24th ICID INTERNATIONAL CONGRESS
73rd IEC MEETING
3RD OCT - 10TH OCT 2022
ADELAIDE | SOUTH AUSTRALIA

Flood Management

Indian Context

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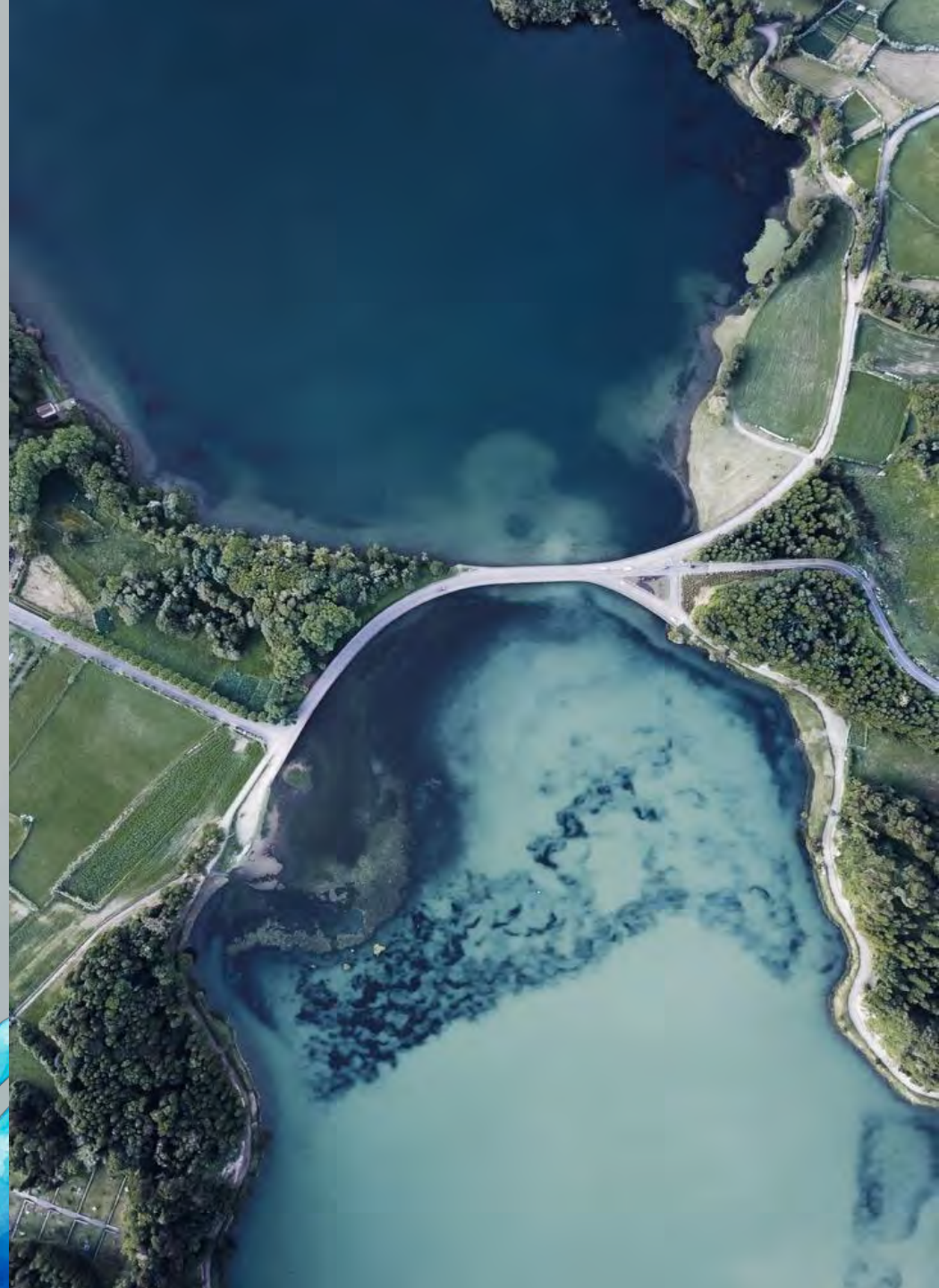
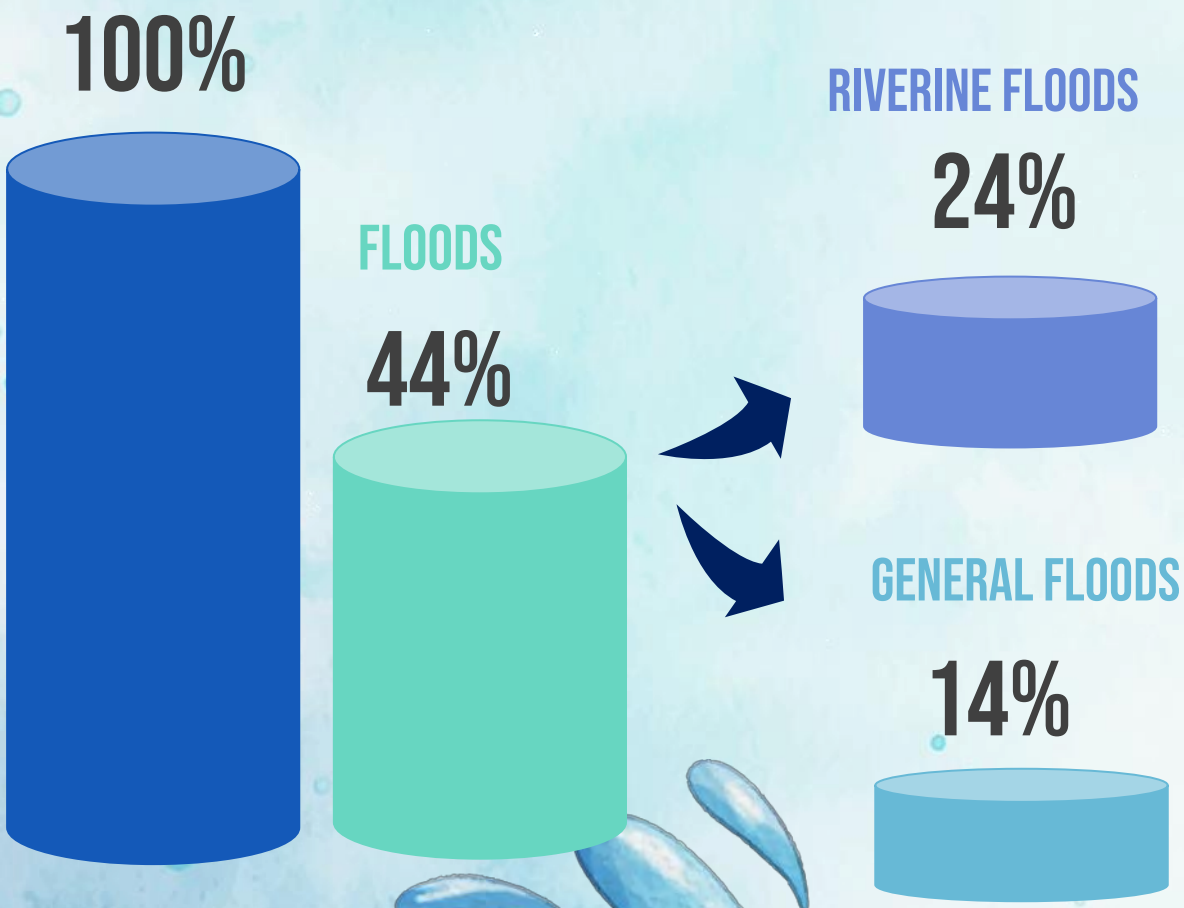
WAPCOS LIMITED
(भारत सरकार का उपक्रम)
जल शक्ति मंत्रालय
(A Government of India Undertaking)
Ministry of Jal Shakti



