

Management of Monsoons in Mumbai, India

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Monsoon Emergency Response Operations Plan

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PREFACE

Monsoon Emergency Response Operations Plan

Mumbai, also known as Bombay, is the capital of India's state Maharashtra. It is a beautiful city known for its westernized culture and fishing. The name of the city was derived from India's beloved Mother Goddess Mumba Devi. The city is located on the West coast of India and is surrounded by the Arabian Sea and Thane Creek. There is a total population of around 20 million people living in an area of 233 square miles, making it a densely populated city and the second most populous city in India, after Delhi. Mumbai is a metropolitan city, meaning that most people live in urban areas.

Although Mumbai is known for its cultural diversity, westernization, and modernization, it is at risk of yearly disasters- especially flooding associated with Monsoon season. This season lasts from June to September, with July and August peak months for the heaviest rainfall. The city is normally very hot with extreme humidity. During monsoon season, Mumbai accumulates, on average, more than 2250 mm of total rainfall, meaning there are many storms in all areas of the city. This can cause many drownings, loss of ecosystems, and extreme infrastructure damage, with many collapsed buildings and damage to the built environment. Additionally, as India's Financial Capital, economic losses may also occur during the season, and this impacts the rest of India's economy.

Because of the public health significance of monsoon in Mumbai, this disaster plan focuses on protecting the health and wellbeing of effected community members.

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SIGNATURE PAGE

Team IDQ has collaborated with organizations and community members to create the attached Annex to India's National Disaster Management plan for the Management of Monsoons in Mumbai. The undersigned accept this Annex for further consideration and hereby agree to review and revise this Annex at least annually or within six months of revisions to either India's National Disaster Management Plan or Maharashtra's State Disaster Management Plan.

Arghya Iyengar	Date
Team Captain, IDQ	

National Disaster Management Authority	Date
Ministry of Home Affairs	
Government of India	

State Disaster Management Authority	Date
Disaster Management Unit, Relief and Rehabilitation Department	
Government of Maharashtra	

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MISSION STATEMENT:

The mission of the National Disaster Management Authority (NDMA) is to build a safer and disaster resilient India by a holistic, proactive, technology driven and sustainable development strategy that involves all stakeholders and fosters a culture of prevention, preparedness and mitigation. The Maharashtra Disaster Management Authority's priority is to save the lives of people and minimize the loss of property and environmental degradation by properly mobilizing resources and launching a well-coordinated response while ensuring clarity around roles and responsibilities across State, District and local authorities.

STATEMENT OF PURPOSE:

The purpose of this plan is to coordinate with India's National Disaster Management Authority and Maharashtra's State Disaster Management Authority as well as all partnering organizations and communities to create a disaster relief plan to enhance mitigation strategies in preparation for the monsoon season. Additionally, the plan in coordination with this organization will help develop plans to provide better relief during and after the monsoon season and get ready for the next season.

AUTHORITIES AND GOVERNANCE:

- The NDMA, headed by the Prime Minister of India, serves as the primary body for Disaster Management as mandated by the Disaster Management Act, 2005.
- Prime Minister's Ten Point Agenda for Disaster Risk Reduction
- NDMA's National Policy on Disaster Management 2009 which conforms to the International Strategy for Disaster Reduction, the Rio Declaration, the Millennium Development Goals and the Hyogo Framework 2005-2015.
- The Sendai Framework for Disaster Risk Reduction 2015-2030
- National Disaster Management Plan, November 2019
- Government of Maharashtra State Disaster Management Plan

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DEFINITIONS:

CWC= Central Water Commission

NDMA= National Disaster Management Authority

FEMA= Federal Emergency Management Agency

NDRF= National Disaster Response Force

SDRF= State Disaster Response Force

WNC= Western Naval Command

ICG= Indian Coast Guard

CRPF= Central Reserve Police Force

MOR= Ministry of Railways

COMMUNICATIONS PLANS:

In the event of monsoon season, the Government of India in partnership with the National Disaster Management Authority should follow two forms of communication, an internal and external form. These will be done in partnership with the Central Water Commission (CWC) to understand what is happening on the water. Additionally, the communication plan will be in partnership with transport and rail communication networks who will connect flood and monsoon disaster relief and supply centers to flood prone areas,

