



Blue-green infrastructure for flood management in Uttarakhand

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Presenters



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About WRI India

About WRI India

WRI India is a research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

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ABOUT WRI INDIA

- Mission and Goals
- Values
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Mission and Initiatives

WRI India's mission is to move human society to live in ways that protect Earth's environment and its capacity to provide for the needs and aspirations of current and future generations.



Our Initiatives

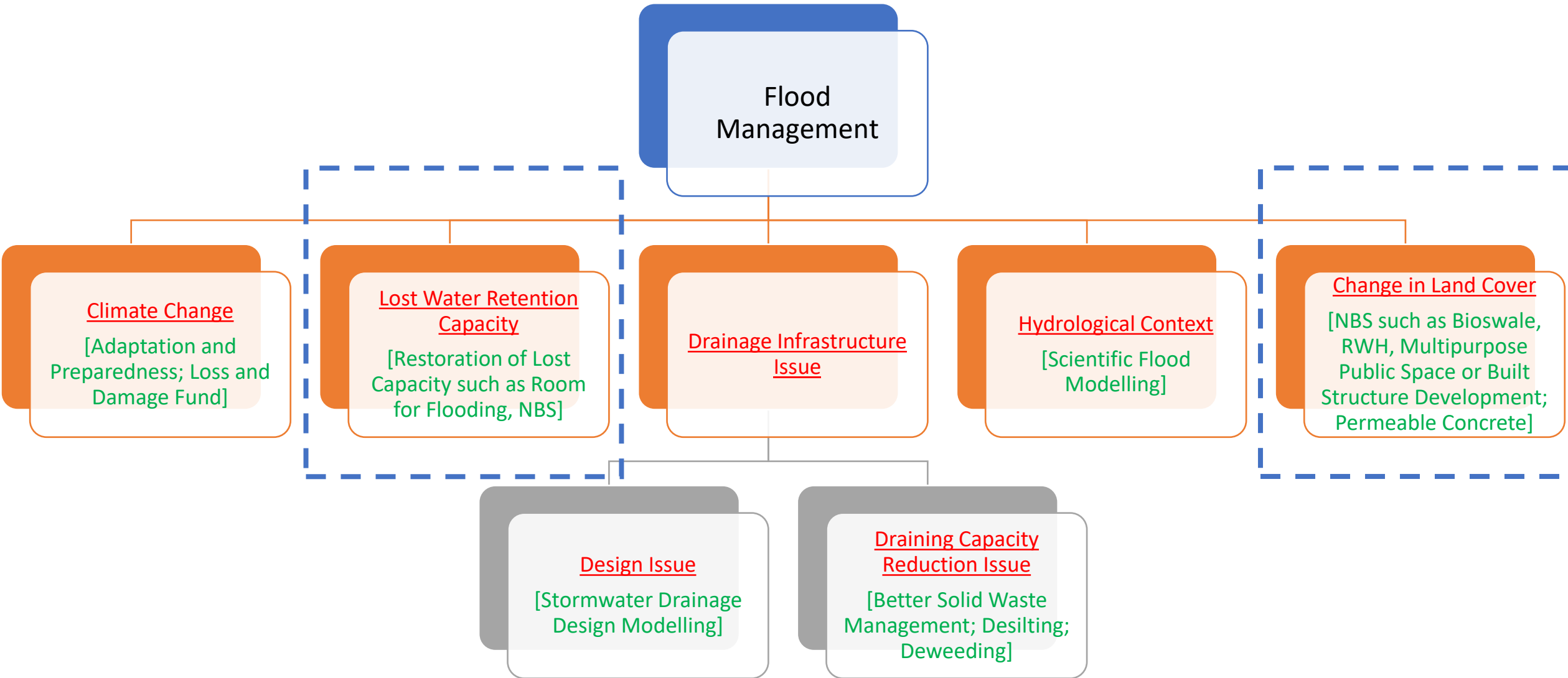
At WRI India, we combine research, analysis and tools, along with direct engagement with decision-makers, to bring about sustainable change. All of our program teams draw upon cross-cutting disciplines - business, governance, finance and economics – to further their analysis and recommendations.

Our work can be viewed through two critical lenses – Urban Development and Climate – with four associated programs driving on-ground transformative change:

- Sustainable Cities:** Our largest program, we support Indian cities in their journey to be low carbon, resilient and inclusive through our work in 10 practice areas – Integrated Transport, Electric Mobility, Safer Roads, Sustainable Housing, Data-Led Urban Planning, Livable Neighborhoods, Climate Smart Cities, Clean Air, Water Resilience and Innovations and Startups.
- Energy:** We work towards India's transition to clean energy while improving energy access and achieving higher levels of energy efficiency. The access to energy for health, livelihood and education, in predominantly rural regions, is one of our key focus areas.
- Sustainable Landscapes and Restoration (SLR):** We combine advances in knowledge, robust analysis and cutting-edge technology to provide innovative tools and strategies to protect, maintain and restore India's forests and agricultural landscapes and rural livelihoods.
- Climate:** We inform businesses in the deployment of low-carbon technologies and practices, simulating and testing possible carbon markets. We also use modelling technologies to inform policymaking and evaluate green technologies in the Indian context.

Water, Urbanization and Climate Change

Training Scope



The Challenges

TOO MUCH WATER



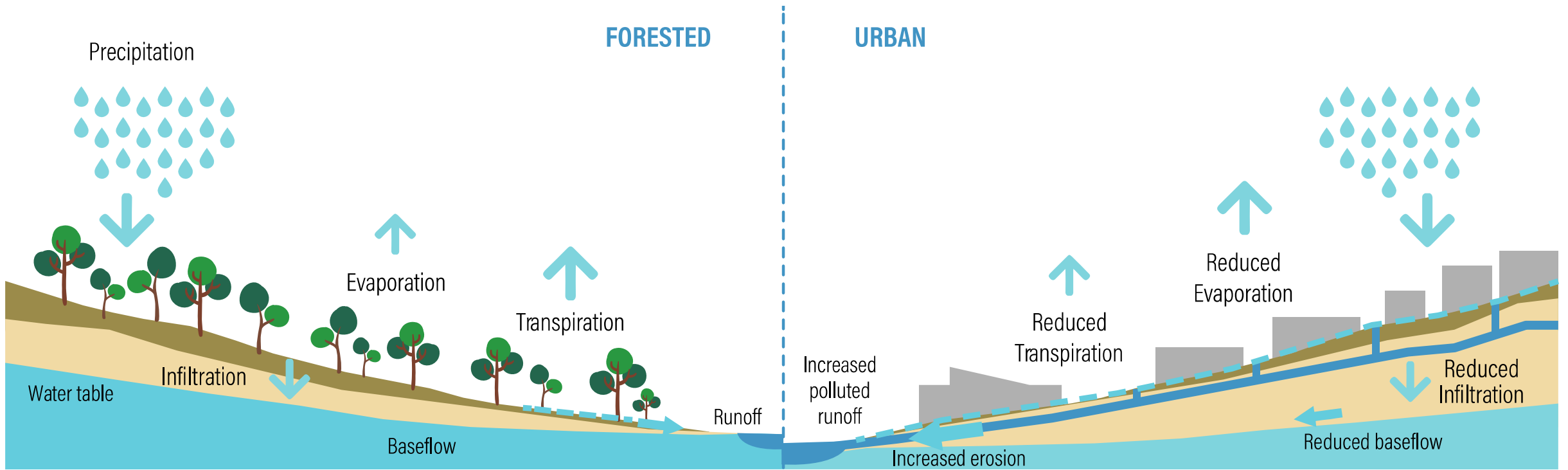
TOO LITTLE WATER



TOO DIRTY WATER



How urbanization affects stormwater infiltration



Climate Change Impacts

Climate change poses a high risk to urban infrastructure, services, human lives and economy as extreme weather events are on steady rise