Flood – A Disaster



Flood is considered
the most destructive natural disaster
(in terms of)

ECONOMIC LOSS

SPATIAL EXTENT

Floods - Global Context

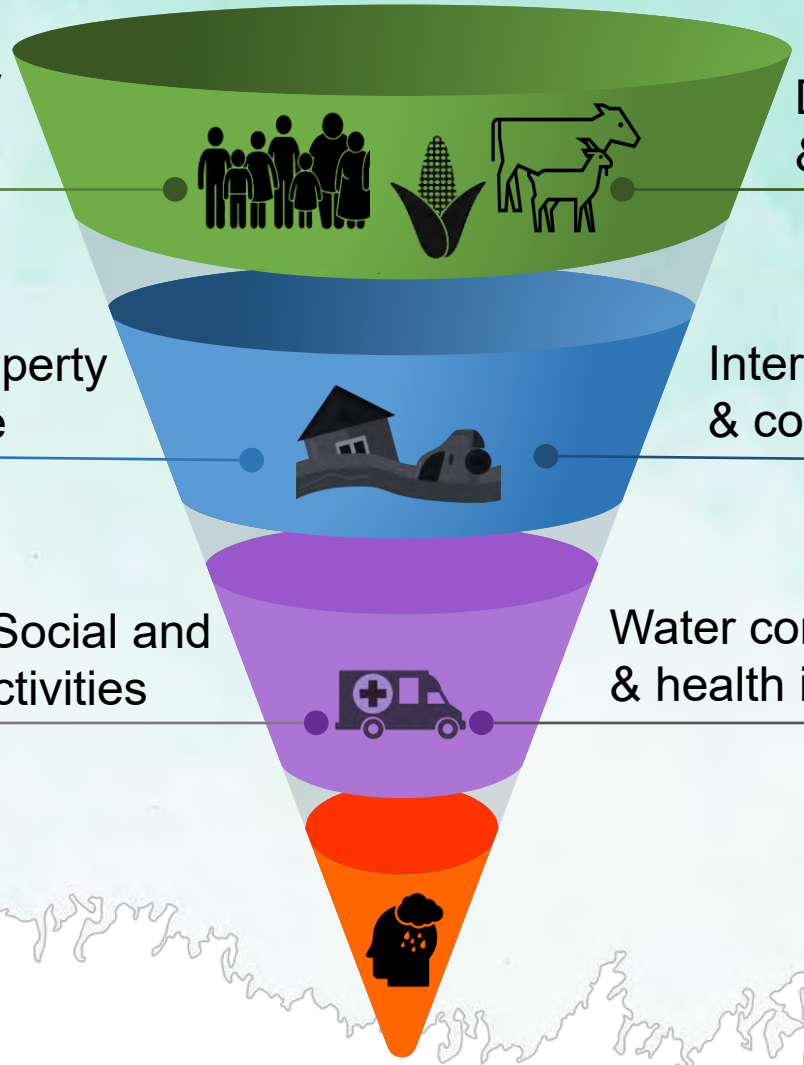
Tangible & Intangible Impacts

In 2021, more than 50 severe flood events around the world caused combined economic losses of US$ 82 billion

