



## Understanding the Various Roles and Responsibilities in Community Level for Flood Risk Preparedness Plan

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**Abstract:** Flood is one of the most prominent natural disasters causing colossal damage to humans and properties almost every year in Odisha. It is a state in eastern India between 10 and 100 km wide and 482 kilometers long, and is vulnerable to Floods, cyclones, and storm surges because of its geographical location. And the maximum number of floods that formed in Balasore make it a highly susceptible district as compared to other districts of Odisha. The preparedness and awareness for Flood disasters is the assessment of the degree of various losses or damage due to their manifestation and their given severity which will help to protect the population and community resources from potential flood damage. This paper developed a Preparedness framework for reducing damage caused by floods by reviewing relevant literature. The Preparedness framework might be helpful in reducing damage due to floods. It would also help policymakers in managing flood disasters.

**Index Terms - Flood vulnerability, Preparedness, Non-structural measures, Responses, Emergency Plan.**

### I. INTRODUCTION

Throughout the history of time, flood is among the most devastating natural event that has caused the potential loss of lives and properties as well as the environment. A flood can be classified by characteristics such as triggering events, geographic occurrence, and duration of the event, time of onset, frequency, magnitude, and secondary occurrences. Therefore, these factors can help in determining various types, such as coastal flood, river flood, flash flood, storm surge, and urban flood. Furthermore, it makes it possible to compare various threats with one another in terms of flood levels. And by measuring the vulnerability of an area or a targeted population will help in community planning and emergency management. The study's key aim is to assess flood vulnerability and adaptation strategies for providing a better solution to reduce the effects of flooding.

In Odisha, 1.40 lakh hectares of the state's total 15, 571 million hectares of land are prone to flooding. Severe flooding in the river basin and delta areas is a result of the flat coastal belts' poor drainage, high levels of river siltation, soil erosion, breaching of embankments, and dumping floodwaters over them.

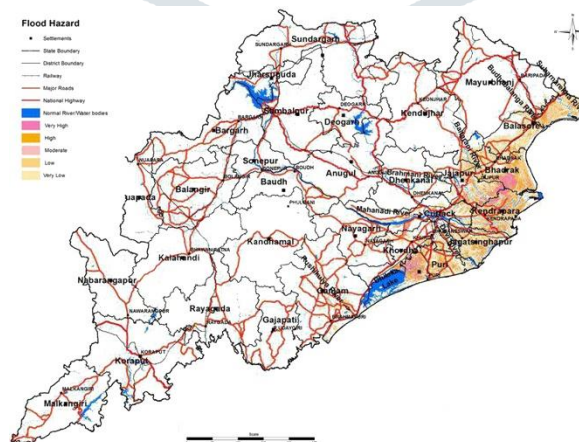


Fig-1 Showing the Flood Vulnerable map of Odisha (OSDM-2019)

The Mahanadi River and its tributaries have the capacity to produce extremely dangerous floods. Ten additional significant river basins in Odisha regularly experience flooding. Based on the flood hazard index derived it can be said that out of 30 districts, about 08 districts are worst flood affected districts and these are Balasore, Kendrapara, Jagatsinghpur, Bhadrak, Puri, Jajpur, Khordha & Cuttack. And Balasore lies in the rank one.

