2mm in two days occurred in august 23-24, highest in 46 years. It inundated low lying slums as well as upmarket areas like Banjara hills and Jubilee Hills causing dozens of deaths, property damage and over 700 crore in losses.[2]
- The 2008 flood event- In August 2008, an unseasonal rain of 12cm in 14 hours led to

[1] Zaheer Ahmed, D. Ram Mohan Rao, Dr. K. Ram Mohan Reddy & Dr. Y. Ellam Ra, *Urban Flooding- Case Study Of Hyderabad*, 2(4) GJEDT, 63-66 (2013).
[2] *Id.* 1

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severe inundation, it mainly affected the districts of Andhra Pradesh.[3]

- The 2020 flood event- In October 2020, rainfall up to 320mm in 24hours inundated Telangana, Andhra Pradesh, Karnataka and in Hyderabad due to deep depression BOB O2.[4]

2. Delhi urban flood (2002, 2003, 2009, 2010)

Delhi, one of the noticeable city in the face of flood events even after having less than average exposure to monsoon rainfall. It faced the flooding in years like 2002,2003,2009 and 2010 shutting down the transport system, severe waterlogging, economic disruptions and strain on civic services.

- The 2002 flood event- During monsoon season 2002, although the rainfall was below-normal scale however it caused the intense widespread flooding, filling of lakes, blockage of natural drainage channels by garbage and illegal construction on floodplains which demonstrated the infrastructural deficiencies.[5]
- The 2003 flood event- Just the previous year faced the similar situation of flood during monsoon despite that the infrastructural management was not as improved as it should have. This year again despite short-duration rainfall, it led to severe water logging and urban flooding due to overwhelming drainage network.[6]
- The 2010 flood event- On September, 2010 over 900,000 cusecs of water was released from the Hathnikund barrage which pushed the Yamuna river above its danger mark of 204.83 meters. Existing drainage system could only handle 200,000 cusecs at that time in Delhi eventually leading to massive inundation.
- The 2009 flood event- Flooding was not caused by the handicaped infrastructural instead by the rise of water in Yamuna River led to extensive urban inundation covering most of the north Delhi and Trans-Yamuna area.[7]

3. Mumbai urban flood (2005)

Mumbai, the 'Financial and Entertainment Capital of India' with the mouthwatering street foods and the hypnotic view of artistical historical sites like the Gateway of India and

[3] *Id.* 1
[4] *Id.* 1
[5] A.K. Gossain, P.K. Khandelwal & S. Kulshrestha, *Urban Floods: Case Study Of Delhi*, 3 D&D, 15-45 (2009).
[6] *Id.* 5
[7] *Id.* 5

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Elephanta caves faced various flood events, one of the major flood in the history of Dubai was in 2005.

- The 2005 flood event- On July 26, 2005 Mumbai received a record-breaking rainfall of 944mm within 24hours causing massive flooding in both residential and commercial areas. Over 500 deaths reported and millions were stranded with the crippling of city's transportation for days.[8]

4. Bangalore urban floods (2013, 2022)

Bangalore also known as 'Silicon valley of India' has been rapidly urbanising since 1980s, the large scale construction on wetlands and lake beds leading to extensive changes in use of the land and loss of natural water bodies causing frequent pluvial flooding during high intensity, short duration rainfall.[9]

There are some such floods which have occurred in previous years.

- The 2013 flood event- On November 23,2023 Bangalore faced high intensity rainfall which created excess runoff which was six times the carrying capacity of local drains resulted overwhelming drainage in the low-lying areas of west zone. It had socio-economic impacts, effects daily mobility, hindered emergency responses and led to localised economic loss.[10]
- The 2022 flood event- on September 5,2022 Bangalore recorded rainfall of 132mm within 24hours spreading flood in residential areas and tech parks such as Sarjapur road, Bellandur, Mahadevapura and Varthur.[11]
- The 2024 flood event- On October 2024, a record breaking rainfall of 157mm within 6hours in Yelahanka flooded over 1030 homes in North Bangalore. For the first time in 17years the Doddabommasandra lake overflowed, inundating nearby areas.

5. Chennai urban flood (2015)

A home to over 8.6 million people lies on a flat bounded by Bay of Bengal. Chennai often faces flood during northeast monsoon (September - November). However, the 2025 flood was an exceptional in cases.

