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Flood Risk Management: Suggested Policy and Advocacy Interventions

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Resilient India - Disaster Free India

National Institute of Disaster Management
(Ministry of Home Affairs, Government of India)



Flood Risk Management: Suggested Policy and Advocacy Interventions



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Plot No.15, Pocket 3, Block-B, Sector-29, Rohini, Delhi-110042
Website: https://nidm.gov.in

Flood Risk Management:
Suggested Policy and Advocacy Interventions

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Authors

Prof. Surya Parkash

Dr. Harjeet Kaur

Mr. Pranav Dhavan

Major General Manoj Kumar Bindal, VSM

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ताज हसन, भा. पु. से.
कार्यकारी निदेशक

Taj Hassan, IPS
Executive Director

सत्यमेव जयते
आज़ादी का अमृत महोत्सव

राष्ट्रीय आपदा प्रबंधन संस्थान
National Institute of Disaster Management
(गृह मंत्रालय, भारत सरकार)
Ministry of Home Affairs, Govt. of India
प्लॉट नं. 15, ब्लॉक बी, पॉकेट 3,
सेक्टर 29, रोहिणी, दिल्ली – 110042
Plot No. 15, Block B, Pocket 3,
Sector 29, Rohini, Delhi-110042



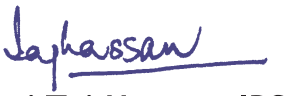
Foreword

Floods have become a recurring disaster in India which causes loss not only to our lives but also to properties, livihoods, infrastructure as well as public utilities among other things. On an average every year more than 1600 people lose their lives, 32 million people are affected and more than 7 million hectares are affected due to floods in the sub-continent. The Government of India has set up various task forces, committees, working groups and formulated policies and guidelines for flood management in the country.

At present, in the country, there exists a fragmented approach towards flood management. This document suggests a new framework for flood management in India. It is suggested for the formation of an Integrated Reservoirs, Dams and River Basin Management Authority (IRDRBMA) under the aegis of Ministry of Home Affairs having a multitude of authorities working in co-ordination for an integrated approach to flood management in India. A multi-stakeholder approach for integrated flood management is suggested which will include all relevant departments at the national, state, district and municipal levels be part of the stakeholder group devising flood management strategies and take part in flood management planning. Each stakeholder has different perceptions of risk, and various community members and groups have different vulnerabilities and capacities. It should not only include government departments but also flood prone communities, upstream and downstream communities, scientific institutions, NGOs, private sectors, etc.

This document also proposes an action plan for flood risk and disaster management for reservoir, dam and basin which includes establishing of an Integrated Reservoir, Dam and River Basin Management Authority which will perform an assessment of flood risk at the national and state level. After a successful assessment, a flood management plan will be developed and adopted. Necessary projects and schemes will be put in place after due consideration to the existing town plans, disaster management plans, local environment policies etc. The IRDRBMA will play an integral role at every step of flood risk management from the pre-flood phase to the post flood phase situations.

I express my deep appreciation to Prof. Surya Parkash, Head GMR Division and his team for preparing this document.



Shri Taj Hassan, IPS

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Prof. Surya Parkash
Head GMR Division, NIDM

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Abbreviations

CAG - Comptroller and Auditor General of India

CWC – Central Water Commission

DMP - Disaster Management plan

EAP - Emergency action plan

FEWS - Flood Early Warning Systems

IMD - India Meteorological Department

IRDRBMA - Integrated Reservoirs, Dams and River Basin Management Authority

NDMA - National Disaster Management Authority

NDRF - National Disaster Response Force

NGO - Non-Governmental Organization

NIDM - National Institute of Disaster Management

NWP –National Water Policy

PHE – Public Health Engineering Department

PWD - Public Works Department

SDMA- State Disaster Management Authority

SDRF- State Disaster Response Force

SIDM- State Institute of Disaster Management

WMO - World Meteorological Organization

1. Introduction

Devastation by floods is a recurrent annual phenomenon in India, affecting one or more areas in the country causing loss of lives and public property. As per the information published by various governmental agencies, the tangible and intangible losses are increasing in India

As per CWC, 2020 more than 1650 people lost their lives, 32 million people were affected and more than 7 million hectares were affected due to floods annually between 1953 - 2018 on an average. The total damages within the sub-continent of India can be seen in Annexure A - Flood damages due to floods/heavy rains during 1953-2018 in India. This can be attributed to many factors such as high intensity rainfall in short duration, reduced channel capacity, reduced natural drainage in flood prone areas, inadequate drainage, faulty reservoir regulations, failure of flood control structures, encroachment of flood plain, and other aspects.