Shifting rainfall patterns



Hotter and drier summers



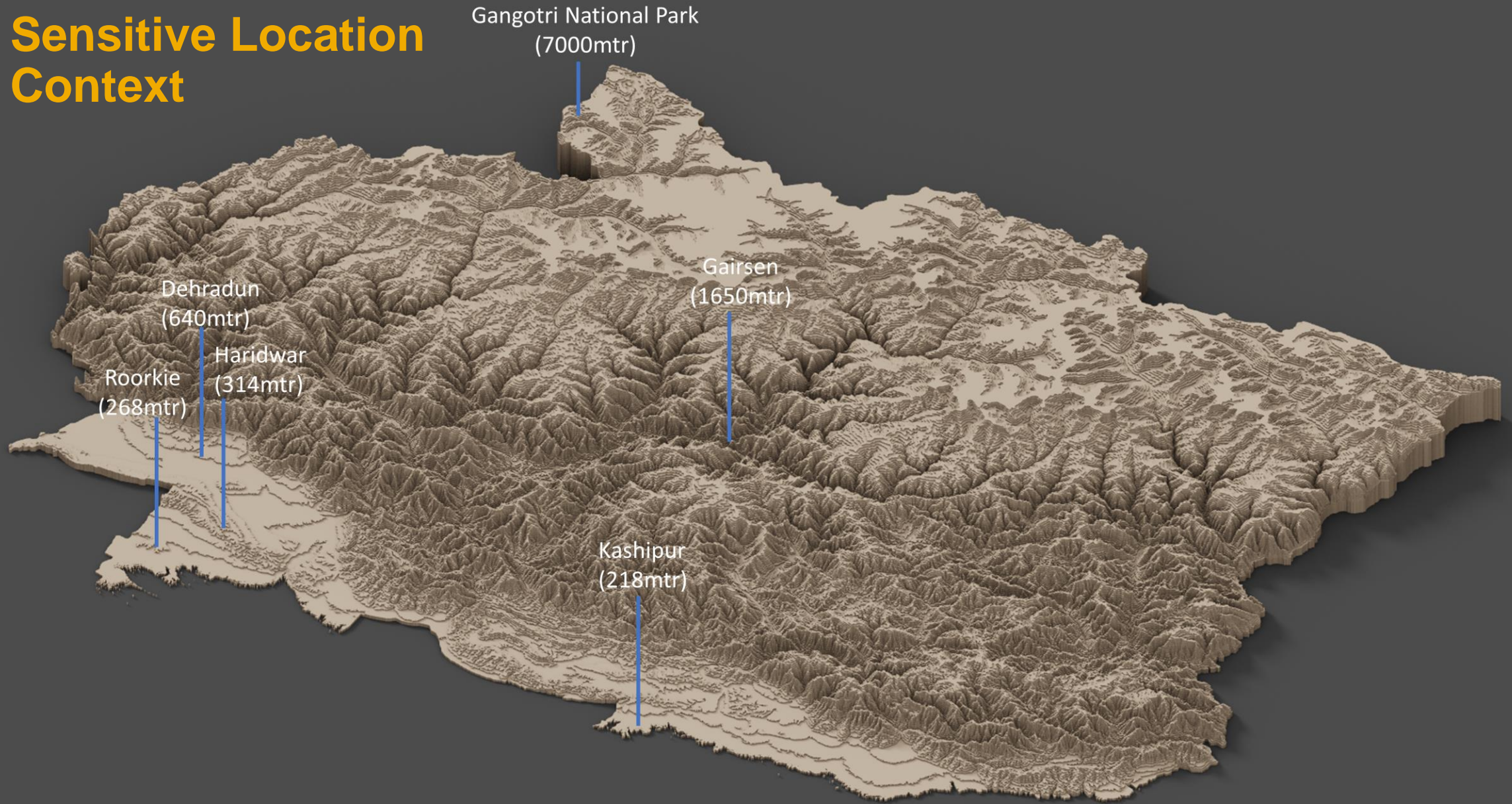
Shorter and wetter monsoons

“The precipitation that has been forecast shows a net increase in the 2030s with respect to the simulated rainfall of the 1970s in the Himalayan region by 60 to 206 mm”