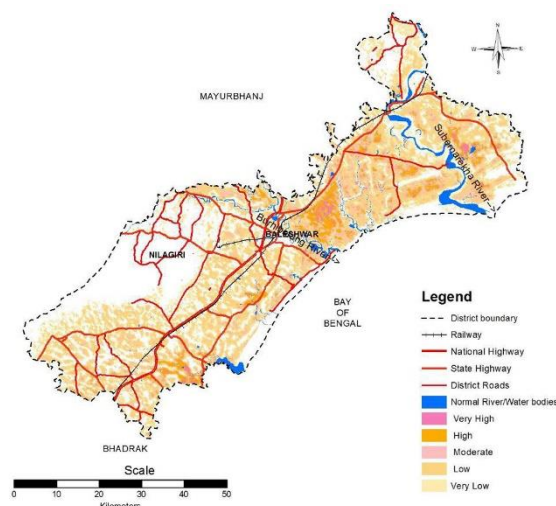
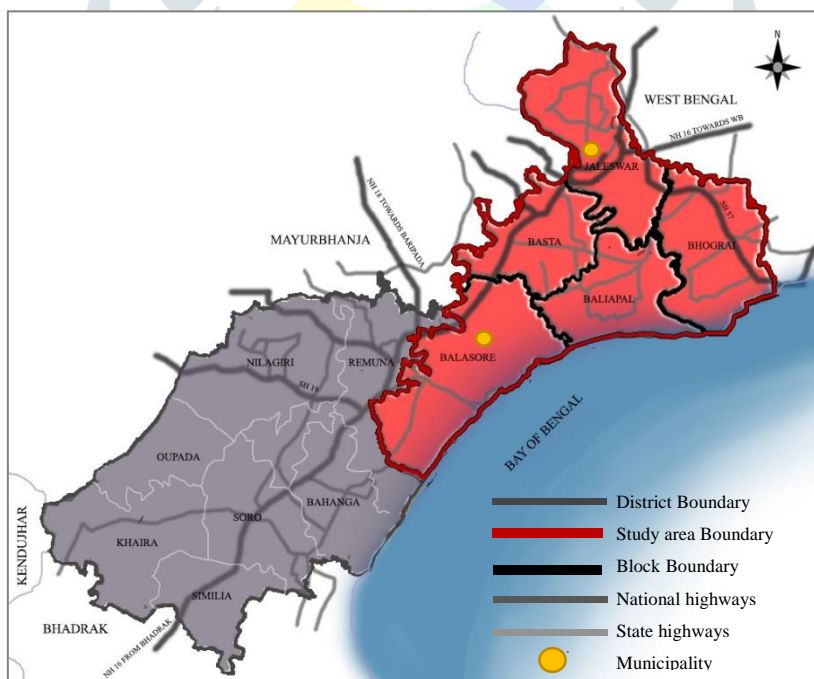


Fig-2 Showing the Flood Vulnerable map of Balasore (OSDM-2019)

**II. STUDY AREA**

Balasore is one of the seaside Districts of Odisha and it is spread over an Area of 3,806 Sq. Km. with a Population of 23, 17,419 (according to registration 2011) and 26, 56,225 (Assessed populace for 2022).It lies in the northernmost piece of the state and has forever been in the middle phase of normal disasters like floods since the days of yore. This is fundamentally referred to as the place that is known for streams as it has given way to the waterways to be specific Subarnarekha (Sono), Budhabalanga, Jalaka, and Kansabansa. It is bounded by the Bhadrak region in the south, the Bay of Bengal in the east, the Mayurbhanj region in the west, and the Midnapur (W.B.) region in the north. This area comprises two developments specifically Balasore and Nilagiri and is additionally separated into 12 Blocks. Among these blocks, Bhogarai, Baliapal, Basta, Balasore Sadar, and Jaleswar are 5 for the most part impacted blocks of the region concerning weak populace and topographical region. During 1994-2010; the Balasore region encountered a bigger number of flood occasions for multiple times. The study area comprises about 1684.87 sq. km, or 44.26 percent, of the district's overall area.

The district normally has a low humidity climate. The hottest month of the year is often May, and the coldest month is typically December. At Balasore, the greatest recorded maximum temperature was 44 C on 8.6.98. Every year, on June 14, the monsoon season officially begins. The district receives 1592 mm of rain on average. The district's yearly rainfall is made up of at least 75% of the rain that falls between June and December. The district experiences 73 wet days on average per year.



Map-1 Showing the study area

**III. METHODOLOGY FOR THE FLOOD MANAGEMENT PROCESS**

After receiving the weather/flood warning from the subdivisional control room, the first priority will be to alert those who live in low-lying areas, specifically, through Sarpanches, PS members, Ward members, youth clubs, NGOs working the area, and by using a public address system, some drums, blowing the sankha, or any other conventional method in the village and local markets. If the circumstance calls for it, you must take the required actions to evacuate people from low-lying locations. They need to make sure that there is enough rice, wheat, Chuda (dry rice flakes), kerosene oil, matchboxes, fuel, etc., available at local markets and in retail sales locations.