Tangible

Intangible

Loss of Lives
12800 deaths yearly
, (WMO Report)



Destruction of Crops & Livestock

Damage to Property & Infrastructure

Interruption to mobility & communications

Impacts on Social and Economic activities

Water contamination & health issues

Psychological effects of loss of life, displacements, and property damage - a long lasting impact,
Difficult to asses

Floods - Indian Context

India is 2.4 times smaller than Australia

National Commission on Floods estimated the total area liable to floods in the country as ~0.4 million km^2

Average Annual Damage due to flood (1953-2018)

Loss of Life 1654

Monetary Damages USD 706 million

Loss of Cattle Life 6,18,248

House Damages 1.2 Million

(Source: NITI Ayog, 2021)

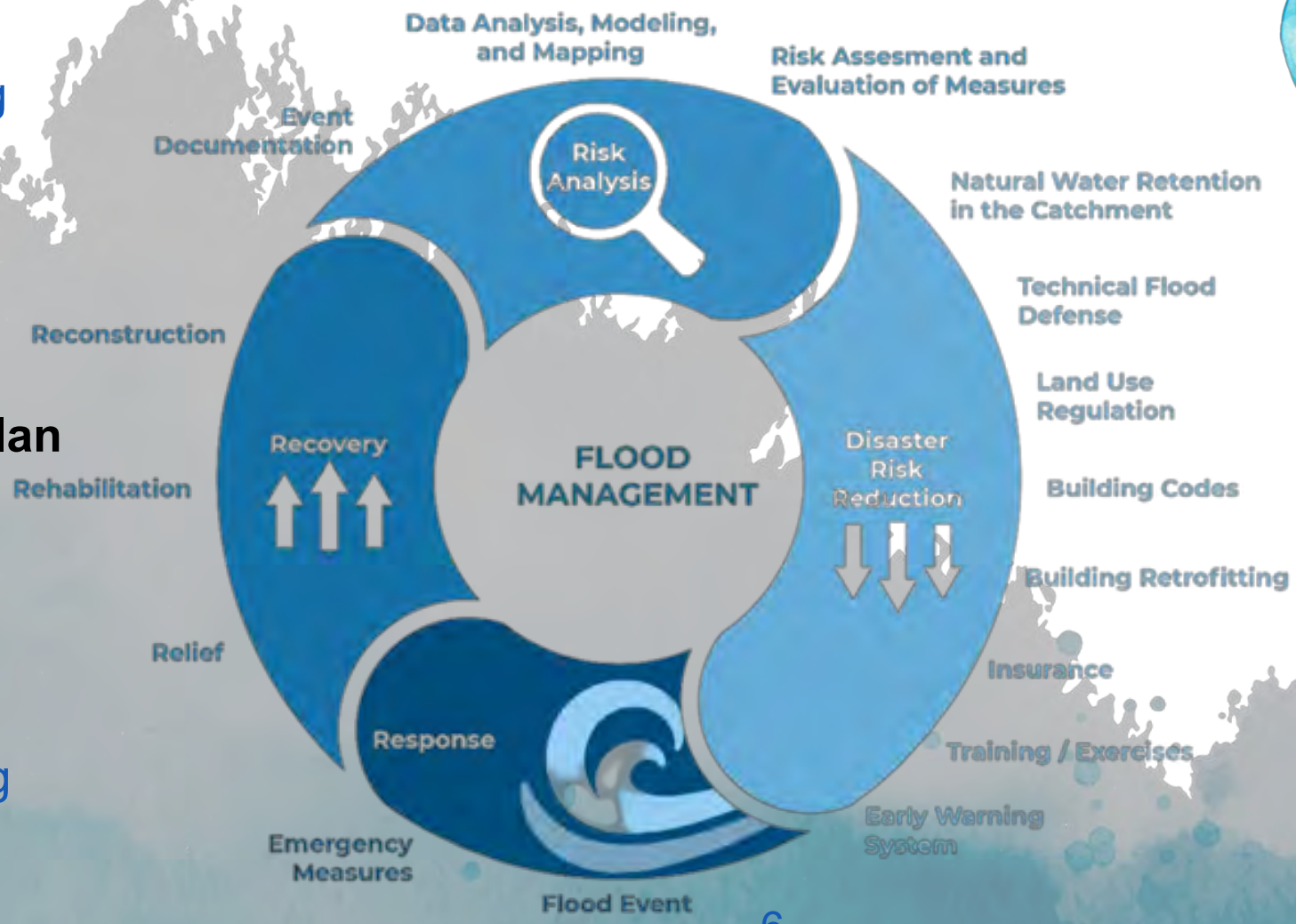
Flood Protection Measures: Structural

- **Dams, Reservoirs and High Flow Diversions** - to store flood water or to divert it from the area to be protected
- **Channel Improvement Works** - to increase discharge carrying capacity and to pass flood water adequately
- **Embankments** (4459KM), **Levees and Flood Walls** - to stop the flood water from entering the areas to be protected
- **Catchment Area Treatments** - to induce holding of water in the catchment temporarily
- **River Interlinking** – to divert water from water-surplus to water-deficient basins

