SPONGE CITY AN OPPORTUNITY TO REDUCE URBAN FLOODING & WATER CRISIS

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Abstract: High to absurd water stress went up against 54 percent of India. Rajasthan, Gujarat, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Maharashtra, Andhra Pradesh and Tamil Nadu make up this 54 percent of India. This examination is directed to know how and what all measures can be used to reduce water insufficienties and urban floods. This assessment relies upon cognizance and separating different frameworks related with water crisis decline, similarly as the procedures drew in with vanquishing the effect of urban flooding. This fuses low impact improvement, 3R and 5R intervention frameworks which can be used to restore surface water Recharge of groundwater, similarly as diminishing the effect of urban flooding. The maker endeavours to take a gander at Wuhan, China, and Bangalore, India, a worldwide and an Indian city. The relationship shows how water lack can be decreased at the same time with the effect of urban flooding. The maker endeavours to give recommendations that can be executed in Gwalior city, Madhya Pradesh, India. Since it is one of the most water-insufficient urban networks in India and regardless, during the Monsoon season there is an urban flooding situation in the city.

Keywords: Urbanization, Sponge City, Low Impact Development, Urban floods.

Introduction:

It has seen that India has gone up against one of its major and most certified water crises reliably. India's water crisis is routinely credited to a nonappearance of government orchestrating, extended privatization of associations, present day and human waste, and corruption by governments. Moreover, water need is foreseen to intensify in India as the hard and fast masses is depended upon to addition to 1.6 billion by 2050.

Following 2 dynamic significant stretches of weak rainstorm, 300 million people have been affected by an extraordinary dry season about a territory of the country's masses. Around 50 percent of India’s treatment of dry season like conditions is basically in various western and southern states with under-ordinary precipitation. This year the condition was particularly monstrous in different western and southern states which completely got underneath typical precipitation.

As demonstrated by Niti Aayog’s 2018 Composite Water Management Index (CWMI) report, 21 urban networks are moving towards zero groundwater level. This is required to show up by 2020 and will impact around 110 million people. Regardless, 12 percent on account of radical groundwater siphoning, an inefficient and wasteful water control structure and extended lengths of poor deluge, India's masses is starting at now living in the 'Day Zero' situation.

Urban floods have bit by bit began to form into a consistently wonder in India. Urban floods in Uttarakhand since 2013 have included floods due to deluge and substantial precipitation in Kashmir storm. Chennai storm floods in 2016 in Assam, and Madhya Pradesh. India is correspondingly transforming into the most flood-slanted country with ordinary fiascos continuing to occur.

Indian towns couldn't get away from that destiny. Uber urban communities, state capitals, metropolitan urban areas and littler towns have all been hit by very overwhelming deluges, remarkable in numerous cases. They have constantly surpassed the limit of urban communities and towns to deplete this water out, coming full circle in enormous logging of water. City-level outcomes have been financial, business and foundation misfortunes. Residents have endured on an individual premise Death toll, properties and long periods of unspeakable misery.
Methodology:

From the start, the maker recognized the necessity for the examination close by thinking about India's ebb and flow condition, similarly as perceiving all the intercession systems that can be used to hold, invigorate and reuse water to vanquish the urban water crisis. Furthermore, a couple of systems, too This can in like manner be used to vanquish urban flooding in view of a development in soil impermeability and an abatement in soil attack. The organized strategies for tending to water crisis and urban flooding in urban areas are understood and clarified with the help of logical investigations from International and National. For the assessment paper the I picked 2 relevant examinations: 1) Wuhan, China, 2) Bangalore, India. The makers endeavoured to give game plans and proposition to beating India's water crisis and urban flooding that can be applied in any city in India.

Case Study:

1. Wuhan, China

![Figure 1: Location of Wuhan](source: TU Delft Report)

Wuhan, the rambling capital of Hubei territory in Central China, is a business community isolated by the streams Yangtze and Han. The town comprises of various lakes and parks, including broad Delightful lake toward the East. Near to the Hubei Provincial Museum shows relics from the length of the Warring States, including the coffin of the Marquis Yi of Zeng and melodic bronze rings from his fifth century B.C. Internment chamber. Internment place.

The city of Wuhan is 8495 sq. km in region. The city's people are 10 million, and the atmosphere is moreover clingy subtropical, the city's typical yearly precipitation is 1100 mm.