- The 2015 flood event- During northeast monsoon in Chennai in 2015, Chennai faced a

[8] Kapil Gupta, *Urban Floods:Case Study Of Mumbai*, 3 D&D, 99-120 (2009).
[9] Pallavi Mukhopadhyay & Bijay Kumar Das, *Urban Flooding: Case Study of Bangalore*, IMCCRT (2023).
[10] *Id.* 9
[11] *Id.* 9

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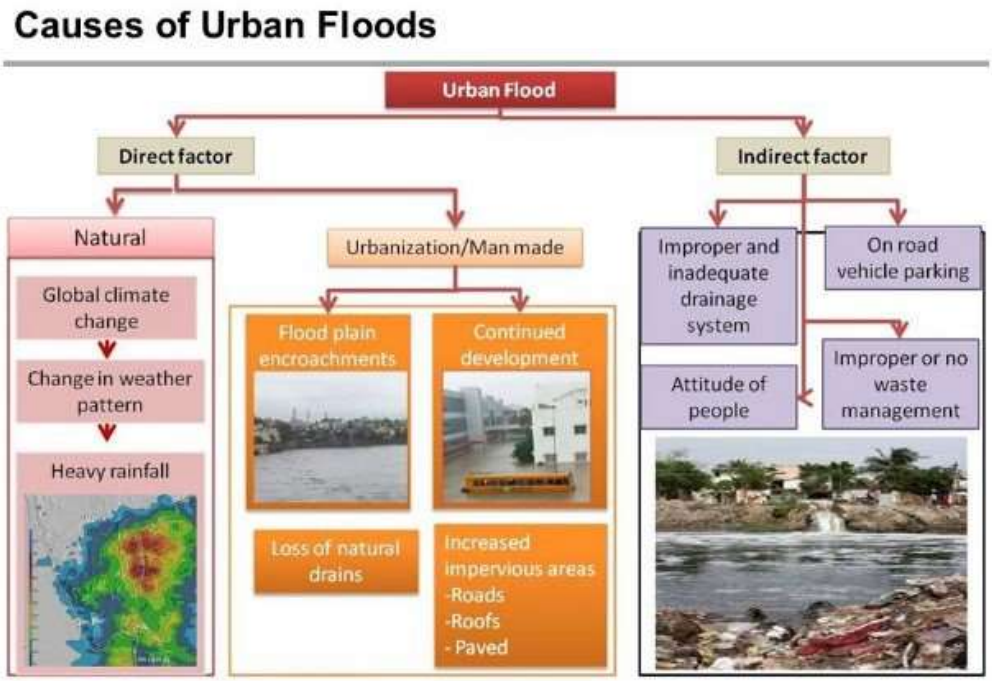
rainfall of over 1000mm in less than a month due to deep depression in bay of bengal causing havoc and overflowing of rivers (Cooum, Adyar, Kosasthalaiyar) with the sudden release of water from the Chembaramkkam reservoir, affecting more than 4million people and over 400 deaths were recorded with the infrastructural damage of exceeding 20000 crore.[12]

CAUSES OF URBAN FLOODS IN INDIA



As it can be seen in the above mentioned picture[13] that there the cause of urban flood is divided into 2 factors: Direct factor & Indirect factor which is further categorised; here is a detailed breakdown of these:

1. DIRECT FACTORS

These are those factors that have a direct and immediate influence on the occurrence of floods. They are basically Natural and Anthropogenic sources which directly causes excessive water accumulation; these natural and anthropogenic sources further categorised into following-

[12] Ar. K. Lavanya, *Urban Flood Management: A Case Study of Chennai city*, 2(6) SAP (2012).
[13] ILEARNCANAavailable at https://ilearncana.com/details/URBAN-FLOODING-IN-INDIA/1420 (last visited Sep. 30, 2025).

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A. NATURAL

i. Global climate change- The rapid change in global temperatures which is continuously rising have intensified the water cycle making heavy downpours more frequent and severe leading to sudden overwhelming of city drainage systems.[14]

Eg: In 2023, Delhi experienced intense floods as a result of record rainfall and Chennai in 2015 saw record rainfall aggravated by anomalous weather linked to a warming climate.[15]

ii. Change in weather patterns- Irregular monsoon behaviour, delayed or shifted rainfall, and erratic weather have increased the unpredictability and incidence of high-intensity rainfall event within short durations.