Srisailam Dam, Telangana

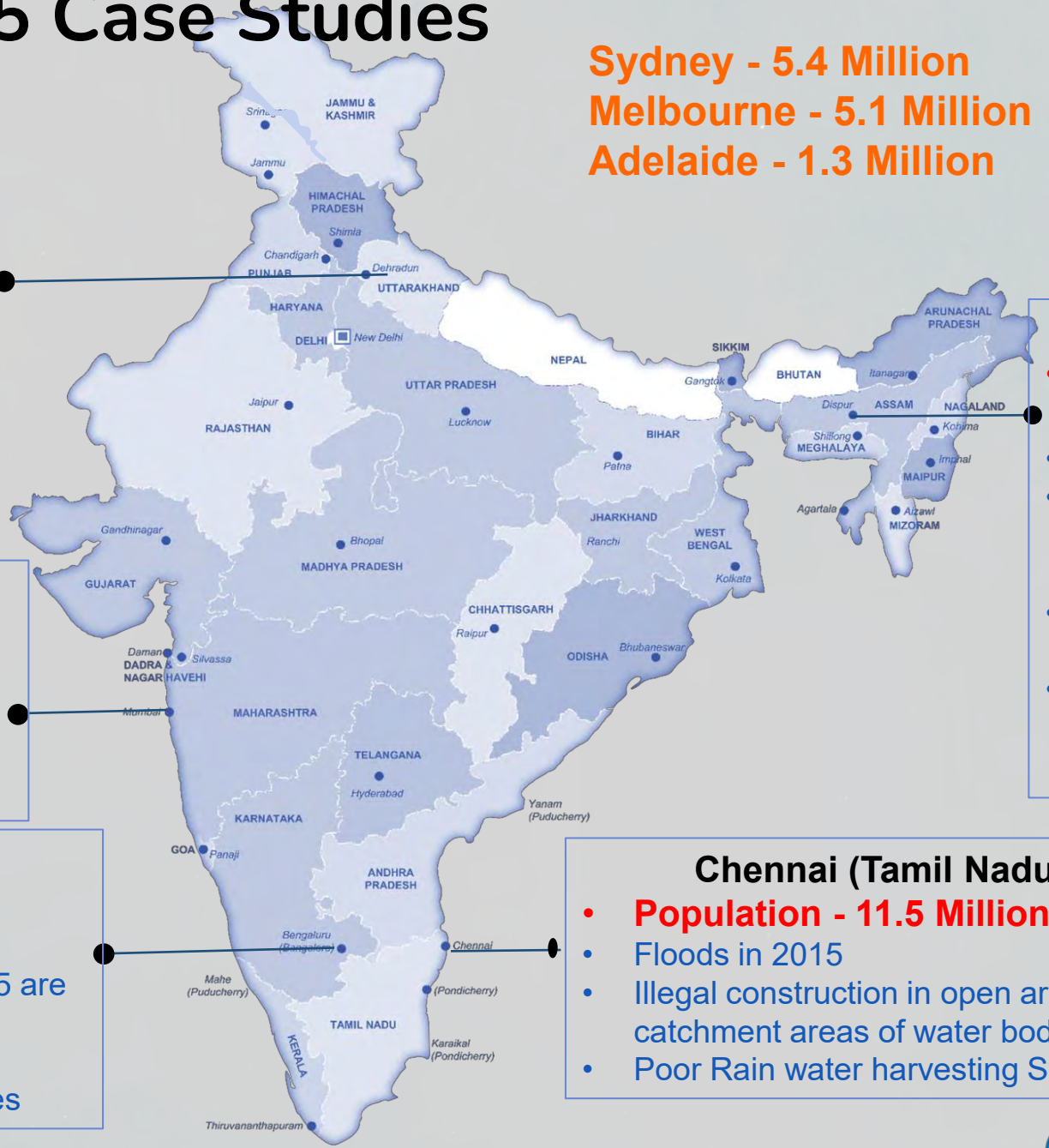
Flood Protection Measures: Non-Structural

- Flood Plain Zoning & Land use planning
- **Flood Hazard Maps**
- Flood Forecasting and Early Warning System
- **Dam Safety and Emergency Action Plan**
- Disaster preparedness and assistance (Disaster Relief Forces)
- **Soil conservation Afforestation**
- Social Awareness and Capacity Building
- **Flood Insurance**



Learning Lessons - 5 Case Studies

Sydney - 5.4 Million
Melbourne - 5.1 Million
Adelaide - 1.3 Million



Uttarakhand
- **Population - 11 Million**
- Floods in 2013
- Poor share of storm water drains & sewer flowing into them
- Encroachment of Water bodies

Mumbai (Maharashtra)
- **Population - 21 Million**
- Floods in 2005 & 2017
- Raising Sea levels
- Poor infrastructure planning
- Extensive Urban flooding