As per the working group on Flood Control Management Programme for the Xl Five Year Plan (2007-2012), the total flood prone area in India was 45.64 million hectares (m ha), which is approximately 14% of the total area of the country. (Comptroller and Auditor General of India, 2017). A considerable portion of the total flood prone area has already been provided with protection against floods of low to moderate return probabilities. Making the flood prone areas protected against all return probabilities. of floods is neither economically viable nor practically possible. Such an exercise would involve stupendously high cost for construction and maintenance. In order to provide a reasonable degree of protection against flood damages, a pragmatic approach is needed through a combination of structural and non-structural measures. The structural measures include building storages/reservoirs across the rivers, protective embankments along the river banks, channelization of rivers, drainage improvement, diversion of flood waters, watershed management etc. The non-structural measures include bio-engineering based bank protection measures, vulnerability linked relocation, flood forecasting, flood plain zoning, restrictive land use legislations and policies in flood plains and awareness building among others.

The Government of India has also set up various committees, task forces, working group and formulated policies and guidelines for flood management to reduce the impact of the floods and its potential consequences and as per the local conditions and nature of problems, the states have adopted different methods of flood protection/mitigation.

2. Present policies and framework for flood management in India

The subject of flood control, unlike irrigation, does not figure as such in any of the three legislative lists included in the Constitution of India. However, drainage and embankments are two of the measures specifically mentioned in Entry 17 of List II (State List), reproduced below"

"Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provision of entry 56 of List I (Union List)."

Entry 56 of List I (Union List) reads as follows:

"Regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest."

It may be seen that the key responsibility of flood control lies with the States. A number of States have already enacted laws with provisions to deal with matters connected with flood control works. However, there exists a significant provision that the powers to be exercised are subject to Entry 56 of Union List.

The flood management schemes are planned, investigated and implemented by the State Governments with own resources as per priority within the State. The Union Government renders technical assistance and promotes financial assistance to States in this regard The Ministry of Jal Shakti is the primary authority which is responsible for laying down policy guidelines and programmes for the development of water resources of the country. The ministry is also responsible for the operation of the central network for flood forecasting and warning system in inter-state rivers, provision of assistance of state schemes apart from technical guidance and conducting scrutiny, clearance and monitoring of the irrigation, flood control and multi-purpose projects (major/medium). (Comptroller and Auditor General of India (CAG), 2017; NDMP, 2019)

2.1 Policies

2.1.1 National Water Policy, 2012

The National Water Policy (NWP) (attached in Annexure B - National Water Policy, 2012) was formulated to govern the planning and development of water resources and their optimum utilization. The first NWP was adopted in 1987. It was reviewed and updated in 2002 and later in 2012. (National Disaster Management Authority, 2019) A revision of the policy document has been envisaged and a drafting committee has been constituted on 5th November 2019. (Press Information Bureau, New Delhi)

Section 10 of the NWP "Management of Flood and Drought" highlights the key point w.r.t floods which are mentioned below.

10.1 While every effort should be made to avert water related disasters like floods and droughts, through structural and non-structural measures, emphasis should be on preparedness for flood/drought with coping mechanisms as an option. Greater emphasis should be placed on rehabilitation of natural drainage system.

10.2 Land, soil, energy and water management with scientific inputs from local, research and scientific institutions should be used to evolve different agricultural strategies and improve soil and water productivity to manage droughts. Integrated farming systems and non-agricultural developments may also be considered for livelihood support and poverty alleviation.

10.3 In order to prevent loss of land eroded by the river, which causes permanent loss, revetments, spurs, embankments, etc., should be planned, executed, monitored and maintained on the basis of morphological studies. This will become increasingly more important, since climate change is likely to increase the rainfall intensity, and hence, soil erosion.

10.4 Flood forecasting is very important for flood preparedness and should be expanded extensively across the country and modernized using real time data acquisition system and linked to forecasting models. Efforts should be towards developing physical models for various basin sections, which should be linked to each other and to medium range weather forecasts to enhance lead time.