Eg: The sudden cloudbursts seen in Himachal Pradesh (2023) and Mumbai (2023)[16].

iii. Heavy Rainfall- Resulting from both climate change and disrupted weather, torrential rain in a short period exceeds the capacity of urban drainage and natural absorption, causing flooding.

Eg: Mumbai rainfall in July 2005 was cause by 944mm rainfall in a single day which was way beyond the drainage system's capacity.[17]

B. ANTHROPOGENIC

i. Flood plain encroachments- Unauthorised construction on river beds, floodplains and wetlands reduces the natural capacity for water storage and channels, blowing natural drainage routes and increased the risk of waterloging and urban floods.

Eg: • Delhi's Yamuna floodplain has lost over 75% of its area to encroachments which results in reducing floodwater carrying capacity and causing the river to flood city areas even at lower discharge levels.[18]

- Bangalore lost 80% of its lakes due to illegal construction leading to rampant urban flooding in 2022 and 2024.[19]

ii. Continued development- The rapid growth of urbanisation in last few decades have contributed in the flooding as well.

[14] *Id.* 13
[15] *Supra*, note 5, A.K. Gossain, P.K. Khandelwal & S. Kulshrestha *at 4.*
[16] *Supra*, note 8, Kapil Gupta *at 5.*
[17] *Supra*, note 8, Kapil Gupta *at 5.*
[18] *Supra*, note 5, A.K. Gossain, P.K. Khandelwal & S. Kulshrestha *at 4.*
[19] *Supra.*, note 9, Pallavi Mukhopadhyay & Bijay Kumar Das *at 5.*

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Eg: Increased impervious areas such as surfaces like roads, concrete pavements and roofs, they do not absorb water, forces rainwater into drains which may already be inadequate, leading to increased runoff and flood risk.

2. INDIRECT FACTORS

These are the underlying contributors which does not directly caused flooding but intensify its likelihood, duration or impact by creating unfavourable urban or societal conditions. These factors are further discussed below-

i. Improper and inadequate drainage system- Many urban areas have outdated or insufficient drainage infrastructure that cannot cope with the now rainfall intensities as it was designed during colonial periods, leading to quick water accumulation ad flooding.

ii. Eg: Mumbai's drainage handles 25mm/hr but rainfall exceeds 100mm/hr resulting in frequent flooding.[20]

iii. On-Road vehicle parking- Vehicles parked on streets, especially during rains blocks the free flow of water. Often causing artificial choke points and localised flooding.

iv. Attitude of people- Lack of civic responsibility, including negligence in maintenance, and protecting public resources, exacerbates flood risks.

v. Improper or no waste management- Garbage like plastic and debris, dumped into drains and water bodies blocks flow, reducing drainage efficiency and leading to frequent water logging and flooding.

THEORETICAL FRAMEWORKS AND MODELS USED FOR EVALUATING LEGAL AND POLICY RESPONSES

In the recent years various theoretical approaches and models have been developed and deployed to assess the effectiveness of legislation and public policy concerning urban flood risk. Here, some most significant approaches have been discussed:

1. Legal-Ecological Frameworks

This approach recognizes the interdependence of law and environment. Environmental law, with statutes like the Environment Protection Act, 1986 and the Wetlands (Conservation and Management) Rules, 2010, is analyzed not just for its intent but for its practical power to

[20] *Supra.*, note 8, Kapil Gupta *at 5.*

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preserve ecological "services" such as flood absorption. For eg: before any big construction, government agencies have to do Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA), they are foregrounded as tools to anticipate flood risk in development planning. Legal-ecological critiques often reveal that while laws exist 'on paper', their enforcement is piecemeal often bogged down by political feuds, economic pressures, and bureaucratic inertia.