-Uttarakhand Action Plan on Climate Change

Urbanization Impacts in Uttarakhand







Sensitive Location Context

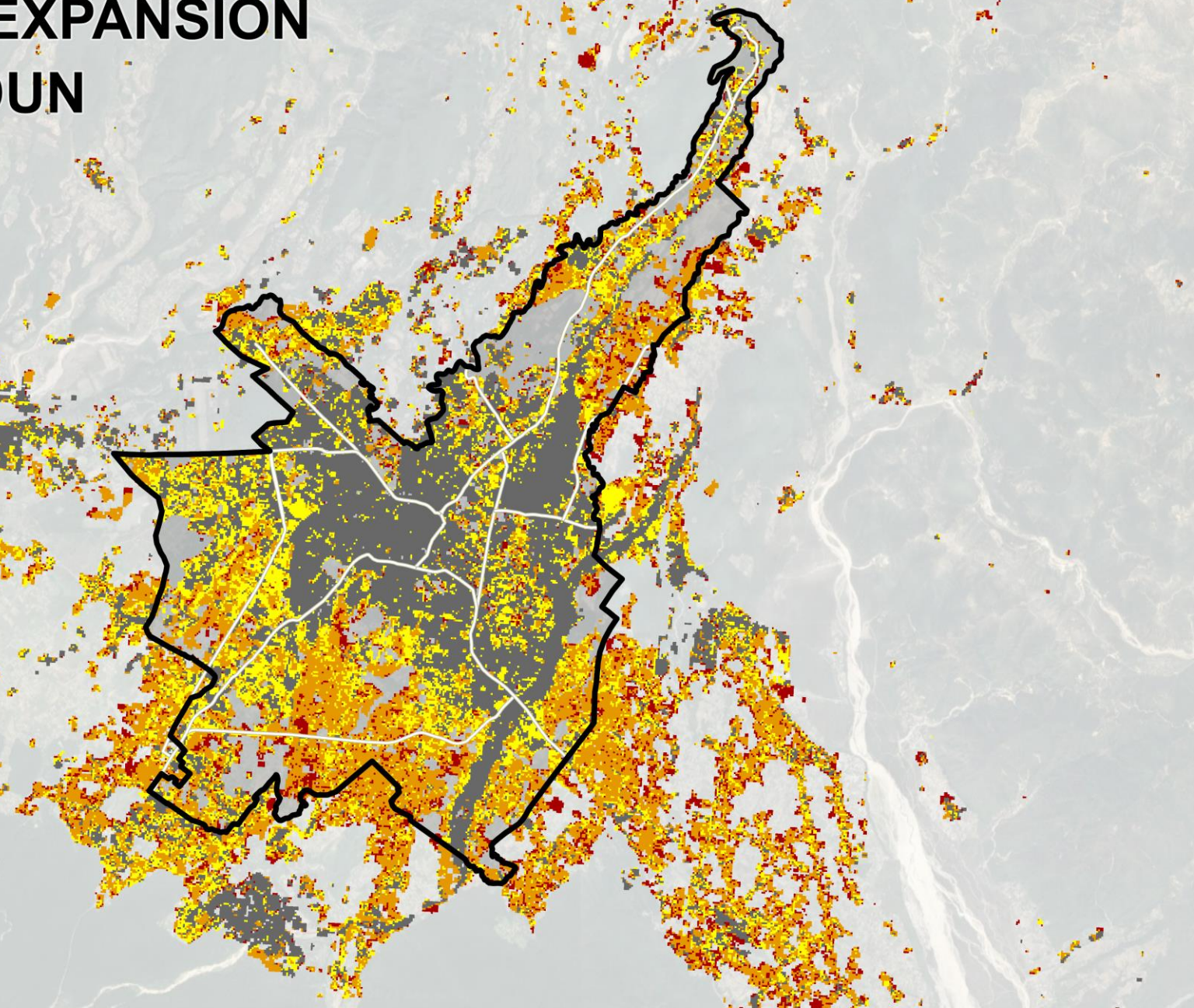


URBAN EXPANSION DEHRADUN

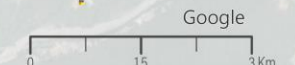


LEGEND

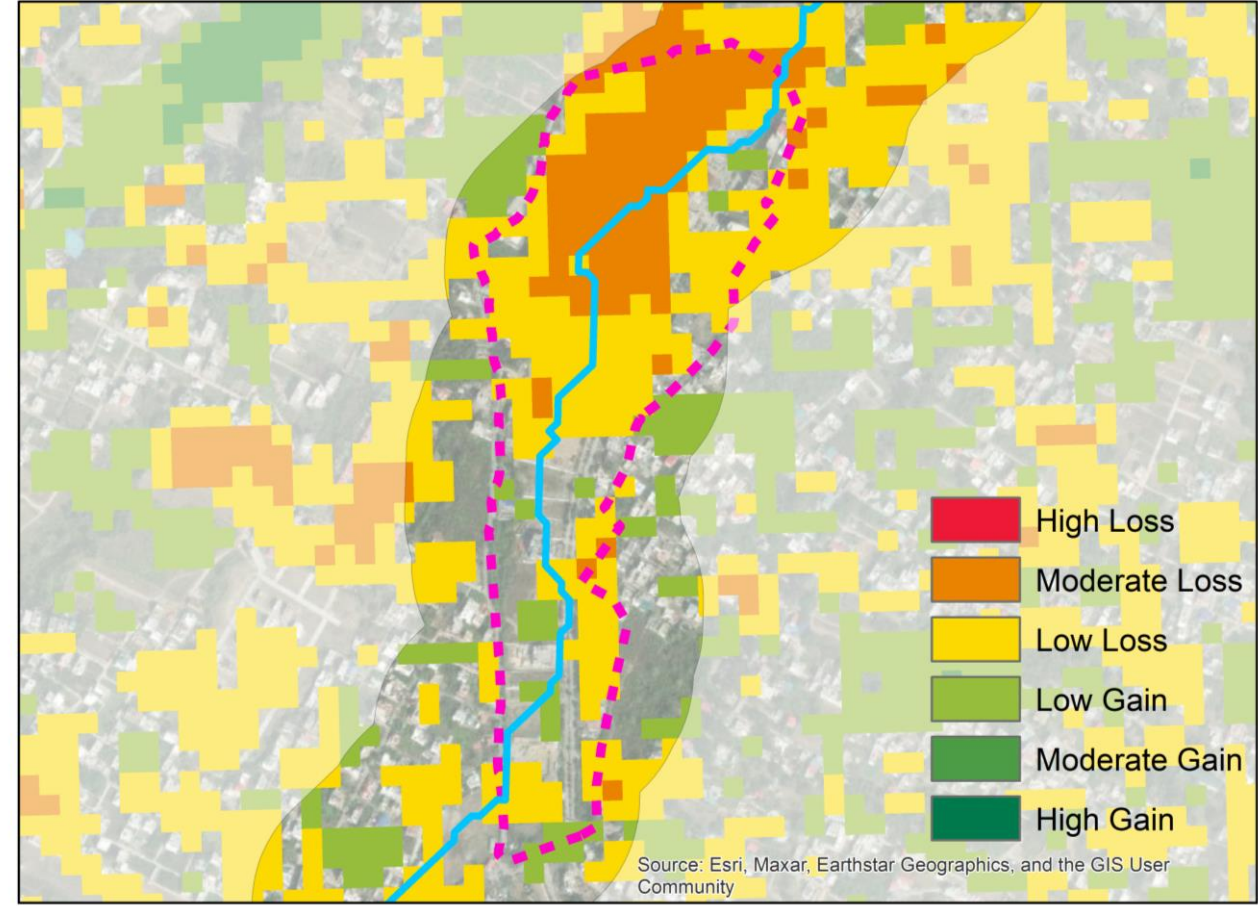
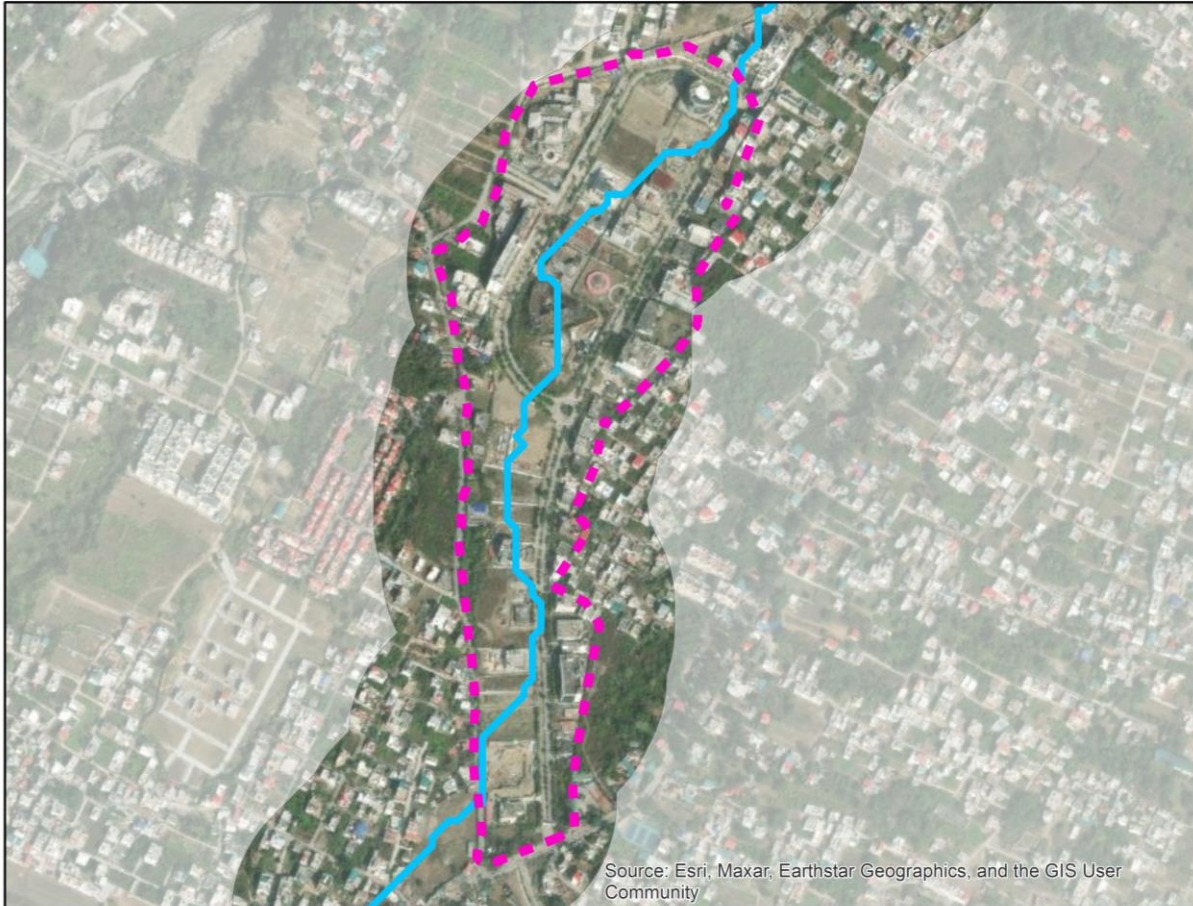
-  Municipal Boundary
-  Roads
- Builtup Growth**
-  1985
-  2000
-  2010
-  2015