The next phase will be to secure the weak and exposed areas of embankments using village volunteers, Home Guards, and police officers, among other means. If necessary, the Irrigation Department may be contacted to offer assistance and support. After getting the go-ahead from the relevant Collector/Sub-Collector, they will begin distributing urgent help in marooned areas if the situation warrants it. The Officers Concern may enlist the cooperation of DMTs (relief team members) at the GP and village levels to deliver and distribute aid. Additional vehicles might be required to carry out rescue and relief operations. They would promptly get in touch with the district control room or sub-collectors for assistance in such cases.

**A. Response phase at municipal level**

This response phase takes place in 5 stages which starts before 5 days of happening of the flood and it continues after 180days of the event. Both stage-1 and stage-2 i.e. Early warning and Evacuation process respectively, which starts before 5 days of the event, then stage-3 i.e. Relief operation which starts before 3days of the event and continue for 30 days. After 5 days of happening of the event the restoration and recovery stage take place. Then at the end the final stage starts after 45days of the event i.e. rehabilitation and preparedness which take next 45 days to complete. The following diagram showing the timeline of Response phase.

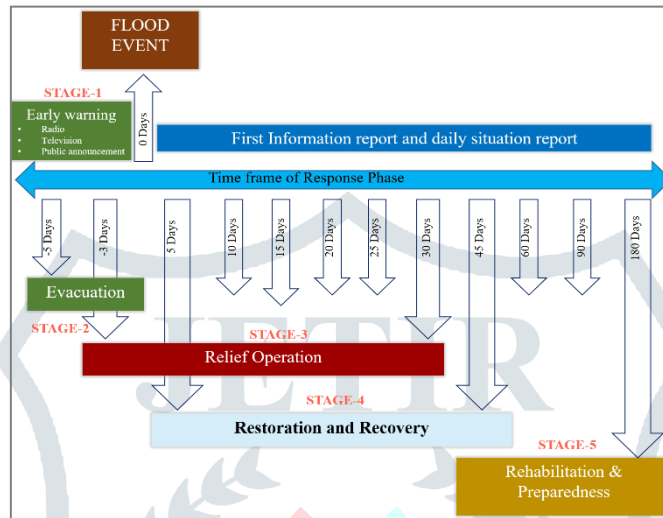


Fig-3 Showing the time frame of Response phase at Municipal level

**B. Relief management phase at municipal level**

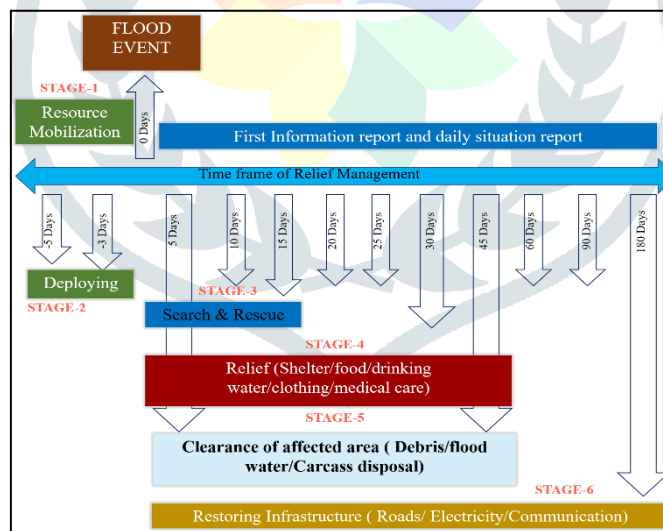


Fig-4 Showing the time frame of Response phase at Municipal level

Relief management includes resource mobilization, deploying, search and rescue operation, then relief operation like provision of food, drinking waters, temporary shelter, clothing, and medical care for any type of first aid treatment and at the end clearance of affected area such as clearance of debris, flood waters and the carcass disposal is to be done.

**IV. ANALYSING THE ADVERSE CONSEQUENCE OF FLOOD AND THEIR IMPACT ON THE COMPLETE POPULATION OF THE STUDY AREA**

The study area, which consists around 37% of the Balasore district's overall population has a total population of 8, 38,694. From which 1, 36,988 people, or 17% of the population in the study area, are vulnerable. Meanwhile, 17.8% of the individuals living in the Balasore area are the most vulnerable.