China gets itself vulnerable against trademark frustrations. It is one of the five generally a significant part of the time affected outside regions by trademark screw-ups from 2004 to 2014 (Guha-Sapir, Hoyois, and Below, 2015), the most observable being floods, torrential slides, and hurricanes. Wuhan City is picked as a relevant examination since it is a SCP pilot town and is exposed against flooding Hit by flooding or waterlogging (water stagnation on the ground floor) when predictably in the decades to come (China Urban Centre, 2016).
Also, it is moreover one of China's most water-fearing urban networks.

After 2004, China's organization decided to fight the country's urban flooding condition and water deficiency. The wipe city thought was proposed in 2012 and 2015, the underlying 16 pilot urban networks were picked for wipe city use followed by the accompanying 14 extra urban zones in 2016.

This thought of a wipe city has three parts for instance Advancement, Information Technology and People. The central thought of creative mind saw that we can structure a town with the goal that the town will have a time of water in it. This can be worked on using water. That kind of improvement should be made Which can store water for one year from now and for emergency purposes. Progressions should be with the ultimate objective that the town should be changed into a wipe. For this case, it can in like manner be called organize orchestrating as wipe town masterminding. The ensuing component is advancement we ought to find the 3R of water when arranging a wipe town for instance Lessen, reuse, and reuse. The headways to be executed should follow Water 3R. Green establishment advances to store water, too, should be executed. Green structure can be used to stimulate groundwater misleadingly, too. All the progressions to be realized are prepared towards water the board strategies. The city will have a course of action of Federal Government. What's more, moreover, over all the social and business organizing exhibiting should be done to While masterminding the wipe town was used an interdisciplinary approach containing water the board, pressure driven planning, urban orchestrating, and designing. The town will have a bureaucratic sort of government. Also, moreover, specifically the social and business masterminding promoting should be done to While organizing the wipe town was used an interdisciplinary technique involving water management, hydraulic engineering, urbanism and architecture. The approach used is first to assemble ground data from different sources and a short time later to facilitate and dismember data with urban information and systems for low impact development. The advancement of the wipe city was as such realized, including masterminding, plan, improvement, undertakings the load up and application and evaluation.
Finally, it maintained the idea for an individual by walking associate. This framework was used by individuals by walking just as for water the administrators. The individual by walking interface had branches related with the water gathering systems at the roof. These branches were tubes void that would pass on water inside them, and thereafter move the water to the underground storing tanks. These limit tanks are worked for water accumulating, and can be used in the going with year. Apart from this, it moreover proposed green system and headway of low impacts. The recommendation for the private, commercial, and roads were autonomous.
2. Bangalore, India

![Location of Bangalore](source: google images)

This town is in any case called India's 'IT City,' or 'Silicon City.' Bangalore is furthermore India’s third greatest metropolitan region with a people of around 12.47 million and a locale of 709 sq. km. Typical precipitation at Bangalore is 970 mm.

This town has changed from "City of Lakes" to "City of Concrete" as a result of a climb in warmth and water pressure. Significant lots of quick urbanization, a creating people, and lacking water the administrators have achieved drying taps, declining groundwater levels, and foggy lakes that could surge ablaze. Up to 35 percent of the masses relies upon borewells.

![Land Cover change](source: http://wgbis.ces.iisc.ernet.in/energy/water/paper/urbanfloods_bangalore/floods_city.htm)

This town has ceaselessly stood up to a condition of water pressure. Since 1973 it has diminished 159 water bodies to 34 out of 2016. In addition, the situation in groundwater has been reduced to 35 meters. Also, moreover, since 1973 the created from 1973 has extended from 7.97 percent to 93.3 percent in 2020, while green space has dropped from 68.2 percent in 1973 to 2.96 percent in 2020.

![5R strategy of Bangalore](source: Strategies for Combating Urban Floods in Bengaluru)

The Bangalore government has realized 5R Solution to address the water pressure and urban flooding condition. This 5R plan has been changed from Water 3R. 5R Approach applies to restoration, protection, reuse, reusing and reuse. This 5R was needed to restore both groundwater and surface water bodies Retention of water in water bodies followed
by reusing of wastewater, greywater and dirtied water, reuse of reused water in conclusion make people subject for water the administrators, fitting use of water and moreover use of the water gathering system.