Bengaluru (Karnataka)
- **Population - 13 Million**
- Floods in 2017
- Out of 285 water bodies only 65 are left as of today
- Poor Drainage systems
- Sewerage flow into water bodies

Guwahati (Assam)
- **Population – 1.2 Million**
- Floods every year
- Brahmaputra flood plains – Low lying areas
- Poor waste management system
- Absence of integrated storm water management system

Chennai (Tamil Nadu)
- **Population - 11.5 Million**
- Floods in 2015
- Illegal construction in open areas and catchment areas of water bodies
- Poor Rain water harvesting Systems

Uttarakhand - Key Take Aways
(Learning Lessons)

- **Regulate Construction** within the flood plain of the river - Flood Plain Zoning Act
- **Disaster Impact Assessment (DIA)** to be made compulsory besides EIA (for clearance of all hydropower)
- Landslide risk zonation mapping to be conducted
- **Scientific Techniques** to be undertaken for effective stabilization of slopes in shear and weak zones
- **Blasting for developmental activities -** to be avoided as it may destabilize the weak rocks in mountainous regions
- **Community based disaster management system** to be put in place
- **Establishment of emergency communication system -** to ensure last mile connectivity

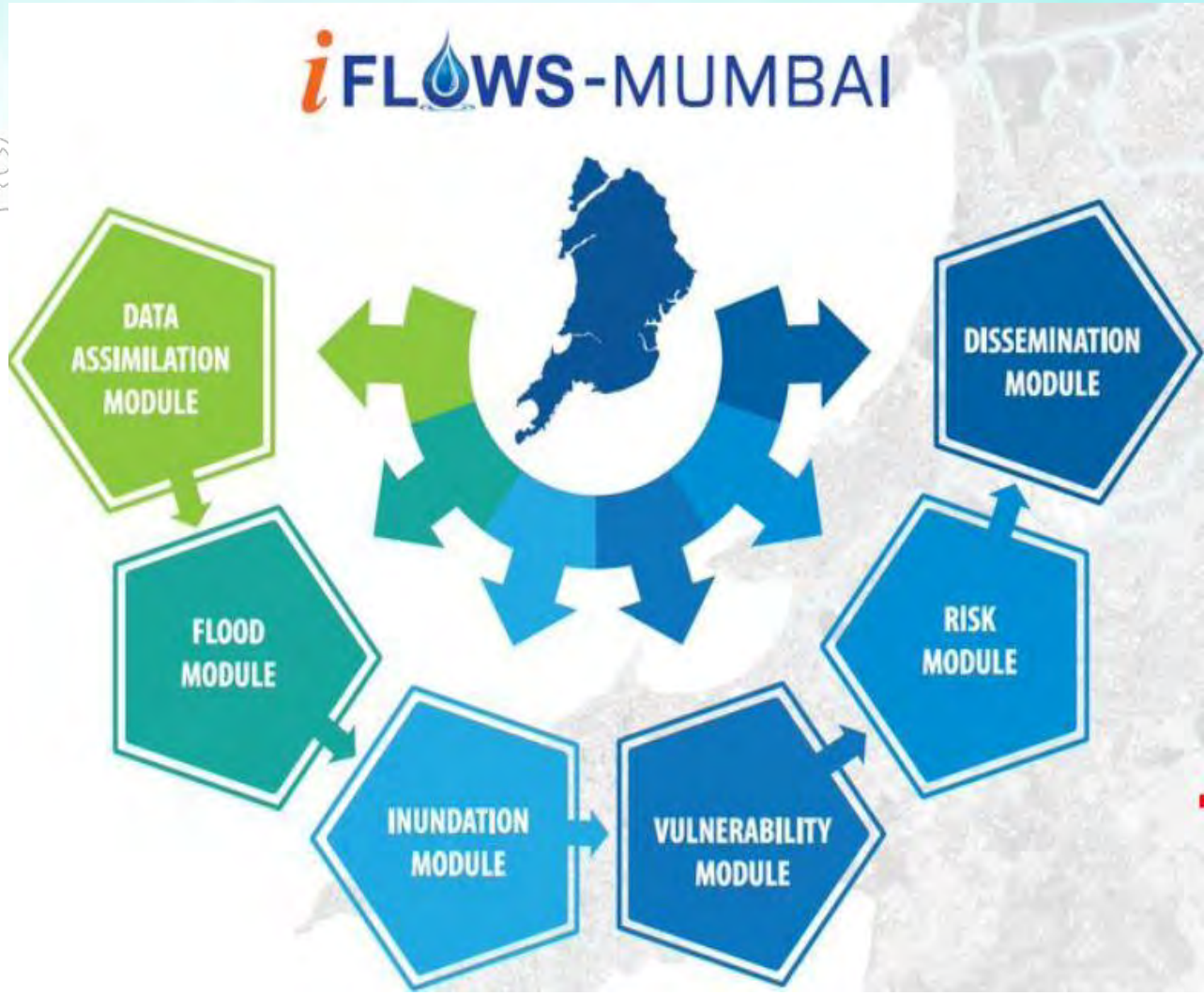
Mumbai - Key Take Aways

Introduction to "IFLOW" Management System

Integrated flood warning system - known as IFLOWS-Mumbai comprises six modules, namely **data assimilation, flood, inundation, vulnerability, risk and dissemination.**