A. In term of vulnerable agricultural land Out of the total 56,300 hector affected agricultural land, Baliapal having the maximum vulnerable crop lands.

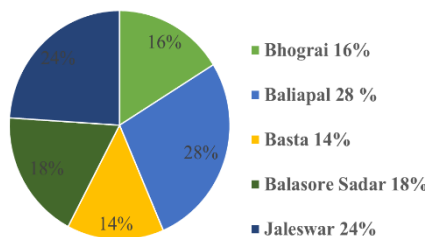


Fig-5 Showing the percentage of flood vulnerable agriculture lands of different blocks of study area

B. In terms of connectivity network, 58km of road structure is affecting at the time of flood, and this is high in Baliapal Block. The poor condition of Murom road is creating a major issue at the time of relief distribution system as well as the response phase during the event.

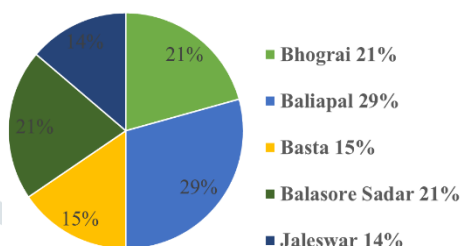


Fig-6 Showing the percentage of flood vulnerable infrastructure of different blocks of study area

C. There are total of 15,325 numbers of vulnerable household and Jaleswar having the maximum number between these 5 blocks.

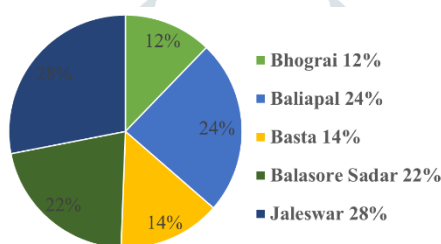


Fig-7 Showing the percentage of flood vulnerable household of different blocks of study area

### V. UNDERSTANDING THE LAND USE CHANGES AND THE DEPLETING CAPACITY OF THE STUDY AREA

The northern region of the district is where the main land use transformation is noticeable. In Balasore, change detection between 2001 and 2021 found that about 504.4 sq.km of agricultural land was converted to other land uses. Primarily for the 466.9 sq km of built-up area and the 34.5 sq. km of forest cover. It results in a percent increase in the forest area. Over a 20-year period, agricultural land decreased as built-up area increased. More than 70 percent of the area is covered by arable land, which is the main land use in this district. Rural Settlements, which occupy approximately 12.37 percent of the region, come next. Together, all of the forest land occupies about 9.94% of the total area. Water bodies, which take up around 2.51 percent of the area, and 1.9 percent of the study region's total geographic area is comprised of wetland and waterlogged areas.

### VI. IMPORTANCE OF STRUCTURAL AND NON-STRUCTURAL MEASURES IN FLOOD PREPAREDNESS PLAN

#### A. Structural measures

Physical structures may be built or renovated as part of structural flood mitigation to lessen the effects of flooding on specific properties or entire catchments. This can achieve through:

**Maintenance of existing infrastructure:** - To retain existing creeks and storm water drainage systems functioning hydraulically, maintenance is essential. For places vulnerable to flooding, creating and regularly evaluating a maintenance schedule can be quite advantageous during monsoon season.

**Individual flood proofing measures :-** It could be possible to prevent flood waters from entering residences if the inundation of flood water is quite modest (often less than 700mm) by installing solid fences, elevating windows, covering doors with "stop boards," and preventing sewage contamination with reflux or backflow valves.

**Improved access to traffic:-** Residents of flood-affected areas benefit from improved flood resilience of roadways because they may escape floods and have access to emergency services. Important access routes to vital facilities like hospitals and shelters for the homeless should have at least a Q100 flood protection.

#### B. Non-structural measures

Many sensitive sites cannot be adequately protected from flooding using simply structural measures; significant flood risk reduction through non-structural methods is highly required. By using administrative measures, loss or damage can be reduced. It has no influence over or control over the inundation process. This can be accomplished by using strategies like:

**Property inspections:** - To help property owners, insurers, and buyers understand the true effects of flooding on each property, detailed surveys of flood-affected homes can improve the accuracy of flood modelling.