2. Policy Analysis Models

These are the classic policy process models such as agenda setting (an initial idea), formulation(shaping the rule), adoption(officially deciding on it), implementation(putting it into practice) and finally evaluation(seeing if it worked); provide a scaffold for investigating why sound flood management policies often falter. These models often argue that failures are usually found not in technical design but in weak institutional follow-through., stakeholder disengagement, or poor feedback mechanisms for learning and adaptation. Newer policy analysis incorporates "adaptive governance," advocating policy cycles that remain responsive to rapidly changing rainfall and urbanization patterns.

3. Risk Governance and Urban Resilience Models

Contemporary urban flood scholarship builds on the Sendai Framework and similar international protocols emphasizing risk governance i.e. the participation of multiple governmental tiers, the private sector, and communities in managing flood hazards. Integrated Water Resource Management (IWRM) models are commonly applied, promoting an all-systems approach: aligning water supply, stormwater, waste, and ecosystem management. The "sponge city" concept is gaining traction for promoting permeability and nature-based solutions such as cities should let water be absorbed with parks, open soil and natural ponds, and not just push it away with concrete.

4. Community-Based Disaster Risk Reduction (CBDRR)

Research demonstrates that top-down approaches to legal and policy reform will fall flat without grassroots involvement. The best outcomes come when local neighbourhoods are involved, CBDRR models prioritize local knowledge, participatory risk mapping, and empower communities as active agents in both preparation and response. These models yield policies that are more likely to be enforced and adapted to ground realities.

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5. Socio-Legal and Institutional Analysis

This framework scrutinizes the effectiveness of institutions tasked with disaster management; urban local bodies, municipal corporations, water authorities, and their legal mandates. Analyses often uncover overlapping or poorly defined roles, legal ambiguities, and a lack of cross-sectoral collaboration. Comparative legal studies of Indian law and policy with global best practices, helps in identifying avenues for harmonization with evolving global standards on climate adaptation and urban sustainability.

6. Sustainability and Social Equity Theories

Lastly, sustainability science and social equity theories critique urban flood governance where legal and policy responses fail to consider the vulnerabilities of informal settlements, slum-dwellers, or marginalized groups. Empirical studies demonstrate that floods disproportionately harm those with the least resources, creating feedback loops of poverty and risk. Thus, 'just resilience' models underscore the need to blend technical, legal, and socio-economic considerations in crafting flood policies.

LEGAL AND POLICY ANALYSIS

Urban flooding is one of the biggest administrative challenges in India, where rapid and unplanned urbanisation interacts with the increasing intensity of rainfall due to the drastic climate change. It critically examines the existing legal and policy framework, including relevant judicial precedents, to identify systemic weaknesses and propose reforms based on comparative international best practices.

1. Indian Laws and Urban Floods

India's legal framework for managing urban flooding is an incoherent mix of disaster response, regional environmental laws, and municipal regulations, lacking a single, coherent focus on proactive water and land use integration.

i. **The Disaster Management Act, 2005 (DMA):** The Disaster Management Act, 2005 (DMA) created a hierarchical structure (i.e., NDMA, SDMA, DDMA) for the management of all disasters, including urban flooding. It emphasizes the preparation of disaster and mitigation plans (Sections 23, 31).

Critical Evaluation: The DMA is strong in **institutional design and post-disaster**

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response (relief and rehabilitation).[21] However, its proactive mitigation provisions are weak in execution. Mitigation plans often fail to legally compel the necessary changes in statutory urban planning and construction codes. DMA is inherently reactive, focusing on managing disasters rather than applying the hydrological discipline needed to prevent them, which largely rests with fragmented municipal and planning agencies.[22] The Act is also provide for the authorities like National Disaster Management Authority at centre level and State Disaster Management Authority at State level established by central government and State Government respectively.[23]

ii. **Environmental and Planning Regulations:** There are various laws enacted by the parliament for the purpose of protection and improvement in the environment. The most prominent and effective Act of parliament is The Environment (Protection) Act,1986 which comprehensively covers all components of the natural world and their interactions and water as a part of the environment. The Act defines "environment" as it includes water, air, and land, along with the inter relationship between them and human beings, other living creatures, plants, micro-organisms, and property.[24]

iii. **The Water (Prevention and Control of Pollution) Act, 1974:** The Act aims to prevent and control water pollution by prohibiting the discharge of pollutants into water bodies without the prior permission of the State authorities. Therefore, its purpose is to maintain or restore the healthfulness of water, ensuring it is safe for domestic, agricultural, industrial and ecological uses. While analysing this Act we find that it focuses on water quality and does not adequately address the physical blockage of drainage channels by solid waste and encroachment, which are major causes of urban flooding.