A Storm Water Management And Road Tunnel (SMART) was another suggestion which showed up. As a result of the impact in flood rate and to manage the plenitude flood going into the low-lying domains, this splendid and everlasting methodology was used. Using the Geographic Information System and Remote Sensing to recognize these low-lying districts After all, the SMART entry geological, geotechnical and hydrological estimations have gotten gathered and are organized in one of Bangalore's most flood-slanted zones. This is a 12 km long section in Nayandahalli and during the rainstorm season, it holds the wealth overflow water. Simply this section is used as transportation office during the non-rainstorm season. The upper layer is similarly used for stormwater improvement during the rainstorm season, and this can be cleaned and made for reuse inside 48 hours for transport workplaces.

Additionally, one of the key components for lessening water lack is the water harvesting system, this water gathering structure has been made required by the Bangalore government for both new and old improvement in the locale. Hence, around 90 percent of Bangalore used a water gathering structure and maintained a 5R game plan.
### Comparative Analysis:

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Wuhan, China</th>
<th>Bangalore, India</th>
</tr>
</thead>
<tbody>
<tr>
<td>R’s of water</td>
<td>3R (Reduce, Reuse &amp; Recycle)</td>
<td>5R (Rejuvenate, Retain, Recycle, Reuse &amp; Responsible)</td>
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<tr>
<td>Construction</td>
<td>Pedestrian Bridge</td>
<td>SMART tunnel</td>
</tr>
<tr>
<td>Green Infrastructure &amp; Low Impact Development</td>
<td>A bioretention system, Infiltration strips, Blue/Green roof, Park roof, water roof, streetscape, rainwater harvesting</td>
<td>Rainwater harvesting, constructed wetlands, bioremediation, rainfall &amp; level sensors.</td>
</tr>
</tbody>
</table>

### Study Area: Gwalior, Madhya Pradesh

Gwalior is the fourth greatest city masterminded on Madhya Pradesh's Northern side. The ordinary city tallness is 211 meters. According to data from the 2011 measurements, the city has a mass of 10,69,276 with a decadal addition of 27.32%. At present, the town's masses are evaluated at 13,14,692 This town has been standing up to a massive water pressure condition all through the past barely any years. What's more, besides, conditions of urban flooding occur during the monsoon season.
Gwalior is a city that has gone up against the draft condition reliably. Additionally, on account of strong warmth sway the groundwater level decreases during top summers. Because of this condition, all water-related exercises all through this midyear season must be shut down.

This urban flooding occurs because of the going with issues:

- Drainage structure insufficient
- Inadequate road and incline establishment
- Flood fields clogged
- Increased domain which is impervious
- Continued turn of events

**Result:**

The maker has proposed some green establishment and low-influence progression strategies to settle the urban flooding and water lack issues.

**Green Building:**

- Bioretention system: It involves soils planted with sensible non-meddling plants. Stormwater overflow entering the bioretention contraption is isolated through the earth planting bed sooner than it is sent something like a lowered machine or infiltrated under the soil bedding into existing soil. Getting unadulterated water is the standard filtration structure and this can be used for home use.

![Bioretention System](SCP_Final_report_nov2018)

- Surface channel upgrade: Surface channel support ought to be finished. This additionally incorporates expelling intrusions to make the way to surface water.

![surface drain](Google Images)

- Pervious lanes: boulevards are made of penetrable concrete to penetrate surface overflow water from the path to the underground channel and this channel is related with an underground water tank or drainage pipes.
• Rain Gardens: little gardens attempted to withstand outrageous precipitation and help to keep up or reduce the overflow of stormwater by intrusion or limit

Low Development Impact:

• Conserving basic resources
• Minimizing land trouble
• Impervious rule of the field
• Picking up water

Recommendations to Policies:

1. Assurance the city will have an air adaptable water the barricade framework set that is transformational, broad, and locally appropriate.
2. Assurance open venture and obligation regarding urban establishment
3. Misusing inventive money related and regulatory frameworks to help green establishment and assurance the collaboration of the private part in wipe mediation.

Conclusion:

The assessment concentrated on understanding the stream gives the city was looking during the urban flood and water emergencies circumstance. The city can change itself in any case to make the city water versatile, it requires the help of tenants and government. Besides, the proposals made by the creator are reasonable for making the city a blue-green town. Such suggestion is given to give the city a pulled in out impact on keep up an imperative decent way from urban flooding and water deficiencies, and are joined by some system proposals that the city should make to address the water need condition.
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