10.5 Operating procedures for reservoirs should be evolved and implemented in such a manner to have flood cushion and to reduce trapping of sediment during flood season. These procedures should be based on sound decision support system.

10.6 Protecting all areas prone to floods and droughts may not be pragmatic; hence, methods for coping with floods and droughts have to be encouraged.

Frequency based flood inundation maps should be prepared to evolve coping strategies, including preparedness to supply safe water during and immediately after flood events. Communities need to be involved in preparing an action plan for dealing with the flood/ drought situations.

10.7 To increase preparedness for sudden and unexpected flood related disasters, dam/embankment break studies, as also preparation and periodic updating of of emergency action plans with Standard Operating Procedures to be followed by dam owners, citizens and civil authorities should be evolved after involving affected communities. In hilly reaches, glacial lake outburst flood and landslide dam break floods studies with periodic monitoring along with instrumentation, etc., should be carried out.

2.2 Present Framework for flood management in India

The present framework for flood management in India has been described below

2.2.1 Pre-floods

A central flood control room is set up in Central Water Commission (CWC) which received meteorological and hydrological data from India Meteorological Department (IMD), CWC and state Departments. The control room operations starting from 1st May for North East region of India to 1st June for rest of India and remain operational till end of flood season, which is 31st October for regions experiencing South West monsoon spells and 31st December for regions experiencing North East monsoon spells. By using this data, flood warnings are issued for various flood forecasting sites. This flood warning is sent through SMS, Telephone, Wireless, Radio, TV, Email etc. based on which necessary evacuation steps are taken by the district authorities.

Before the onset of monsoon season, necessary pre-flood checks are done at district level by authorities which includes dam operations, safety check of dam structures, maintenance requirements of dams, dam gates, valves etc but not limited to

a. Database of resources present within the district/state
b. Checking all warning and communication systems are working
c. Conducting mock-drills
d. Status report of preparedness and mitigation activities
e. Preparation of response plan
f. Repair/maintenance of structural measures to cope with flooding
g. Design, Operation & Maintenance of flood defences and drainage system
h. Collection of household information for compensation verification

In addition to the above, capacity building of officials is done by National Institute of Disaster Management (NIDM), National Disaster Management Authority (NDMA), State Institute of Disaster Management (SIDM), State Disaster Management Authority (SDMA) etc.