**Planning for land use:** - The extent of flood-affected property will be identified through strategic land use planning, allowing for restrictions on the development of urban and rural residential, commercial, and industrial area. All new developments must conduct land appropriateness investigations to ascertain the extent of limited land, according to the NT Planning Scheme.

**Controls of development and construction:** - To provide some level of flood protection, current construction regulations mandate that habitable floor levels be constructed 300mm above Q100 year flood levels for new homes or significant modifications.

**Early warning systems:** - Early warning systems are crucial in flash flooding situations since many floods happen at night and residents need to be able to react to approaching flood levels. This can include moving parked cars, gathering valuables and pets, and putting personal emergency preparations into action.

**Create a household emergency plan:** - Every family must be ready for extreme weather, including flooding, regardless of any preventive measures.

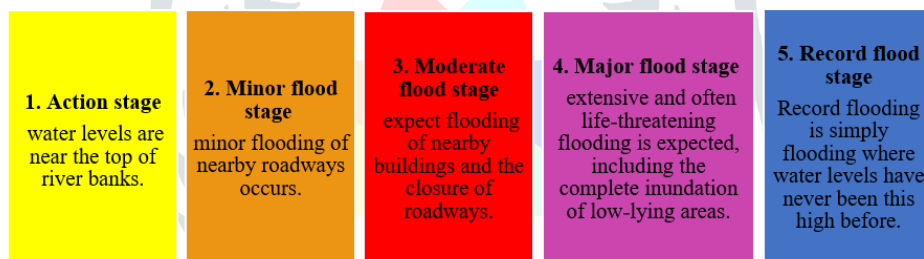
**Understanding and awareness:** - Your ability to react quickly to an oncoming flood depends on your knowledge of your area's flood history and your understanding of how floods behave there.

## VII. RISK EVALUATION AND THE MANAGEMENT PLAN FOR THE FLOOD PRONE AREA

### A. Understanding the different Stages of flood

Depending on its scale it can be categories into 5 stages.

1. When a river threatens to overflow its banks or when the tide begins to swell the shoreline, flooding in the action stage occurs. There is a little flooding in woody areas during this flood stage, but not much.
2. The following level is minor flooding, which is still a minimal flooding stage where usual building damage is negligible. This is the point at which the water usually starts to cover the roads.
3. The third stage of flooding is moderate stage flooding. At this point, damage to buildings begins to occur. There will be some evacuations as the roads become inaccessible.
4. The fourth stage of flooding is the most significant one; this is the point at which flooding starts to damage infrastructure and human life. Buildings are typically under water at this point, and the loss of life begins. Catastrophic flooding is the term used most often to describe this level.
5. The record-setting flooding stage is the final stage. It's critical to note that flooding can happen at any time, which is how we get to this position. Even when there is merely minor flooding, records can still be broken. Flooding that is considered to be a record occurs when water levels are exceptionally high.



### B. Issues identification

The study analysed the district's flood risk sensitivity and preparedness tactics in brief. Based on the analysis, there are several important issues that should be given top priority in order to strengthen the preparedness measures and reduce disaster-related losses.

1. Frequent flood events which causes mostly due to cyclone and heavy rainfall during monsoon.
2. Soil erosion along the river banks cause due to the lack of vegetation
3. Loss of life and livestock
4. Loss of agriculture land
5. Water clogging for more than 5 days
6. Damage roads in the rural areas causing obstacles during the relief process and evacuation process
7. Damage to the infrastructure
8. Water supply scarcity during the flood period.
9. People living in a temporary shelter / kutchha houses are more affected during flood.
10. Effective measures are not taken to minimize the detrimental effects of flood water on the agricultural land.
11. Lack of pucca houses in the low lying area.
12. Unawareness regarding the natural disaster.