It incorporates weather models from National Centre for Medium Range Weather Forecasting (NCMRWF), India Meteorological Department and field data from the rain gauge network stations

- This **GIS based decision support** system has all relevant details - such as **land topography, land use, infrastructure, population, lakes, creeks and data on river bathymetry** (study of the beds or floors of water bodies).
- The system has provisions to **capture the urban drainage** within the city and **predict the areas of flooding** in advance so that the civic body can issue alerts in advance



Bangalore - Key Take Aways

(Learning Lessons)

- **Bengaluru** was once known as **"City of Lakes"** is now called the **"City of Information Technology"**
- In 1980 there were **285** lakes which has reduced to around **65** in 2022.
- **Illegal Construction on river beds & SEZ areas** – Rapid Urbanization cause for urban flooding
- **Alterations to Land use pattern** to be restricted
- Need to expand and **remodel the drainage system**
- **Restoration drive to be conducted** for lakes and other water bodies
- **Low lying areas** to be reserved for **parks** and less human activities
- **Valley zones connecting the lakes** are to be **strengthened** to ensure the continuation of hydrological functions of the drains and flood plains
- **Restrict the sewerage flow** in the remaining water bodies

Bellandur Lake
2002 V/s 2022

Assam - Key Take Aways

Introduction to Concept of Sponge City - “Nature based solutions”

The basic principle of **sponge cities** is to give water enough room and time drain into the soil where it falls, rather than channeling it away as quickly as possible and sequestering it in huge dams

- **Roads to be made of Porous** asphalt instead of concrete
- **Afforestation** - Adding more parks, trees, other greenery or natural drainage can boost a city's absorbency
- **High rise muddy lands** to protect animals from drowning (Kaziranga National Forrest)
- **Conversion of existing infrastructure** like schools to flood shelters for emergency exit plan

Chennai - Key Take Aways
(Learning Lessons)

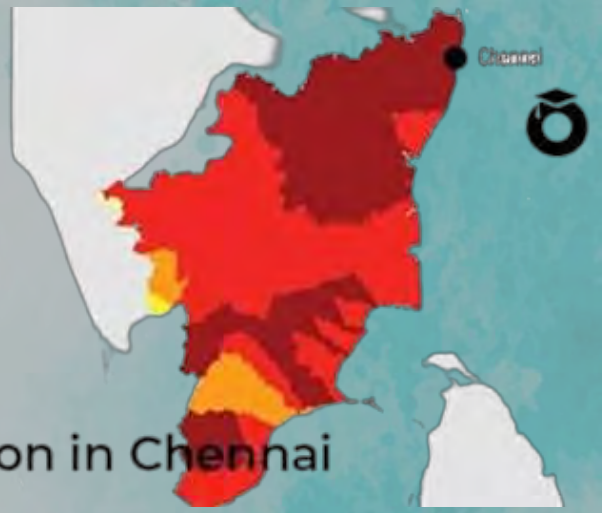
- **Special Drive** to **clean channels** leading to water tanks is undertaken before the monsoon season
- **Massive exercise for desilting** 22,899 tanks and 11,446 Km of water bodies were taken up
- **Introduction of Chennai Mega City Development Mission** - Integrated Storm Water Drain Project and Smart City Project (Constructed 8,835 drains spanning an area of 2051 square km)
- A total of 6,960 **recharge pits were created** & defunct borewells were also converted as recharge pits

Coastal Flood Warning System App ("CFLOWS-Chennai")

- **Web GIS-based** decision support system.
- Used both for **mitigation planning operations** & for real time aspects like **relief work**