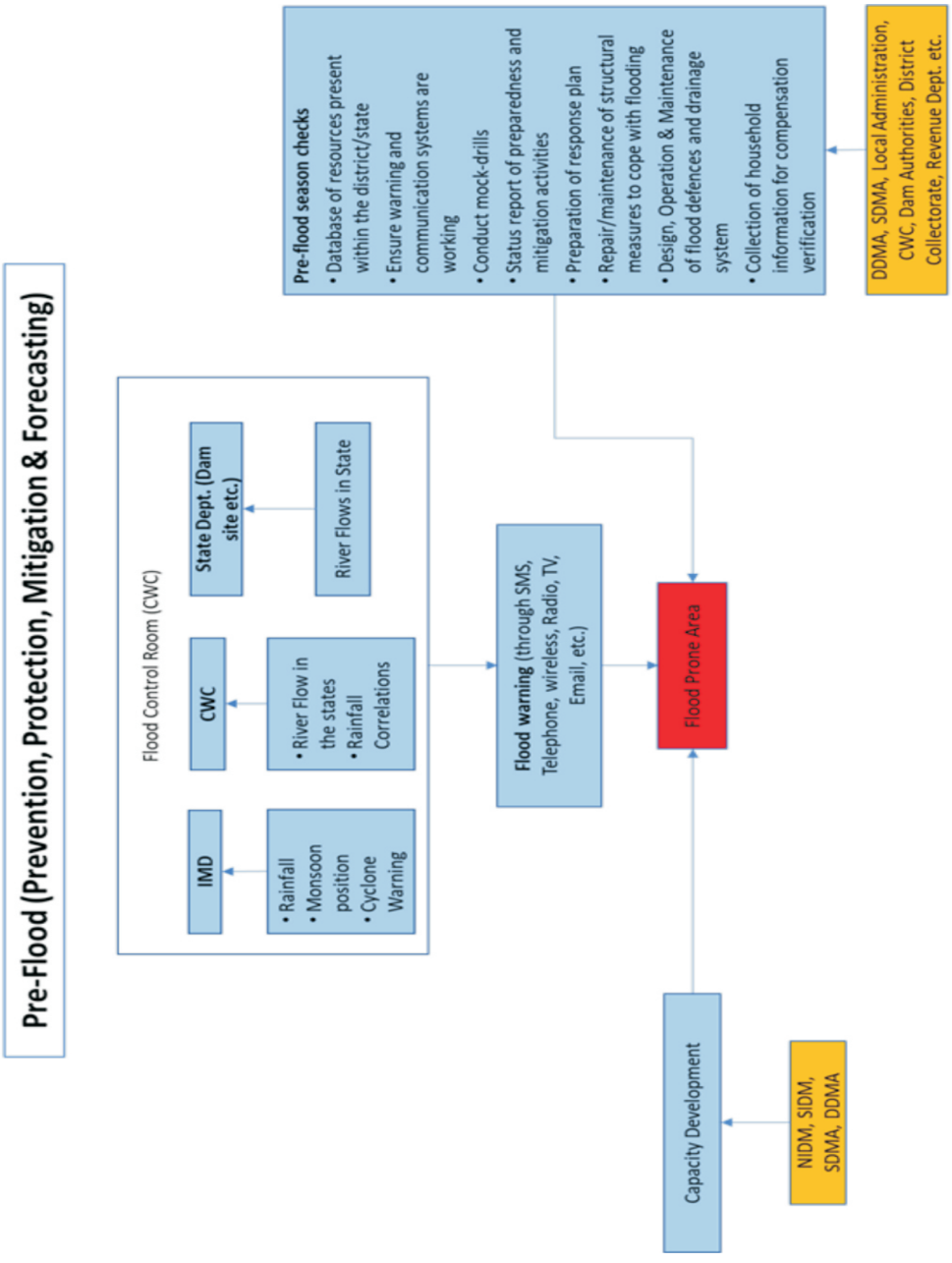


Figure 1: Present Pre-Flood Framework for Flood Management in India

2.2.2 During floods

At present, information is gathered by the State and District Emergency Operations Centre through IMD and CWC observation stations. Some states also utilize data from Private Weather Services and Citizen Science initiatives. The information is then shared through updating of Flood Forecasting Website/ FAX/ Email/Telephone/ SMS. In CWC, Flood forecasting comprises Level Forecasting and Inflow Forecasting. The forecasts are issued once the water level in a river touches predefined warning level (usually one meter below the danger level but dependent on threat perception of the particular location). Inflow Forecasting is used by various reservoir/dam authorities in optimum operation of reservoirs for safe passage of flood downstream as well as to ensure adequate storage in the reservoirs for meeting the demand during the non-monsoon period. The forecasts are shared with the relevant stakeholders, State Emergency Operations Centres and District Emergency Operations Centres for necessary evacuation of the area depending on the threat level and requirement as deemed appropriate by Local Self Governments and DDMAs (Central Water Commission, 2020)

After approval from the DDMA in consultation with the Local Self Governments where ever necessary based on the threat level, the water is released from the dam. Evacuation, relief, rescue and rehabilitation is done by district and local authorities, SDMA/State Disaster Response Force (SDRF), NDMA/National Disaster Response Force (NDRF) and if required by the armed forces.

During a heavy rainfall event while the reservoir is at full capacity, the entire quantum of excess water is released from the dam to the downstream areas by opening the gates of the dam. This increases the inflow for the dam downstream and leads to flooding in the areas. This is particularly the case for reservoirs having no provision of level or inflow forecasting.

A typical notification chart for dissemination of flood forecast by CWC Control Room has been attached in Annexure C-Notification chart for dissemination of flood forecast by CWC Control Rooms.