Source: WSP Evolution (DLR), Google Basemap



Building on Water Paths



IT Park located on the floodplains of Nala Pani in Dehradun

Building on Water Paths



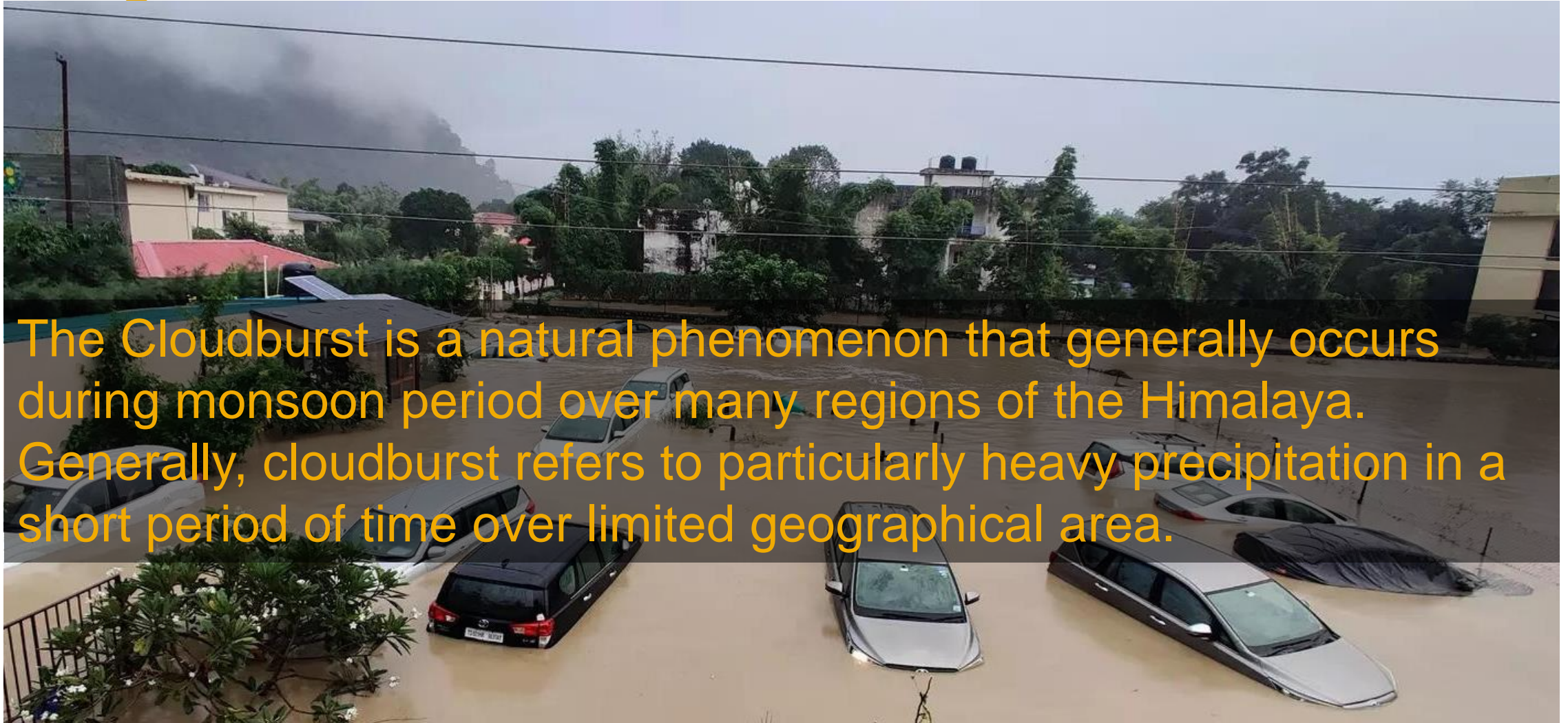
Changing the watershed



Sukhatal lake – 2006 & 2014.
Over the years, this lake acting as a crucial recharge zone
has been modified by many developments

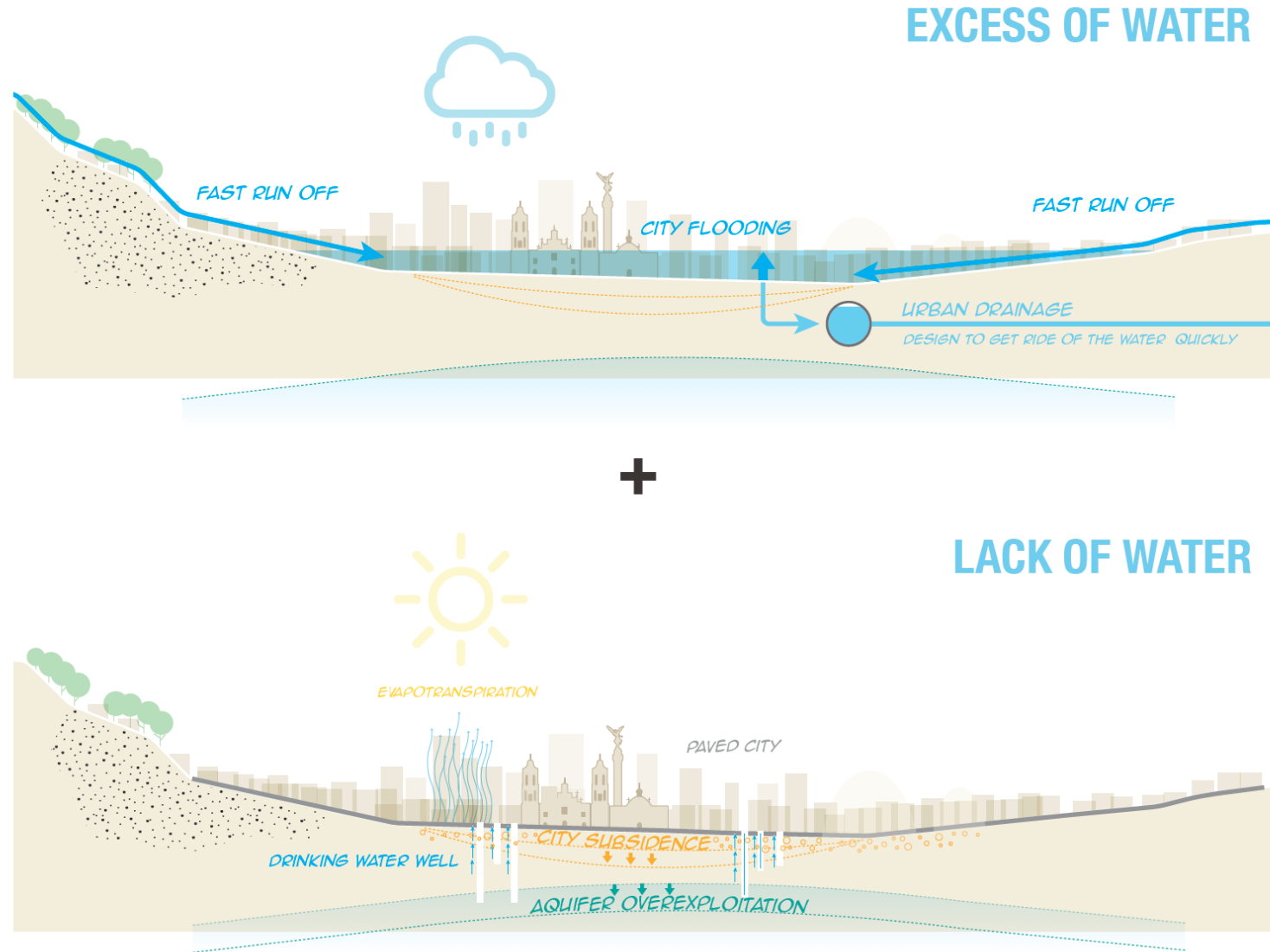


Lost blue-green spaces meets Himalayan terrain and climate change driven extreme rainfall



The Cloudburst is a natural phenomenon that generally occurs during monsoon period over many regions of the Himalaya. Generally, cloudburst refers to particularly heavy precipitation in a short period of time over limited geographical area.

Summary



Reviving our relationship with
urban waters

What is BGI?

Blue-Green Infrastructure

..planned interconnected networks of natural and semi-natural areas, including water bodies, and green and open spaces, that provide different ecosystem services



Grey Infrastructure

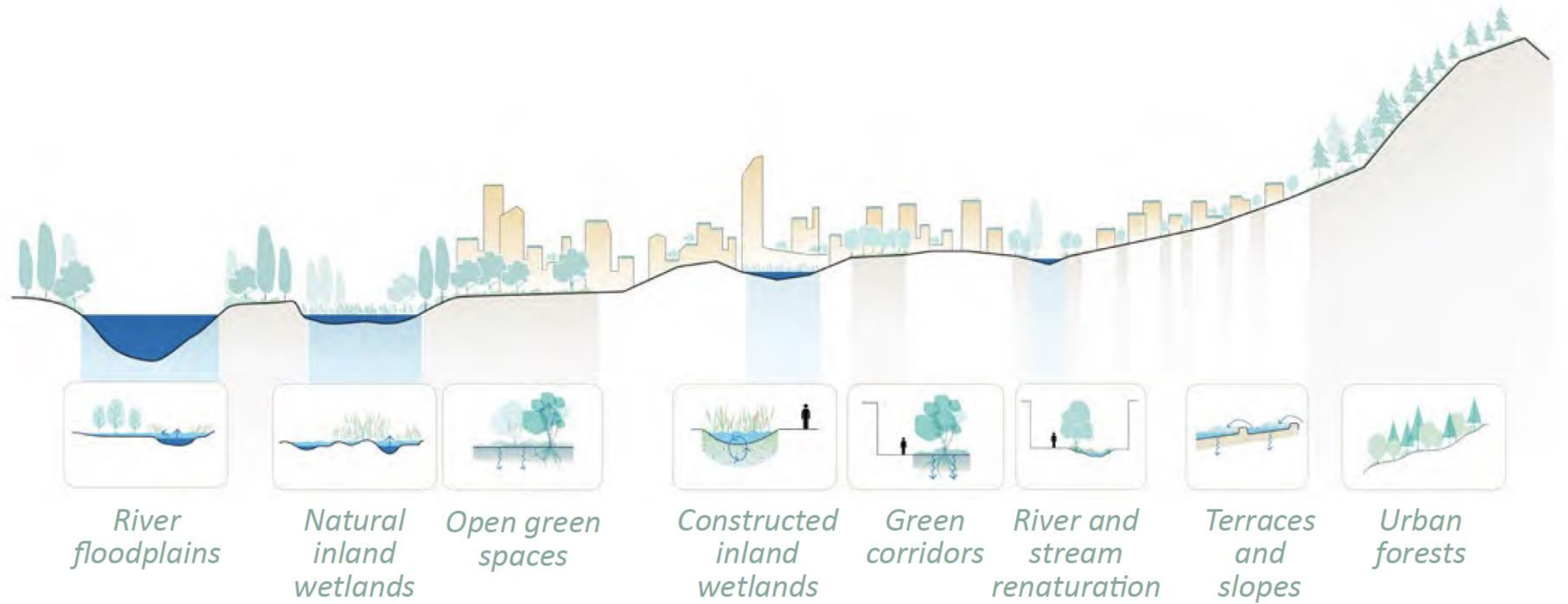
...traditional human-engineered measures that perform infrastructure functions such as water and wastewater treatment plants or protective infrastructure such as dikes and seawalls