- Internal Communications
 - Staff within CWC (phone numbers, emails, etc.)
 - Staff within NDMA (phone numbers, emails, etc.)
 - Communication with transport and rail communication networks
- External Communications
 - Communicate with local media and phones, internet social media etc. to provide important alerts about potential areas to avoid and provide the general population with situational awareness (re flooded areas to avoid, etc.,)
 - Communicate with external organizations for potential relief
 - Provide large scale briefings on the situation at hand
 - Contact the target population at risk as provided by the transport and rail communication networks

MUTUAL AID AGREEMENTS:

- National Emergency Response Center, Disaster Management Division, Ministry of Home Affairs including Fire Services, Civil Defense Corps & Home Guards

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- National Disaster Response Force (NDRF)
- State Disaster Response Force (SDRF)
- Western Naval Command (WNC)
- Indian Coast Guard (ICG)
- Central Reserve Police Force (CRPF)
- Ministry of Railways (MOR)
- Federal Emergency Management Agency (FEMA)

VI. PUBLIC HEALTH CONCEPT OF OPERATIONS

Assessing the Needs of those Affected by Monsoons

Based on the NDMA Monsoon Contingency Plan, food reserves are to be maintained and a supply of drinking water to the vulnerable communities should be given top priority. Relief camps for those affected by monsoons should be established to facilitate transfer of people and livestock to areas of little to no damage. In addition to this, since monsoons can cause disease and virus spread, a comprehensive emergency health response plan should be developed to ensure that necessary drugs and vaccines are made available to the affected population. Health mobile teams should additionally be equipped by Health departments to attend to help prevent the outbreak of an epidemic. Medicines for livestock affected during monsoon season should also be taken into consideration and is recommended by the NDMA¹. Distribution of relief items such as kitchen sets, clean drinking water, latrines and sanitary systems, and tarpaulins are to be provided to households in need. A requirement for evaluation of the aftereffects of the monsoon is the deployment of the Regional Disaster Response Team (RDRT) to plan and monitor the situation as well as to assess the measures required to provide relief to each community. Most of these needs will likely be tended to locally as each part of Mumbai is affected differently by monsoon season².

Matching Available Resources to the Needs

To meet the needs of the vulnerable and ensure continued support during and after the monsoon season, there will be partnership with other governmental and non-governmental agencies to provide relief items and strengthen logistical capacity. The partnership will;

1. Relocate individuals living in areas affected by floods
2. Restore disrupted livestock and veterinary services to preserve livelihood assets

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3. Distribute food, water, hydration salts, medications etc. and basic needs such as tarpaulins, blankets, and tents to affected families while working on adequate shelter to vacate their makeshift shelters
4. Establish disease surveillance systems in affected areas to detect and respond rapidly to potential disease outbreaks like cholera and diarrheal diseases.
5. Provide food assistance including micronutrients to meet daily dietary requirements
6. Construct latrines, distribute emergency water and water treatment kits to promote good hygiene practices among affected individuals

Evaluating the effectiveness of the disaster response:

***Goal: Orderly de-escalation (step-down) of emergency services; not abrupt termination**

- 1) Assess urgency and ability to address:
 - a. Monsoon characteristics
 - b. How many lives lost?
 - c. What damage was caused to dwellings? Government infrastructure?
Businesses?
 - d. How many community members are displaced?
 - e. What public health impacts (basic needs such as food, water, clothing, shelter, energy, health care, education) need to be addressed in the immediate/short and long term?
 - f. What needs are there for recovery and restoration in the immediate, short and long term?
- 2) Resources (identify availability and limitations/gaps)
 - a. Emergency Response Personnel (fire, EMT, police, hazmat)
 - b. Housing/shelter
 - c. Water, food, clothing, medications and other essential goods and services
 - d. Energy/power
 - e. Health care providers
 - f. Education
 - g. Financial assistance
- 3) Recovery and de-escalation efforts; transitioning response from emergency management services to Mumbai governmental agency/department operations center management/Regional Disaster Response Team (RDRT)