## VIII. FLOOD MANAGEMENT CYCLE

The entire process of flood management can be finished in four stages, including

- Prevention and mitigation**, where efforts are made to lessen the impacts or danger connected with flooding. Which is happening as a result of setting goals, assessing risks, and developing strategies for reducing and preventing risks.
- In the second stage, **preparedness**, steps are taken to facilitate response and encourage readiness through emergency response tools, emergency teams, and drills, as well as emergency access and evacuation routes.
- And when there is a flood does the **response** stage begin, which is when emergency measures are implemented to save lives, property, and the environment. These include quick damage assessment, rescue, relief, and salvage as well as immediate damage protection. Restore and resume normal operation with the help of recovery & rehabilitation, treatment (restoration, retrofitting, and repair) and detail damage assessment.

D. Following the flood, **recovery & rehabilitation** phase start, treatment (restoration, retrofitting, and repair), and detail damage assessment are the steps taken to restore and resume regular functioning.

E. Continuity is the actions taken to protect the campus mission from disruption. It influences all four planning phases of Flood management.

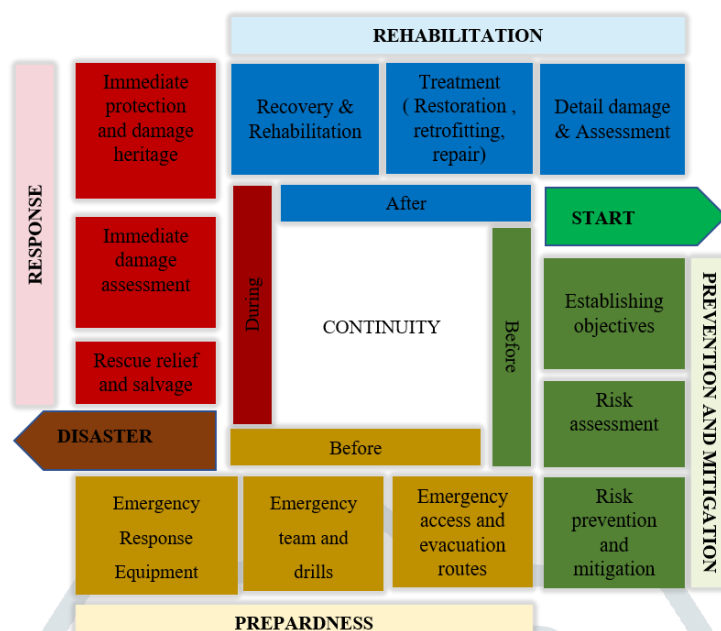


Fig-8 Showing the flood management cycle need to be follow

## IX. ROLES AND RESPONSIBILITIES AT DIFFERENT LEVELS

### A. District level

1. An emergency operations center to guarantee backup (power, fuel, internet, and communication at the district, department, and block levels.
2. Under the direction of Nodal officers, the response force ensures complete Evacuation (Human/Animal), conducts Search & Rescue, and clears relief lines.
3. The request for a car, boat, helicopter, and a list of state and federal support should be submitted by the collector to all relevant authorities.
4. To store necessary relief supplies, such as Chhuda (dry rice flakes), Gudd, and dry foods, at adjacent storage facilities.
5. The chief district veterinary officers will transport, store, and distribute the necessary animal feed to the affected districts.
6. With the aid of the revenue department, the Cyclone Shelter Committee and the Village Disaster Management Committee will set up free kitchens in the shelters.
7. Chief district medical officer and executive engineer-rural water supply and sanitation to assure availability of drinking water, disinfection of water, and maintenance of health and hygiene in the shelters.
8. The chief district medical officer will handle casualty management and first aid.
9. According to requirements, the collector must gather and transmit First Information Reports (FIR) and Daily Situation Reports.

### B. Municipal level

Improving the public awareness through

1. *Training and Community Involvement:* - Each community program begins with educational training to increase flood risk awareness and encourage individuals to do the necessary planning and precautions. Additional training should be given to those who have been identified as prospective champions so they can coach others. Based on a continual increase in public knowledge as well as an assessment of prior experience, it necessitates public participation.
2. *With the help of posters & banners:-* At neighborhood community centers or major road intersections, the use of warning boards and various illustrations may prove to be the most effective communication tool.
3. *Education:* - Children are especially at risk since they frequently have never experienced flooding. By bringing up the subject in class, teachers may encourage parents to open up to their children about their own experiences with floods. To offer the subject to pupils in the most relevant and engaging way possible, help from teachers should be enlisted.
4. *Multimedia and Newspaper:* - The public can be successfully informed about the possibility of flooding using traditional media like radio, television, and newspapers, which can also be used to distribute flood warnings. Raising awareness can be accomplished by handing out brochures to locals with advice on easy and doable steps they can take to safeguard their families and property.