NbS/ BGI Options

Nature-based Solutions		Challenges		
<i>The conservation, restoration, construction, or strategic management of...</i>		Coastal flooding and erosion	Urban flooding and stormwater	River flooding
Coastal	Coral and oyster reefs	X		
	Sandy beaches and dunes	X		
	Seagrass	X		
Wetlands	Salt marshes	X		
	Mangroves	X		
	Constructed wetlands		X	
	Inland wetlands			X
Urban	Green roofs		X	
	Permeable pavement		X	
	Open spaces (e.g., parks)		X	
	Bioretention areas (e.g., vegetated basins)		X	
Rivers	Floodplains and bypasses			X
	River beds and banks			X
Forests	Upland forests			X

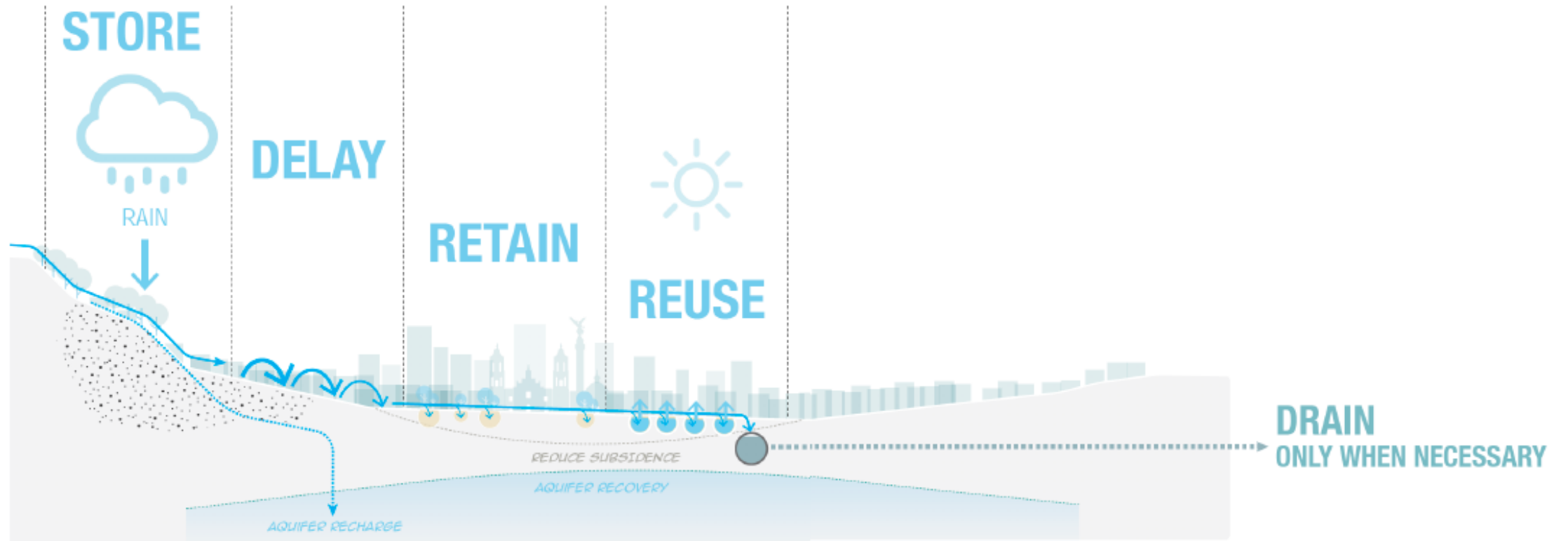
NbS/ BGI Options



Why NBS/ BGI?

- Can be more **cost-effective**
- Can be designed as **resilient, flexible, and reversible**
- Attracts “green” **investors**
- Provides **co-benefits**
 - Sustaining livelihoods
 - Carbon sequestration
 - Improving air quality
 - Reducing urban heat island effect
 - Protecting biodiversity & habitat