Red Atlas Action Plan Map

Unveiled for Flood Mitigation in Chennai



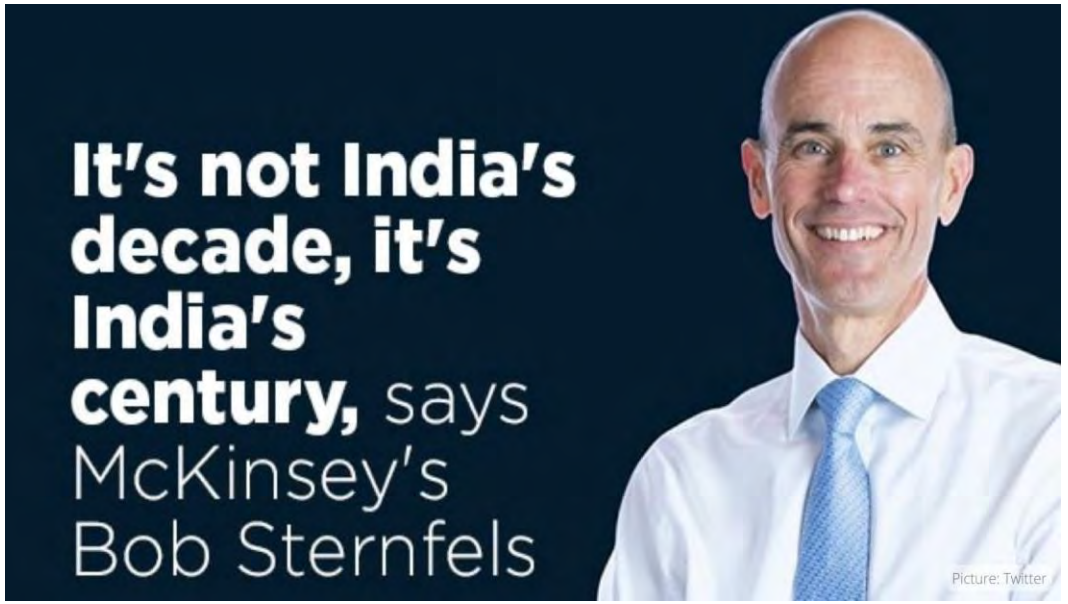
Significance

- **GIS-based evacuation plans**, including current flood water flow, emergency routes, water depth, obstacles and possible **search and rescue (SAR) interventions**, were prepared
- Preparation of **Flood Risk Maps** highlighting availability of grocery stores, restaurants, public utilities, food storage units, hospitals, residential homes for elderly people, high flood prone areas, etc.
- **Development of Local flood plain maps,** to inform construction practices (e.g., selection of appropriate materials for walls and floors)

WAY Forward - Digitalization

"AI Based Solutions for Flood Mitigation"

- As per **McKinsey Report**, India is No. 1 in Digital Adoption Index in the World.
- The initiate taken by the Government of India such as **"Digital India"** is a big win as technology is the need of the hour to transform to a connected nation
- Government of India took a **generational leap** and launched the 5G services in India yesterday which has opened up avenues in the field of **Artificial Intelligence, Augmented Reality, Virtual Reality & Internet of Things**
- This has led to the revolutionary step in exploring AI based solution for flood mitigation
- Some of these solutions are being explored in states of Karnataka, Bihar & Delhi as a pilot project.



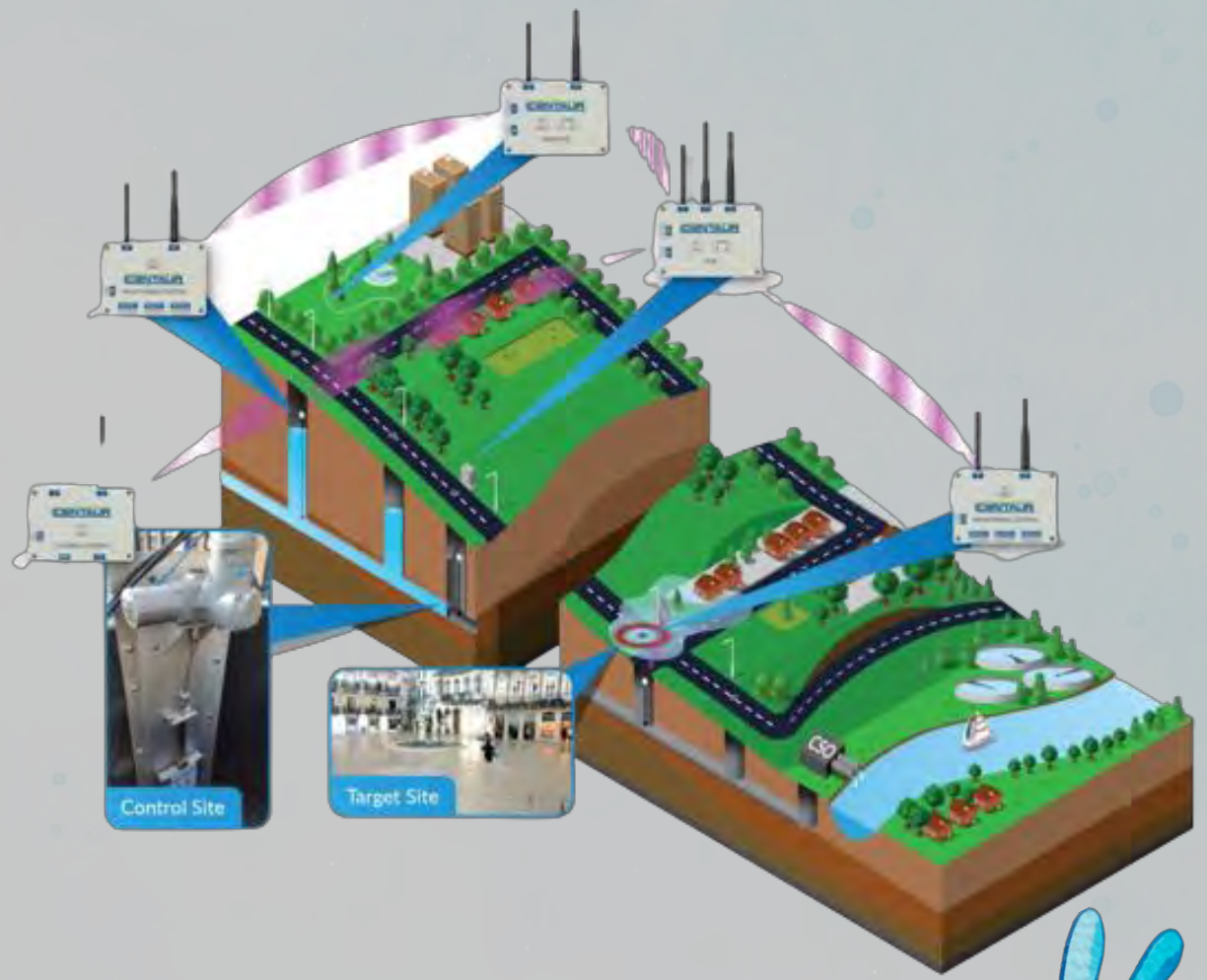
Digital India
Power To Empower

Technology for Flood Mitigation

Some of the AI Based solution are as follows:-

- AI powered flood forecasting techniques can be utilized to predict future events like floods with accuracy prior to 72 hours