iv. **Environmental Impact Assessment (EIA) Notification, 2006:** The Environmental Impact Assessment (EIA) process mandates clearance for large projects but frequently overlooks the cumulative effects of small-scale urbanization on regional hydrology. Critics argue that it often fails to enforce thorough hydrological impact studies or consider future climate change impacts, such as increased extreme rainfall intensities. This oversight risks underestimating urbanization's overall effect on water systems and

[21] National Disaster Management Authority, NATIONAL DISASTER MANAGEMENT GUIDELINES – MANAGEMENT OF
URBAN FLOODING 3-5 (2010)
[22] Jagdish Kishan, *Urban Flooding: A Case of Planning and Institutional Failure in India*, 10(4) JUG, 301-305 (2020).
[23] Disaster Management Act, 2005, S. 3 &4.
[24] Environment Protection Act, 1986, S. 2(a).

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flooding vulnerability, limiting the effectiveness of environmental protection efforts.[25] Most prominent example is The Yamuna River floodplains near Delhi suffer from unchecked urban construction and pollution, this contributes to severe flood vulnerability and environmental degradation.

v. **Wetlands (Conservation and Management) Rules, 2017:** These rules protect natural water retention zones. But its Effectiveness and Enforcement is weak. Wetlands are often illegally converted due to intense development pressure, reflecting a deep enforcement deficit stemming from political and bureaucratic failure to protect common property resources.[26]

vi. **Town and Country Planning Acts and Master Plans:** These are the legal means by which urban form should be controlled. Master plans are systemically flawed; they often lack integrated flood risk data, allowing legal rezoning and construction on natural drainage channels and river floodplains. Failure to integrate planning with natural topography makes urban planning a direct factor in flood risk.[27]

2. Landmark Judicial Intervention

The judiciary has repeatedly intervened, holding that the state's failure to prevent floods violates the fundamental right to life guaranteed under Article 21 of the Constitution of India, forcing the executive to take action.

- In *L.K. Koolwal v State of Rajasthan (1988)* the Court held that an early affirmation that the municipal failure to maintain sanitation and drainage is a violation of the citizen's right under Article 21. The Court further emphasized that poor sanitation posed serious public health risks and could lead to premature death and establishing a baseline of public accountability.[28]
- *R.K. Jallan v State of Maharashtra (Bombay High Court, 2005):* The High Court Followin the devastating Mumbai floods, the Court directly indicted municipal negligence in the desilting and maintenance of the Mithi River and storm drains, highlighting the state's breach of the Public Trust Doctrine over natural water bodies.[29]

[25] CENTER FOR SCIENCE AND ENVIRONMENT, URBAN FLOODING: A REALITY CHECK 20-25 (2017).
[26] Srijan Singh, *Environmental Laws and Urban Flooding in India: A Critique of Enforcement*, 15(2) JELP, 110,115 (2023).
[27] Nitya Jacob, WATER POLICY IN INDIA: GLOBAL PERSPECTIVES AND LOCAL REALITIES 78-81 (2014).
[28] *L.K. Koolwal v. State of Rajasthan*, A.I.R.1988 Raj 2 (India).
[29] *R.K. Jallan v. State of Maharashtra*, Writ Petition No. 1774 of 2005 (Bombay HC) (unreported) (India).

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- *Society for Protection of Culture, Heritage, Environment, Traditions and Promotion of National Awareness (S.P.C.H.E.N.) v Union of India (2013):* The National Green Tribunal (NGT) prohibited construction on the "active floodplain" of the Yamuna River, setting a precedent that ecological necessity overrides development zoning in hydrologically sensitive areas.[30]
- *Forward Foundation v State of Karnataka (2016):* The NGT mandated the demolition of buildings encroaching on the buffer zones of Bengaluru's lakes and rajakaluves (storm drains), imposing heavy environmental compensation. This ruling underscored the judicial necessity of protecting buffer zones as a non-negotiable flood mitigation strategy.[31]

Although judicial activism has provided a legal principle of accountability, the persistent failure of the executive to implement these decisions (e.g., reluctance to carry out large-scale demolitions) remains the biggest obstacle to achieving flood resilience.

