Roadmap for Mitigation of Urban Flood- Short Term, Medium Term and Long Term Measures

	SHORT TERM	MEDIUM TERM	LONG TERM
DRAINAGE	1. Regular cleaning of the drains is a must for providing the flow paths for flow of water for short, medium and long term strategy 2. In addition, efficient de-silting of drains and holding ponds should be completed well in advance before the onset of the monsoon season - 31 March (as mentioned in the NDMA Urban Flooding Guidelines); 3. A SOP for cleaning drains and desilting holding ponds should be in place for regular cleaning of drains.	1. Formulate a Drainage Master Plan (DMP) based on reliable and accurate data for hydraulic design of drains and other drainage related infrastructure; 2. Topographical surveys should be carried out to clearly identify the natural drainage paths. If any unauthorized development/encroachment is found in the natural drainage path, it should be removed in cases where diversion of drain is not possible. 3. The hierarchy of drainage network needs to be created by classifying drains into: a. Major drains which consist of (i) natural drains following the natural gradient, and (ii) drains along the major arterial roads; b. Minor drains consisting of (i) drains along the sub-arterial/collector/service roads, and drains within the residential colonies/industrial/institutional areas; 4. To ensure regular cleaning of the drains, install self-cleaning screens at appropriate locations to enable efficient cleaning of drains. 5. Establish city specific guidelines for constructing new drainage systems using the hydrologic catchment as the unit of planning. This will ensure that the drainage is consistent with one another as well as with existing facilities;	1. The long term mitigation measure should be the implementation of the Drainage Master Plan which was formulated as a medium term measure; The city master plan should take into consideration the drainage master plan providing adequate provision for drainage and water bodies.

WARNING	4. In addition to receiving rainfall nowcasts and forecasts from IMD; short term METARS issued by IMD must be shared with the City Disaster Control Room/Emergency Operation Centre (EOC)/ City Municipal Commissioner/Relief Commissioner 5. In case of cities with airports, the nodal officer should review information regarding thunderstorms (TS) and heavy rainfall (HR) from METARS which are updated every 30 minutes by the IMD. When TS/HRs are observed, the information should be communicated to the Municipal/Relief Commissioner to enable issue of timely alerts and take preventive measures, for example closing schools/offices if heavy rainfall and flooding is anticipated;	6. Identify pilots to facilitate severe weather alerts and establish direct link between pilots and EOC/mass media such as FM stations to issue severe weather/thunderstorm alerts. Continue to communicate IMD/ Aviation severe weather alerts to city authorities and public through FM radio and other mass media.	2. Each city should develop its own permanent network of Automatic Weather Station (AWS) - (1 for every 4 sq km) for effective monitoring of rainfall and issuing of heavy rainfall warnings. These should be used in conjunction with satellite map animations, IMD warnings and flood forecasting software for each city to issue warnings. It should address sudden thunderstorm flooding (20 mm/hr to 120 mm/hr), rapid moving weather disturbances, heavy rains due to various factors etc;
URBAN WATER BODIES	6. Map and list the ownership and condition of water bodies in each city. Subsequently, develop a monitoring framework anchored with the Urban Local Body (ULB);	7. Provide adequate capacity in existing lakes and ponds for holding the floodwaters - bathymetric survey of the lakes and ponds should be conducted in order to assess the water holding capacity of the reservoir; 8. Restore interconnection between lakes and water bodies which have been disrupted due to urbanisation in many cities;	3. In the long-term, all natural drains/water bodies should be well demarcated by building flood wall to prevent encroachments and overflow of floodwaters;

		9. Steps should be taken to initiate building flood wall for all natural drains/water bodies to prevent encroachments and overflow of floodwaters.	4. Riverfront development models that reduce the river width by constructing embankments reduce the water carrying capacity of the river. As a long term strategy, cities should plan riverfront development by adopting models that do not reduce the carrying capacity of the river. 5. Buyouts in flood plains may also be considered as a long term action mechanism for risk transfer provided the areas acquired though Buyouts may only be used for open public recreational purposes.

URBAN PLANNING	7. Identify land parcels best suited for safe debris disposal;	10. Extensive/reliable topographic field surveys should be carried out to ascertain the catchment areas, natural drainage patterns, and natural ground slopes. 11. Start work on Integrated Master Plan for the city to provide a holistic view of the entire urban drainage system irrespective of their different political jurisdictions; Each city should start work on its own Drainage Master Plan (DMP) • To facilitate proper draining of rainwater • To prevent flooding/ water logging in developed/developing areas DMP should be integrated with the City Development Plan (CDP)/Master Plan; For developing Drainage Master Plan, while carrying out survey of drains/channels throughout the stretches, interaction with local population should be done to gain insight.	6. Implementation of the City master plan which should be based on the city drainage master plan
RESPONSE	8. Establishment of Urban Flood/Flood Management cell in each city with technically qualified person as Nodal Officers. State Urban Development Departments may be authorized to coordinate across administrative boundaries; 9. Each city should put in place Standard Operating Procedure (SOP) for urban flood management and mitigation taking into consideration the city scenario i.e. i. Coastal city; ii. Cities on major rivers		

	iii. Cities near dams/reservoirs iv. Inland cities; v. Cities in hilly areas. A city may have one or more of the above traits; 10. Install portable pumps at appropriate flooding locations within the city to meet emergent situation; 11. Formation of high level expert committee for each city with adequate authority to take decision on site for release of water from reservoir. During heavy rainfall this committee will have the final authority to issue gate opening and flood water releases from dams/reservoirs after duly reviewing the inflow forecasts;		
CAPACITY BUILDING	12. Conduct stakeholder workshop before monsoon for capacity building and improved coordination amongst them for managing urban flooding; 13. Public information and education; Each city needs to prepare and have a list of Resident Welfare Authorities or other community groups in every ward or neighbourhood and subsequently involve them to cover the city;		