NbS/ BGI Strategy



NbS/ BGI Strategy

DELAY



RETAIN



STORE



REUSE



**THE OVERALL MOTTO
OF A WATER SENSITIVE APPROACH**

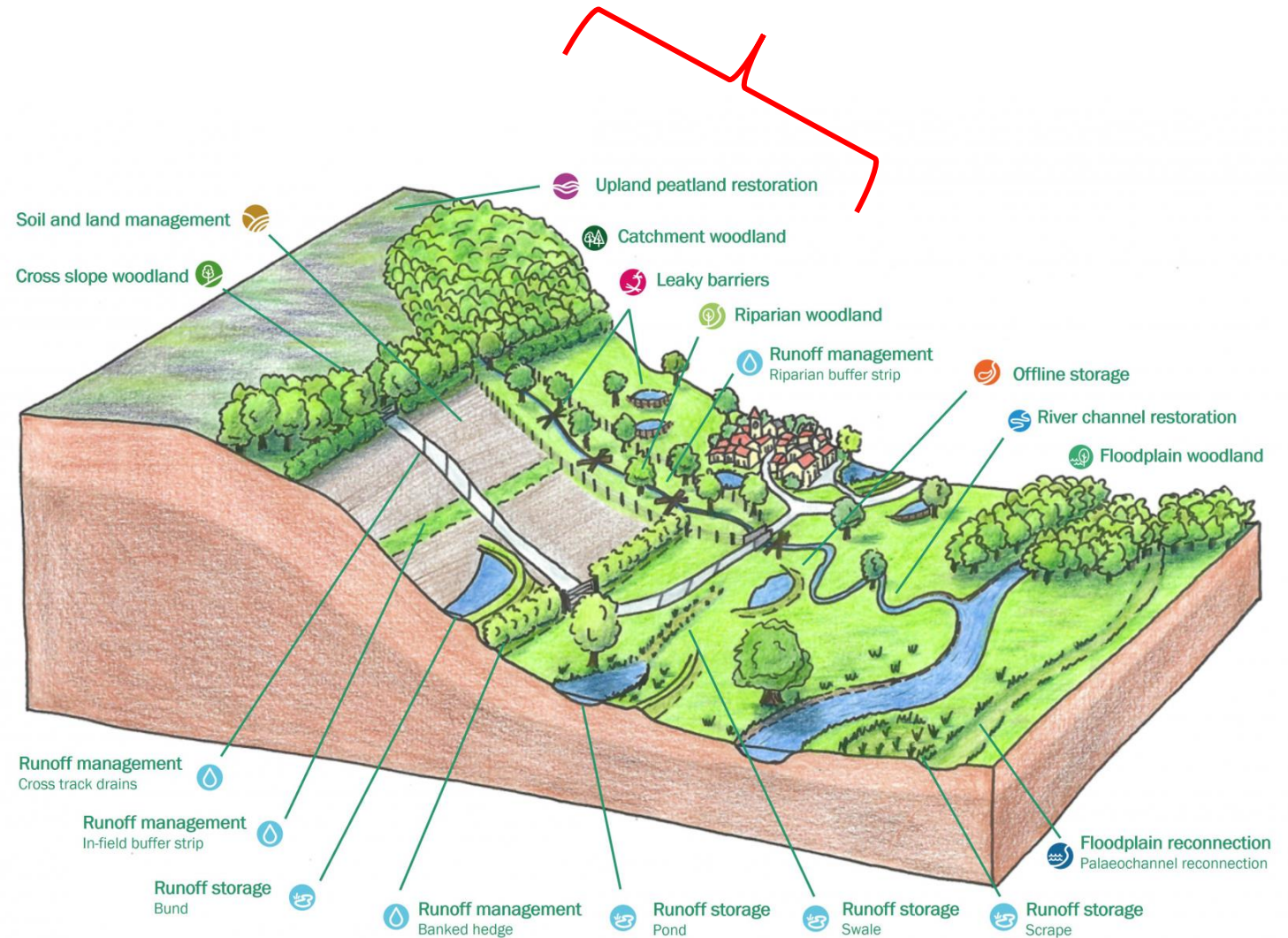


**DRAIN ONLY
WHEN NECESSARY**

Application of BGI

1. Restore upstream habitats and green cover to reduce runoff & erosion

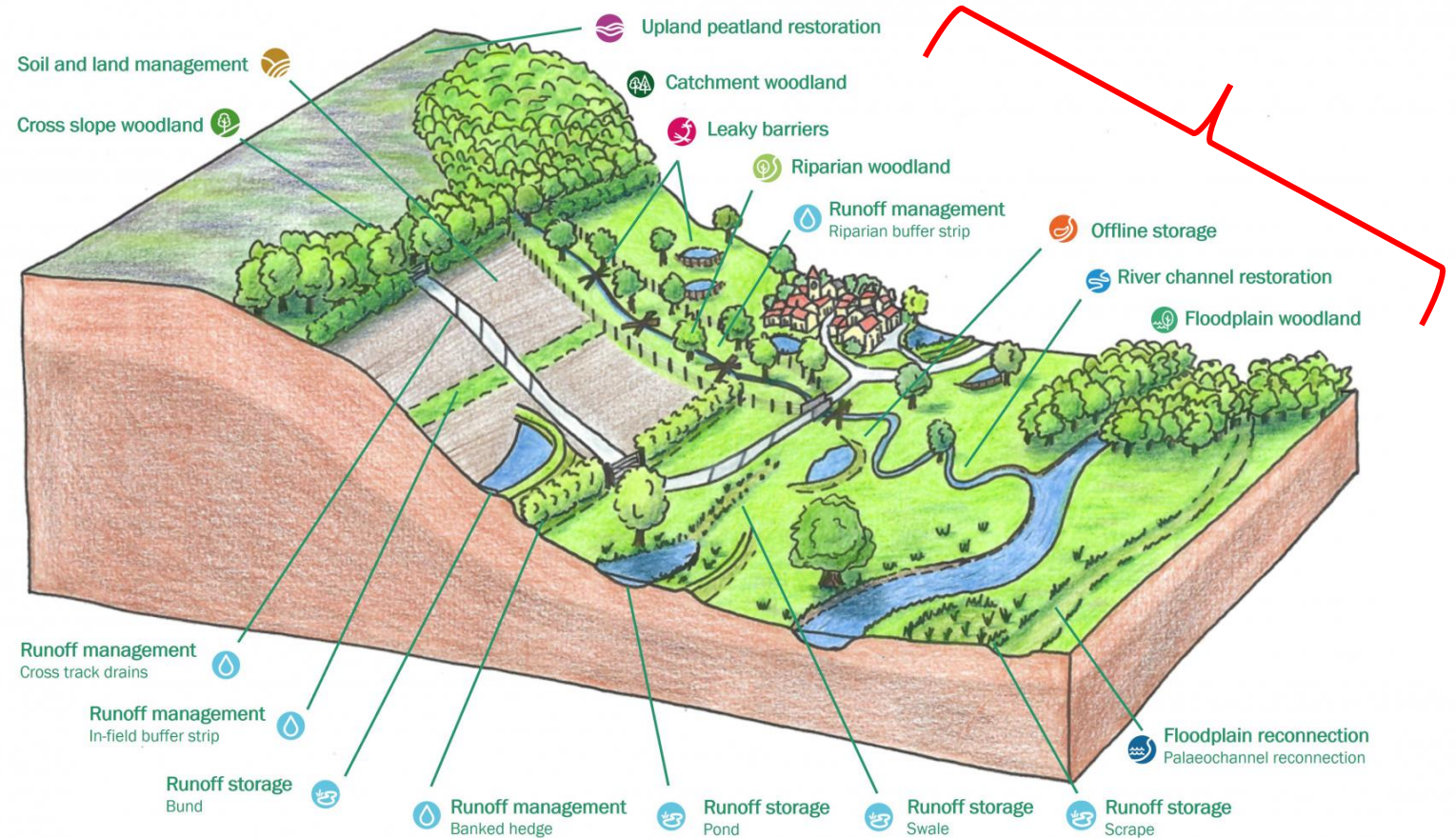
- Restoration of existing forests and promote afforestation of catchments to reduce the amount of runoff
- Install natural leaky barriers to divert stormwater to nearby natural/man-made waterbodies or storage tanks



Application of BGI

2. Do not build in water flow paths /remove buildings in hydrological paths

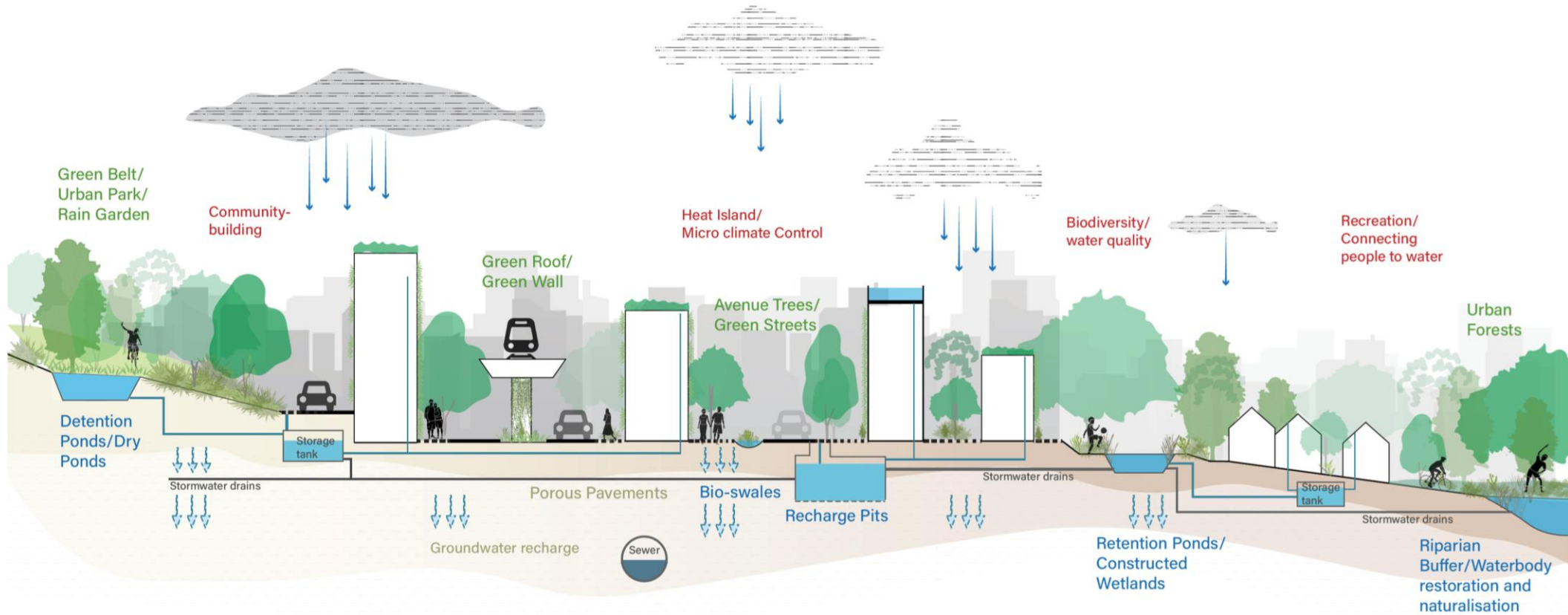
- Maintain buffer along the floodplains of the river by planting trees and vegetation
- Remove encroachments on the river floodplains or drains leading to rivers and waterbodies
- Soften the edges of water streams to reduce the velocity of water



Application of BGI

3. Increase infiltration in areas where buildings cannot be removed

- Convert open spaces and streets across scales to accommodate BGI to absorb stormwater
- Solutions include – recharge wells, raingardens, bioswales, infiltration basin