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- a. Trigger events (severity of monsoon, resource availability, planning capacity and intangibles such as precedent, experience and instinct)
 - b. Protocols and procedures for de-escalation and return to normal operations with conventional services provided and functions for the community reinstated
- 4) Continuous monitoring and assessment to better meet the needs of the people impacted:
- a. Debrief to review all aspects of the effectiveness of disaster response during event(s) during the monsoon season in Mumbai (June-September) and compare response during those stressful times to the “standard of care” applied in everyday programs outside of monsoon season
 - b. Conduct assessment and create an after-action report (taking into consideration the guidelines and assessment criteria of the National Disaster Management and Maharashtra’s State Disaster Management Authorities) and the actions of the Regional Disaster Response Team (RDRT) to identify shortfalls and successes and resulting changes/adjustments that should be made to the plan to improve the process in preparation for the next monsoon season³
 - Data element identification
 - Data collection
 - Prioritization of metrics
 - Data analysis
 - Reporting
 - Conclusions and recommendations including the action, the responsible party/agency, and the timeline for completion/implementation

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REFERENCES:

1. A. (2021, June 9). *Some Facts About Monsoon & It's Rainfall in Mumbai*. Me Mumbai. <https://memumbai.com/facts-monsoon-mumbai/>
2. *Demography | Mumbai City | India*. (n.d.). Mumbai City. <https://mumbaicity.gov.in/about-district/demography/>
3. Flood Hazard Maps for India Empower Informed Risk-Based Pricing. (2018). AIRWorldwide. <https://www.air-worldwide.com/blog/posts/2018/1/flood-hazard-maps-for-india-empower-informed-risk-based-pricing/>
4. *Flood Safety*. (n.d.). Flood Preparedness | American Red Cross. <https://www.redcross.org/gethelp/how-to-prepare-for-emergencies/types-of-emergencies/flood.html>
5. *India: Monsoon Rains and Floods Emergency Plan of Action (EPoA) Operation Update n° 1 DREF n° MDRIN024 - India*. (2019, October 18). ReliefWeb. <https://reliefweb.int/report/india/india-monsoon-rains-and-floods-emergency-plan-action-epoa-operation-update-n-1-dref-n>
6. Kothari, K. (2021, July 1). *Of Mumbai and its Monsoon*. India.Com | Top Latest News from India, USA and Top National Breaking News Stories. <https://www.india.com/maharashtra/mumbai-harsh-monsoon-months-heavy-rains-flooding-4780334/>
7. NDMA. (2021). NDMA. <http://cms.ndma.gov.pk/plans#>
8. *Urban Floods | NDMA, GoI*. (n.d.). National Disaster Management Authority. <https://ndma.gov.in/Natural-Hazards/Urban-Floods>
9. U.S. Department of Homeland Security, Community Preparedness Toolkit, <https://www.ready.gov/community-preparedness-toolkit>, 11/4/2021.
10. *Writing a Disaster Plan: A Guide for Health Departments*. (2005). UCLA. <https://newherc.com/wp-content/uploads/2019/10/Writing-a-Disaster-Plan-Guide.pdf>

ANNEX I. Threat Hazard Identification and Assessment

Natural	Technological	Human-caused
Resulting from acts of nature	Involves accidents or the failures of systems and structures	Caused by the intentional actions of an adversary
<ul style="list-style-type: none"> • Monsoons: Monsoon season normally lasts from June-September, with large areas receiving more than 90% of their total precipitation and south and northwest India receiving 50-75% of their total rainfall, killing around 1,600 people last year • Drought: Over 1/5 of the area is facing droughts in the monsoon off season. From 1870-2016, soil moisture drought was one of the famines that have been deadly, killing millions of people • Electrocuting: Overall, there are about 2,000 vulnerable spots for electrocution and the higher the rainfall during monsoon season, the more likely it is for people to be electrocuted 	<ul style="list-style-type: none"> • Infrastructure stability failure: Infrastructure in India is already an issue because there is a failure of prioritizing infrastructure, and when monsoon season hits with all the rain and floods, the unstable infrastructures collapse with no plans on making them more stable for the next monsoon season • Roads getting flooded: With monsoon season and poorly created infrastructure and roads, flooded roads cause unsafe travel and more collapse of infrastructure. Around 27 acres in one city get flooded each year, causing difficult transportation • Utility disruption: when it comes to floods and heavy rainwater, most of India's power shuts off. However, coal accounts for 70% of India's electricity and since there is a coal shortage, it is difficult for them to generate electricity on a normal basis 	<ul style="list-style-type: none"> • Riots: there are a number of riots that have been happening for the primary reason of the feud between Hindus and Muslims. In 2020, there were the Delhi riots where there were multiple killings and properties destroyed because of the Hindu and Muslim feud • Political unrest: there have been many political unrests due to the change in prime ministers to the way farmers are being treated. Thousands of citizens have died because of this unrest, and this continues to happen