ANALYSE THE EFFECTIVENESS, LACUNAE AND IMPLEMENTATION ISSUES

The current regime's effectiveness is crippled by implementation challenges rooted in fragmented governance and political economy.

1. Implementation Issues and Weak Effectiveness

i. Jurisdictional Fragmentation and Policy Silos: Responsibility for drainage system design, maintenance and land use control is divided among several uncoordinated agencies (ULBs, development authorities, irrigation departments). This institutional inconsistency prevents the implementation of Integrated Urban Water Management (IUWM) and ensures that maintenance and design deficiencies persist in urban catchments.[32]

ii. Lack of Political Will and Enforcement Deficit: Despite legal mandates and judicial orders, political interference conceals illegal encroachments on stormwater drains

[30] *Society for Protection of Culture, Heritage, Environment, tradition and Promotion of National Awareness v. Union of India*, (2013) All India NGT Rep 1(Principal Bench) (India).
[31] *Forward Foundation v State of Karnatak*, (2016) All India NGT Rep 1 (South Zone) (India).
[32] Debolina Kundu & V. G. Krishnan, *Urban Flooding and Governance Challenges in Indian Cities*, 1 EPW, 55, 58-59 (2022).

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(nallahs). The de facto regulation of such structures under political patronage ensures that the water carrying capacity of urban drainage is permanently compromised.

iii. Inadequate Design Standards for Climate Resilience: Infrastructure design is based on outdated historical rainfall data, leading to underdesigned drainage systems that fail catastrophically during high-intensity, short-term events driven by climate change.[33] There is no legal mandate to enforce the use of future climate projections (probable maximum rainfall) in civil engineering codes.

iv. Resource Constraints and Technical Capacity: Urban Local Bodies are the agencies responsible for ground level maintenance and these agencies are generally financially weak and lack the technical expertise, modern equipment, and advanced information technology systems (like sensor based early warning) necessary for managing complex urban hydrology.

2. Major Lacunae in the Legal Framework

i. Absence of a Dedicated Urban Flood Resilience Law: India lacks a specific legislative framework that would override general municipal laws, centralise flood risk management accountability, and mandate a 'prevention-first' approach for urban areas.

ii. Failure to Institutionalize Nature-Based Solutions (NBS): The legal framework and financial schemes are highly biased towards expensive ‘grey infrastructure’. There is no clear, binding legal mandate or strong financial incentive for widespread adoption of Nature-Based Solutions (e.g., permeable paving, bio-pathways, urban green spaces) as a preferred, sustainable flood mitigation strategy.[34]

iii. Weak Accountability Mechanism: The lack of a concretionary system of strict liability or tort law against public agencies for damages caused by negligent infrastructure management eliminates a powerful incentive for executive compliance with engineering standards and maintenance programs.

COMPARATIVE OBSERVATION WITH INTERNATIONAL FRAMEWORKS

International frameworks provide models for structural and legal reforms that integrate risk

[33] K. S. Reddy & P. K. Rao, *Climate Change and Urban Drainage Design Standards in India*, 15 JWM 401, 405 (2021).
[34] Dipak Das & Anupama Rao, *The Role of Nature-Based Solutions in Urban Flood Resilience: Lessons from Global Practice in* WATER GOVERNANCE IN THE ANTHROPOCENE 110, 115 (K. Lal *et.al.*, eds. 2022).

ISSN: 2582-6433

and environmental goals effectively.

1. The European Union (EU) Floods Directive (Directive 2007/60/EC)

The EU approach is defined by its cyclical, risk based management and high degree of legal enforcement. The Key Feature of the Directive can be discussed in the manner that It is legally mandated for the preparation of detailed flood hazard maps and flood risk maps every six years, which would form the basis of Flood Risk Management Plans (RMPs). This emphasizes the need for systematic, evidence based inclusion of flood risk in regional and local planning.[35] Therefore India needs a legally binding, time bound flood mapping and planning cycle. Linking the statutory review of Master Plans to the outcomes of high resolution flood mapping, similar to the EU model, would ensure that development is intrinsically risk informed.