Detention
Reduce stormwater run-off



Retention
Capture water for storage

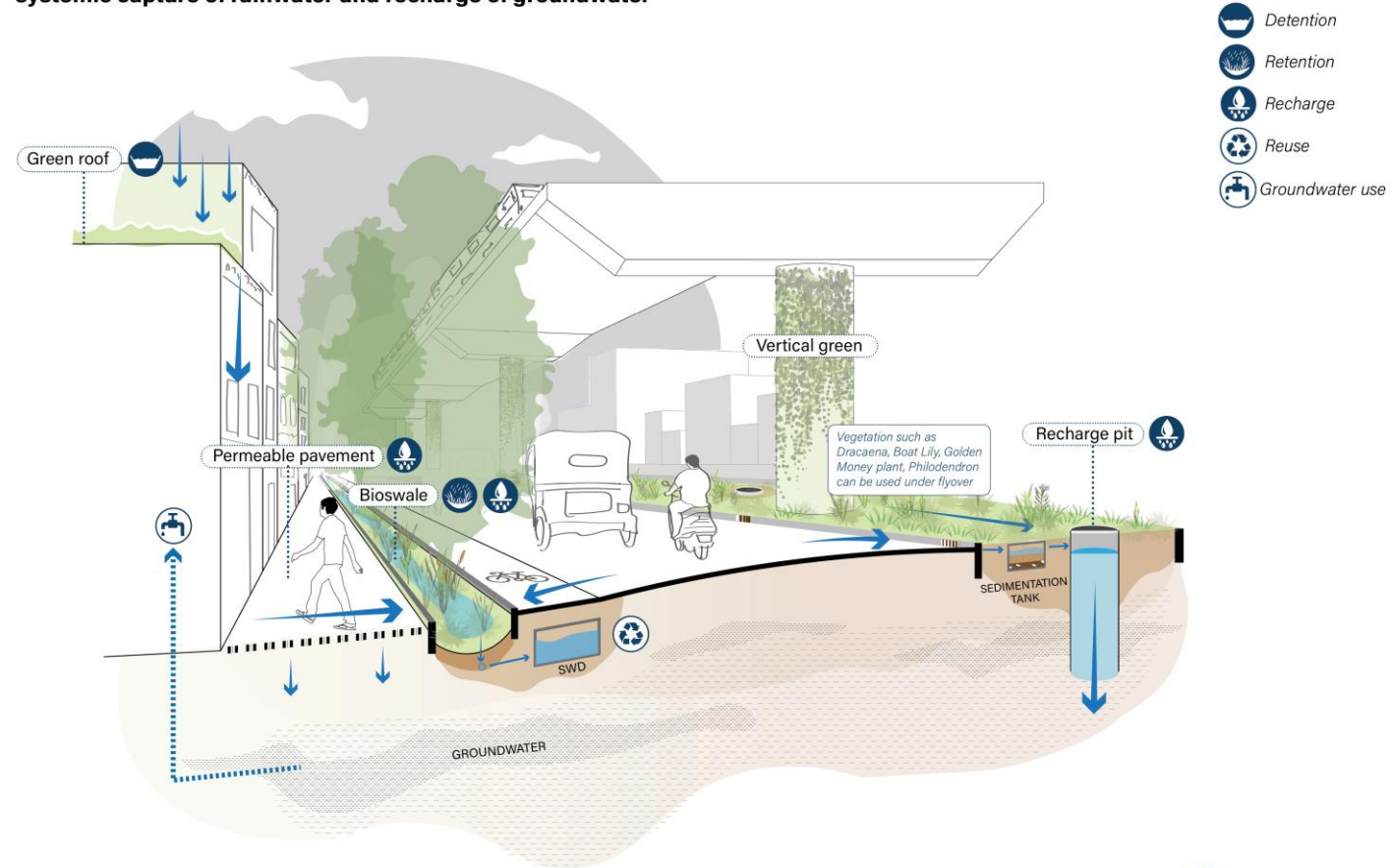


Recharge
Increase infiltration of rainwater into ground

Application of BGI

3. Increase infiltration in areas where buildings cannot be removed

Interlinking transit corridors, building roofs, and neighbouring unused urban spaces for systemic capture of rainwater and recharge of groundwater

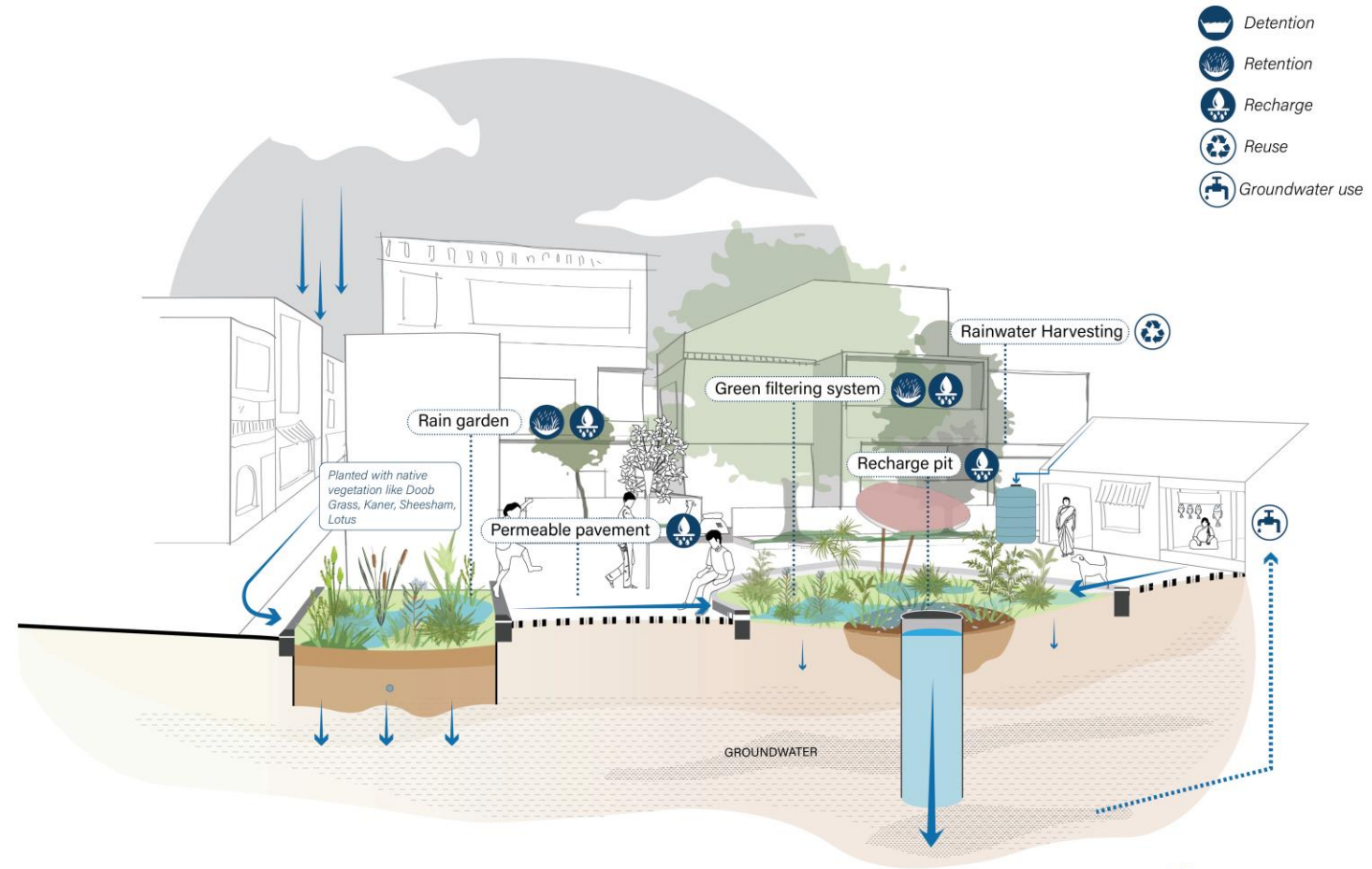


Source: WRI India. Illustration created by Sindhuja Janakiraman

Application of BGI

3. Increase infiltration in areas where buildings cannot be removed

Multi-functional public spaces can be used to capture, filter and recharge

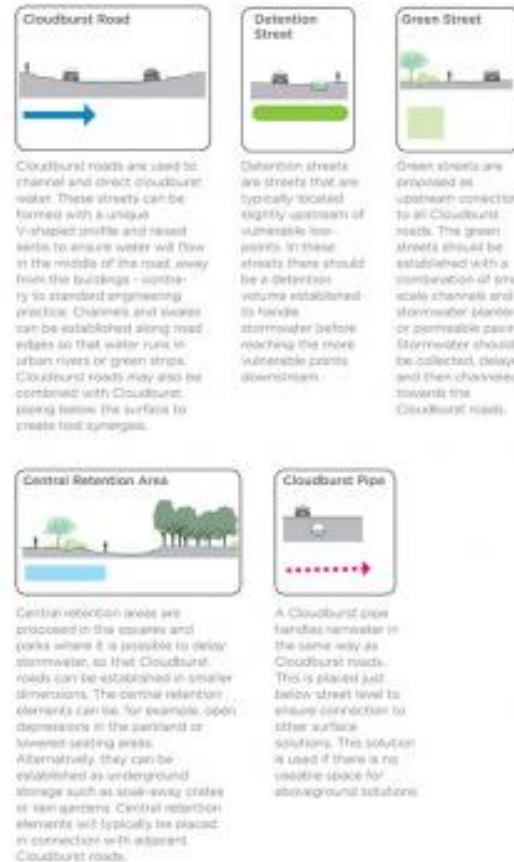


Source: WRI India. Illustration created by Sindhuja Janakiraman

Application of BGI

4. Plan for future weather extremes

- Form a networked plan of available open spaces and streets to perform as BGI
- Solutions include – recharge wells, raingardens, bioswales, infiltration basin