### C. Community level

1. District emergency operation center to disseminate warning communication to Block emergency operation center & Community
2. Response force to ensure Power/Fuel/internet/ Communication at Shelters back up.
3. Supply Inspectors & Marketing Inspectors to distribute relief materials with response force, Task force & volunteers.
4. The distribution of aid, emergency relief operations, relief line clearance, and search and rescue actions are carried out by the response force.

5. First aid and casualty management, carcass disposal, and adequate mortuary facilities should be handled by doctors in the affected communities.
6. Under the overall direction and supervision of the OSDMA and District Administration, local organizations and voluntary organizations, including NGOs, shall actively participate in prevention and mitigation actions.
7. They should actively take part in any training exercises that may be planned and should get familiar with their responsibilities in disaster management.

## X. LAND USE REGULATION AND EMERGENCY RESPONSE PLANNING

- A. *Local social structure strengthening*: - It is possible to organize and train search and rescue teams locally, regionally, or nationally, but in actual flood conditions, the involvement of volunteers, residents, and relatives is significant, necessitating the development of coordination as the action takes place.
- B. *Hazard mapping and Evacuation plan*: - Flood hazard maps, which show flood-prone locations, escape routes, and safe havens, can be extremely useful in raising awareness. To safeguard the population before the flood, an evacuation route for the inundation zone must be determined.
- C. *Institutional strengthening*: - Most of the government schools in the study region serve as emergency shelters during floods, preventing them from being used as classrooms. The disruption of the educational system caused by this activity to the infrastructure and schools is common. Therefore, there should be a focus on enhancing the educational system by offering more emergency refuge. In place of school facilities, emergency shelters should be located in community centers, godowns, and other public buildings.
- D. *Change in the land use pattern*: - To boost the soil's ability to absorb water, building activity in sensitive places can be curtailed, and parks, playgrounds, and gardens can be built there.
- E. *Provision of green belts*: - The areas on either side of the drains should be declared as green belts in both rural and urban areas, and no new construction should be allowed there.
- F. *Restricting indiscriminate development in unprotected hazard prone area*: - Recognizing the protected and unprotected areas that are risky. All buildings' plinth levels ought to be 0.6 m above drainage or flood submersion lines. There will always be a stairway to the roofs of single-story buildings so that people can go there for short-term shelter.
- G. *Reuse of water (with help of Sponge city concept)*: - By adding a recharge pit to every home, rainwater can be used to raise the level of the groundwater. It can also be cleaned and used again for various household requirements. It can be utilized in gardening and for agricultural purposes.
- H. *Infrastructure relocation*: - Existing infrastructure, such as electricity substations and power plants, should be moved to a higher elevation away from flood-prone areas. Pumping stations and tube wells used to supply drinking water should be elevated above high flood levels. Any building that obstructs already-existing natural drainage pathways needs to be taken down or moved right away.
- I. *Emergency spillways*: - The breaching section, often known as an emergency spillway, is a feature of a rock-fill or earthen dam. It is meant to get rid of extra floodwater beyond the intended flood. The emergency spillway is not necessary to operate in a reservoir under typical reservoir conditions.
- J. *Using sand bags*: - Sandbags are a cheap and efficient approach to stop or lessen flood water damage. Sandbags that have been filled and put correctly can serve as a barrier to direct flowing water around structures rather than through them.
- K. *Land filling*: - To lessen the risk of flooding in the filled region, earthen fill is occasionally applied in Special Flood Hazard Areas (SFHA).
- L. *Elevating structures*: - The best defense against flood damage, short of moving the home to a less vulnerable place, is elevation. Raising a structure's base through retrofitting can protect it from rising storm surge and flooding, which lowers the risk of damage.

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