- AI can help in circulating flood warnings in a very short time as compared to traditional methods and hence can avoid 30 to 50% damage



Google's AI-powered Flood Forecasting Model

Google's AI-powered Flood Forecasting Model was created to address the issue of the world's most prevailing disaster - Riverine Floods

Step 1

First of all, the probability of a river to flood is determined

Step 2

Inputs such as precipitation and water level gauge measurement are taken from Governments & disaster management agencies

Step 3

Designing of Hydrological Model (Predictions of water level in rivers)

Step 4

Designing of Invasion Model (Identifies the areas most likely to be hit by floods)

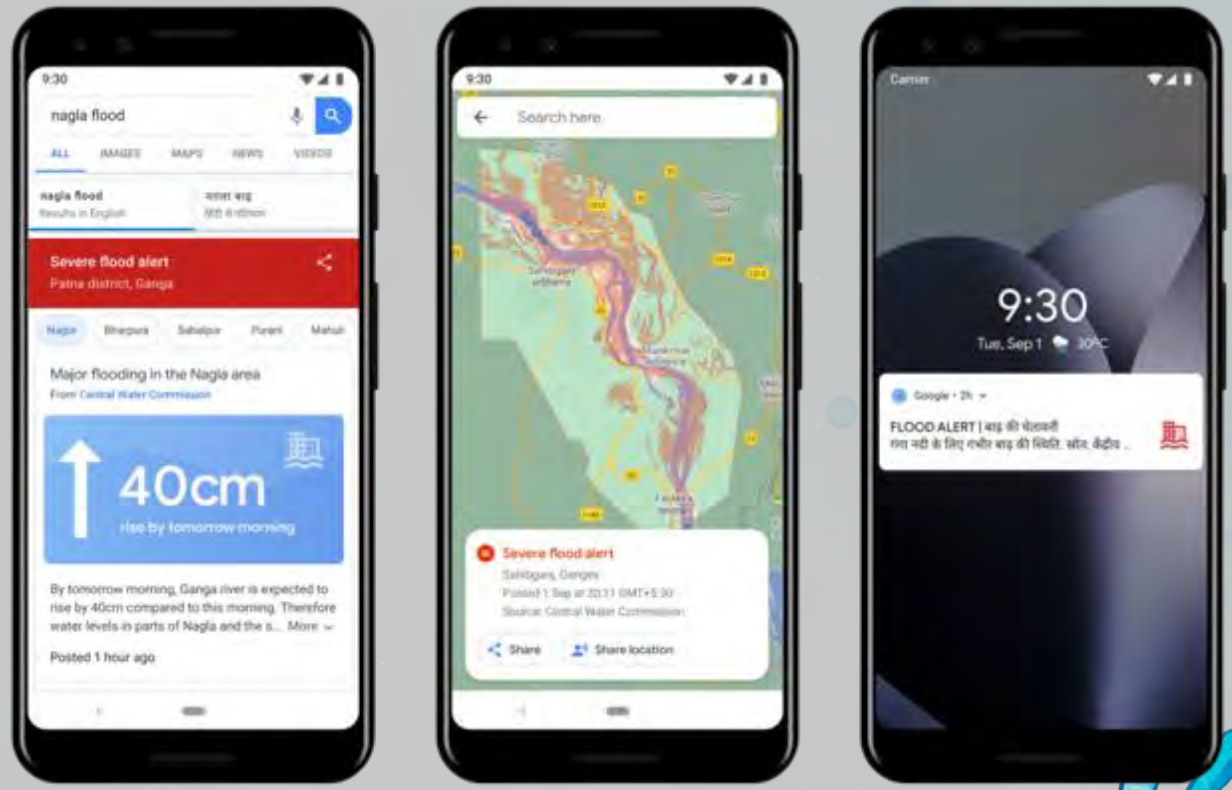
Step 5

Using Machine learning, all data are combined to generate its output by forecasting the river water level at some stage in the future

- With this system, the flood prediction accuracy is 75% where the error rate for the Hydrological model is just 12 centimeters, whereas that of the Invasion model is just 100 meters
- AI system delivers reliable flood information in real-time and warns the residents through Google Maps or Google search to enable them to take defensive measures

Pilot Program - Bihar

- Bihar government is circulating flood alerts with a lead time of 72 hours using ***Google's AI-powered Flood Forecasting Model*** through Google earth and Google maps applications.
- Residents get alerts three days in advance to take precautionary measures.
- As an outcome of these efforts, floods resulted in <u>just 25 deaths in Bihar in 2020 that was 130 in number in 2019</u>.



Thank You !

See you at Stall No. C-21