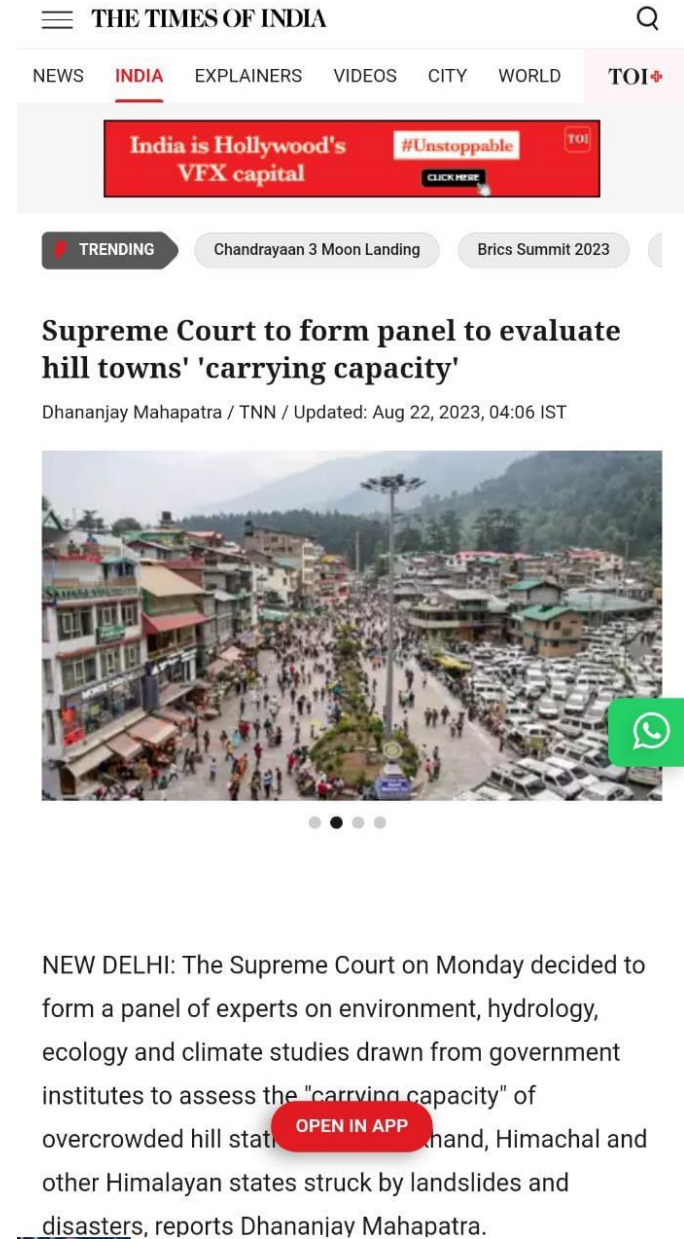
No Silver Bullet – the Wuhan Story



Reversible and Irreversible Risk Management

Climatic uncertainty is the 'New Normal'. A 'Business-as-usual' approach will not solve the challenges.

- District wise Climate Resilience Plan
- Climate resilience strategy and projects
- Resilient infrastructure development



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Supreme Court to form panel to evaluate hill towns' 'carrying capacity'

Dhananjay Mahapatra / TNN / Updated: Aug 22, 2023, 04:06 IST

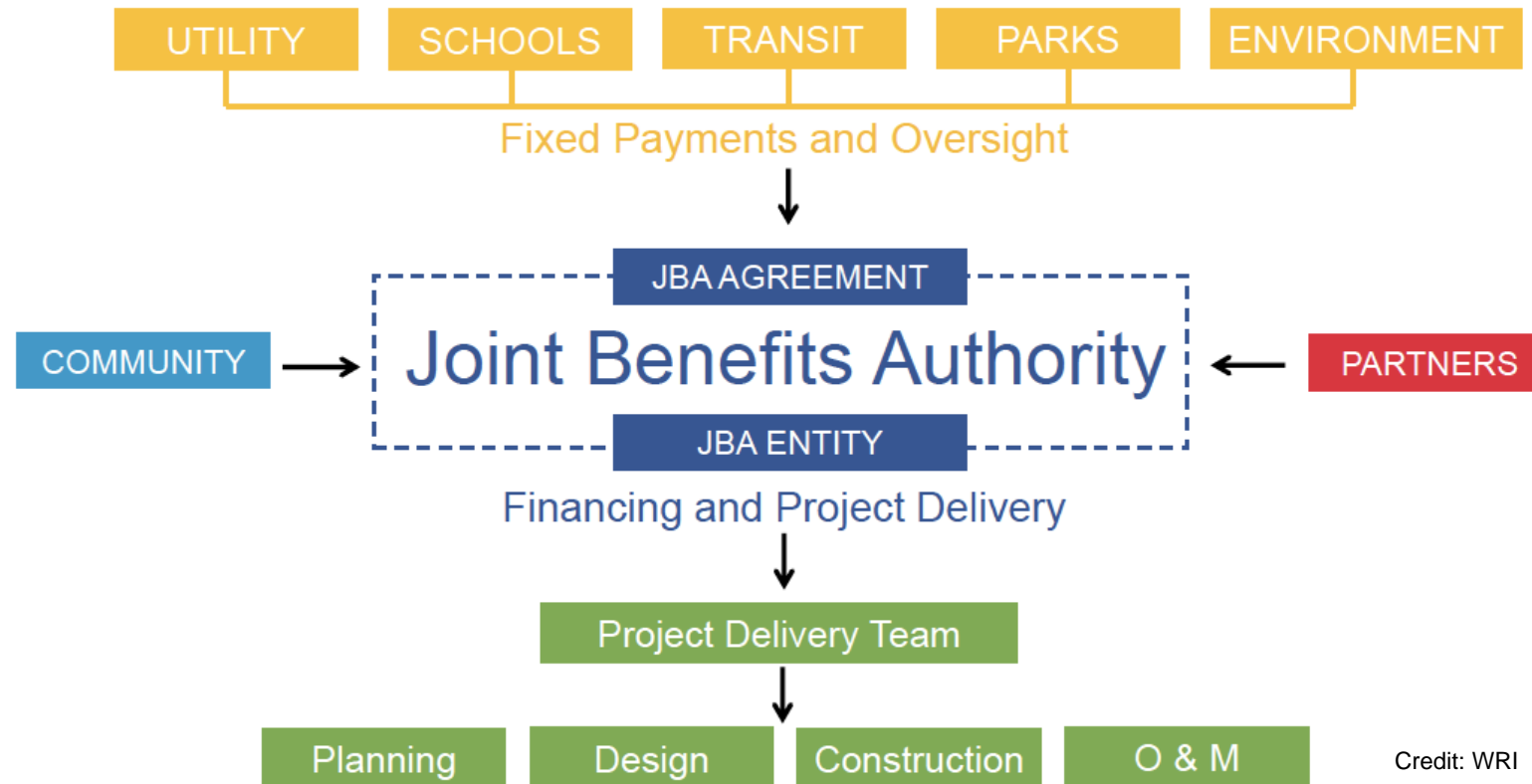


NEW DELHI: The Supreme Court on Monday decided to form a panel of experts on environment, hydrology, ecology and climate studies drawn from government institutes to assess the "carrying capacity" of overcrowded hill states like Jammu and Kashmir, Himachal and other Himalayan states struck by landslides and disasters, reports Dhananjay Mahapatra.

OPEN IN APP

Planning for BGI

Joint Benefits Authority – Share costs and benefits



Credit: WRI

Co-creating and co-financing nature-based solutions.
Comprehensive, unified project for multiple benefits.
Share costs, share responsibility – build infrastructure assets for benefit of urban dwellers

Discussion

Discussion