ANNEX II. Drills and Exercises

Training Seminar Title: Monsoon Preparedness in Mumbai (Community Preparedness)	
Objectives of your Training Seminar (What mitigation strategy are you advocating?)	Community-wide Monsoon Mitigation in Mumbai
Estimate Length of Training	Trainings to occur three times during December-May in preparation for the monsoon months of June-September Each training to be 1 hr long
Target Audience and max size of audience.	Communities within Mumbai most affected by Monsoon season; 50 people max per training (1 community member per household)
Who would be a good candidate (e.g., structural engineer, health dept. official, first responder?) as Facilitator of this session? Why?	Someone from the health department to inform the community about potential pathogens from monsoons; a disaster preparedness specialist, particularly someone who has been working within the realm of floods/monsoons; and a community member who has been through monsoon season before because this enhances trust and community resilience given a trusted resource with first-hand experience can work with the team of others to facilitate the session and add community based views on “real life” scenarios and case studies that have played out.
What do you want community members to do as a result of their attending this session?	Take back the information shared/heard to maximize all community members' awareness of the importance of proactive planning and encourage participation in disaster preparedness activities. Establish a Community Disaster Preparedness Council. Use the grassroots strategy to bring together government and community leaders to involve community members in monsoon preparedness and resilience. Being a member of the Community Disaster Preparedness Council means the individual(s) accept personal responsibility to be prepared; to get training in first aid and emergency skills; and to volunteer to support local emergency responders, disaster relief, and community safety. They are the individuals that have “emergent norm phenomena” and take control of situations to keep their fellow community members out of harm's way.

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Strategies to increase community uptake of your mitigation	<ul style="list-style-type: none">• Assist attendees enroll in emergency alert systems• Provide and assist attendees to complete a family disaster plan• Provide attendees with the contact information of emergency responders and disaster relief agencies• Hand out flyers of community evacuation routes and shelters• Teach attendees basic lifesaving skills• Hand out emergency survival kits including flashlight
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ANNEX III. Short-term Recovery

Necessities	Possible Resources	Distribution Strategies
Water	<p>Clean, bottled water</p> <p>Water treatment kits, hydration salts</p> <p>Water purifiers</p> <p>Dewatering pumps to clean, desilt and divert storm water from drains to sea</p>	<p>UNICEF, the Central Water Commission (CWC) and the National Disaster Water, Sanitation and Hygiene Response Teams (NDWRT)</p> <p>The Indian Red Cross society provides a household water treatment manual</p> <p>Mumbai Metro Rail Corporation Limited (MMRCL) installs in metro stations</p>
Food	Biscuits, rice, and lentils	World Food Programme and Indian Red Cross National, State, and Regional Disaster Response Teams
Housing/shelter	<p>Tarpaulins for shelters, bed sheets, mosquito nets, candles, kitchen sets, clothing, blankets, towels, and buckets.</p> <p>Transitional, tent and core shelters set up wherever plausible</p>	Indian Red Cross Habitat India
Disease Surveillance Systems	Detect through testing and respond to potential disease outbreaks like cholera, diarrheal disease, malaria, dengue, typhoid and leptospirosis with treatments and vaccinations	CDC India with the Gov't of India (GoI), Ministry of Health and Family Welfare (MoHFW). On-ground community centers that develop models for integrated health service delivery in urban informal settlements such as SNEHA Centres Programme

Appendix I. Map of Flood Affected Areas in Mumbai