2. China's 'Sponge City' Initiative (SCI)

The SCI is a large-scale, national level policy commitment to Nature-Based Solutions (NBS). The policy directs cities to adopt green infrastructure technologies to maintain, absorb and reuse a certain percentage (usually 70%) of rainwater in situ. It represents a fundamental institutional shift from rapid 'drainage' to ecological 'retention and ingestion'.[36] Comparatively India should elevate NBS from mere recommendations (like rainwater harvesting in building codes) to a national mission with specific quantitative targets and dedicated financing, legally compelling ULBs to prioritize green infrastructure over concrete channels.

3. United States' National Flood Insurance Program (NFIP)

The US model uses financial leverage to enforce local planning compliance. Communities can only receive federally subsidized flood insurance, if they adopt and enforce minimum floodplain management regulations based on FEMA's detailed Flood Insurance Rate Maps (FIRMs). This links local planning decisions directly to federal financial benefits for each section. India lacks this financial-legal capability. Making Central Government funding for urban development (e.g., Smart Cities, Amrut) contingent upon strict adherence to scientifically-derived, legally gazetted flood- zoning maps would empower local administrators to resist political pressure from encroachers.

[35] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the Assessment and Management of Flood Risks (EU Floods Directive) [2007] OJ L 288/27, art 3.
[36] Lei Wang *and others., Implementation of China's "Sponge City" Program: Policy, Progress, and Challenges,* 168 WP 203, 207–209(2018).

ISSN: 2582-6433

The long standing problem of urban flooding in India is a result of the failure of the executive to enforce existing laws and a highly fragmented and reactive legal framework. While judicial intervention provides important legal principles, effective flexibility requires systemic reform. This requires the following:

-) a new Urban Flood Resilience Law to consolidate the authority;
-) Legally mandated integration of high-resolution flood risk data and future climate projections into the master plan;
-) financial incentives and legal obligations to protect natural drainage corridors and the widespread adoption of nature-based solutions.

Only through such comprehensive legal and policy changes can India protect its cities from future urban flood disasters.

RECOMMENDATION FOR IMPROVING LEGAL AND POLICY RESPONSES

1. Strengthening Institutional Governance And Coordination

i. Operationalising Metropolitan Planning Committees (MPCs)

State governments should legally mandate the operation of MPCs, empowering them to act as the apex coordinating body for area-wide, catchment-based stormwater management and integrated land-use zoning. This addresses the institutional blind spot caused by state-level centralisation.

ii. Institutionalizing Climate Integration

Current urban governance structures are inadequate to address multidimensional climate risks.The Ministry of Housing and Urban Affairs (MoHUA) should mandate the establishment of special climate cells within all A and B category Urban Local Bodies (ULBs). These cells should be given executive authority to proactively screen all proposed infrastructure and development projects for climate and disaster risks, ensuring vertical integration with state and national agencies.

2. Legal Enforcement and Land Use Management

i. Mandatory Restoration and Anti-Encroachment Action

State land encroachment laws must be strictly enforced. To avoid legal delays, urban local bodies (ULBs) should be mandated to prepare a legally verified inventory of all

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stormwater channels based on hydrological catchment areas.[37] Special Anti-Encroachment Task Forces (AETFs) should be constituted and given quasi-magisterial powers to target encroachments on vital water bodies and expedite eviction and restoration proceedings.

ii. Enforcing Municipal Tort Liability for Negligence

Legal liability should be systematically enforced against urban local bodies for negligence in ministerial duties (operation and maintenance). While the initial design of sewer systems is often considered quasi-jurisdictional and immune, negligent maintenance or construction of that system is a ministerial duty for which a municipality can be held liable, a distinction that has been established in American tort law.[38] In *Rajkot Municipal Corporation v. Manjulaben Jayantilal Nakum & Ors.,* the Court confirmed that the liability of the municipality depends on the existence of a duty of care, breach and foreseeable damage.[39] Urban local bodies should conduct public audits and implement maintenance protocols to avoid actionable negligence in case of flood damage due to failure to clean drains.

3. Modernising Technical Standards and Planning

i. Revision of CPHEEO and NBC Standards

The Ministry of Housing and Urban Affairs should immediately revise the Central Public Health and Environmental Engineering Organisation (CPHEEO) manual on drainage design. The new standards will eliminate reliance on historical data and will mandatorily incorporate long-term climate projections (30-50-year scenarios) to determine design rainfall intensity. Furthermore, the plan will adopt the hydrological catchment area as the basis for design, beyond administrative boundaries, as recommended in the NDMA guidelines.

ii. Mandatory Water Sensitive Urban Design (WSUD)

WSUD principles should be integrated into planning regulations. Legal amendments should require the mandatory inclusion of green infrastructure technologies such as spongy surfaces and rain gardens in all major development plans, as Green infrastructure provides more assured results than reliance on voluntary measures.[40]

[37] *Supra.*, note 21, National Disaster Management Authority *at* 11.
[38] *Johnston v District of Columbia*, 118 U.S. 1886.
[39] *Rajkot Municipal Corporation v. Manjulben Jayantilal Nakum*
[40] Georgetown climate centre, *Green infrastructure toolkit, available at*- https://www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/introduction.html (last visited Sep. 30, 2025).

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iii. Revising Model Building Bye-Laws (MBBL)

Urban local bodies should amend the MBBL to mandate risk-informed, area-specific plinth height regulations, and move away from uniform codes that ignore local flood vulnerability. This change should be informed by local flood risk mapping. Furthermore, rainwater harvesting should be made a mandatory utility requirement for every new building, not only for conservation, but also as an important decentralized surface runoff mitigation measure.

4. Financial Resilience and Risk Transfer Mechanisms

i. Promoting Municipal Green Bonds (MGBs)

The Government of India must promote the systematic issuance of Municipal Green Bonds (MGBs). These bonds provide urban local bodies with a structured, accountable instrument to raise long-term capital at favourable rates (8-9%) for structural flood adaptation projects, such as drainage upgradation and Water-Sensitive Urban Design implementation.[41]

ii. Catalyzing Inclusive Disaster Risk Insurance

Insurance penetration in India is very low, and more than 90% of people affected by natural disasters are uninsured due to affordability issues and lack of public trust. To address the insurance gap in the vast informal urban sector, the government must incorporate parametric flood insurance into social security programs. Parametric schemes, which pay out based on predetermined factors (e.g., rainfall intensity), avoid lengthy loss assessments, address widespread trust deficits, and ensure quick recovery liquidity.[42]

CONCLUSION

Urban flooding is now not only an episodic event but a persistent crisis for India's rapidly urbanising cities affecting the safety, livelihood and dignity of millions living in such cities. This research shows that while the existing legal regime such as Disaster Management Act 2005, Environmental and Municipal laws, master plans, were created to tackle disasters and

[41] Mr. Saurabh Dutta, *'Financing Cities of Tomorrow: The Role of Municipal Bonds in Urban Growth and Climate Resilience'* (July. 15, 2025) *available at- https://sankala.org/financing-cities-of-tomorrow-the-role-of-municipal-bonds- in-urban-growth-and-climate-resilience/* (last visited Sep. 29, 2025).

[42] Mongabay-India, *'India Experiments with Parametric Insurance to Mitigate Costs of Disasters'* (Jun. 20, 2024) *available at- https://india.mongabay.com/2024/06/india-experiments-with-parametric-insurance-to-mitigate-costs-of- disasters/* (last visited Sep. 29, 2025).

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protect the environment, is suffering from implementation gaps, lack of coordination, and weak enforcement.

Key judicial intervention such as enforcement of the Public Trust Doctrine, Protection of buffer zones, and recognition of the Right to a healthy environment under Article 21 of the Indian Constitution provide important legal principles for governance. However follow-through at the executive level impede proactive mitigation.

It could be concluded that the purpose of this research shows that like the Global best practices such as EU Floods Directive, China's Sponge City model and the US National Flood Insurance Program, India can also overcome from respected tension within the nation with the better planning, a dedicated Urban Flood Resilience Law, strict land use enforcement, more honest and binding adoption of nature-based infrastructure (like the restoring wetlands, cleaning up drains etc), stronger financial resilience mechanisms. Above all, integrating global best practices with strong local participation and social justice lenses offers the most promising path for legal and policy responses to India's ongoing urban flood challenges.