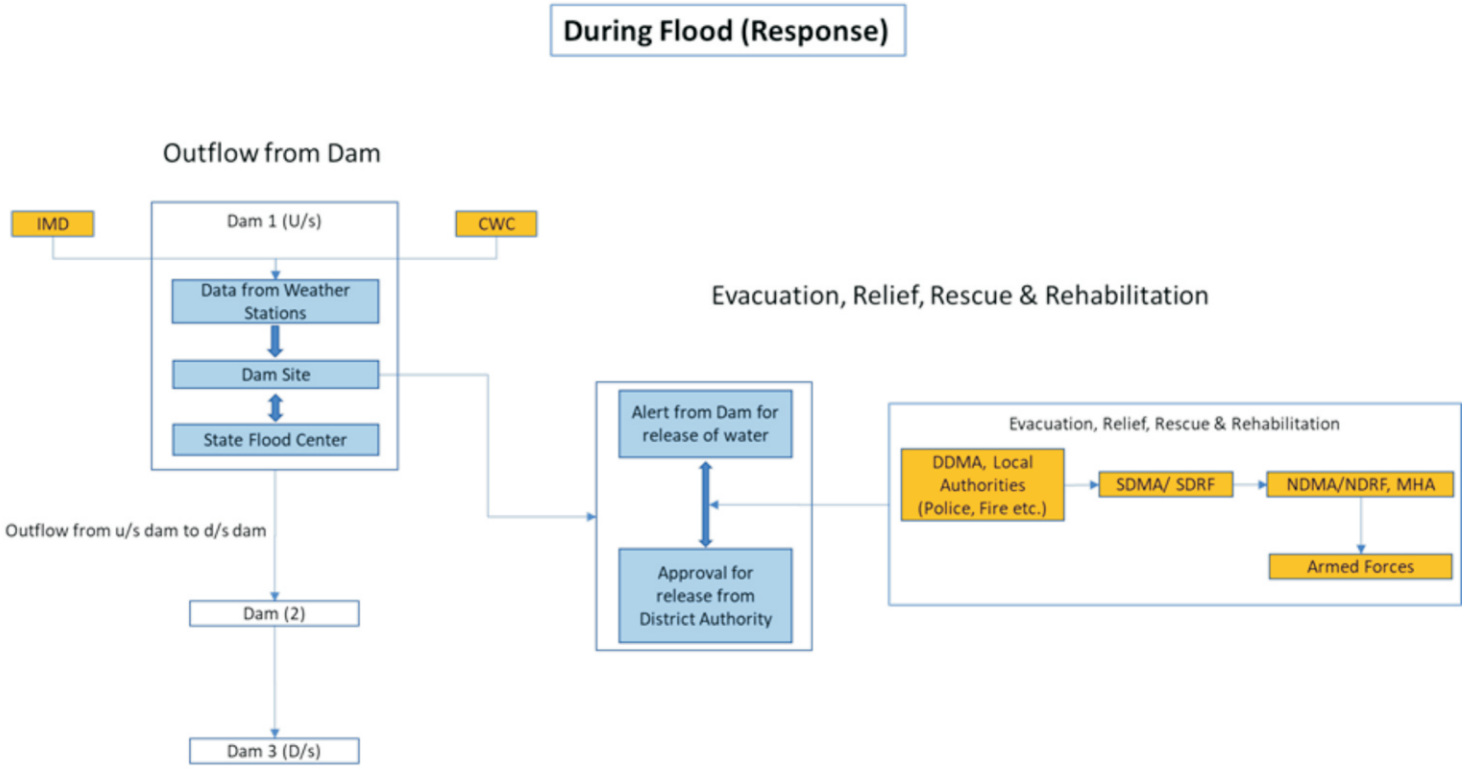


Figure 2: Present During-Flood Framework for Flood Management in India

2.2.3 Post Floods

Assessment of damage is done by the Local Self Governments, Agriculture Department, Land Revenue Department, Animal Husbandry Department, Public Works Department, Electricity Department, Irrigation Department etc. depending on the sector of damage. The damages are compiled by DDMAs at the district level and KSDMA at the State level based on the authenticated reports of the concerned Heads of Departments. department which includes loss of lives (humans and animals); damage and loss to property such as agriculture, plantations, houses, boats etc., infrastructure damage including roads, water supply, electricity, telecommunication etc. After a comprehensivevaluation of the damages, rehabilitation and restoration of villages and affected communities is done by their respective authorities such as Local Self Governments; Public Works Department (PWD), Public Health Engineering Department (PHE), Telecommunication, Power etc. at the local level.

Additional Relief from the state/central government is requested if the damages are higher that the capacities of the district authorities.

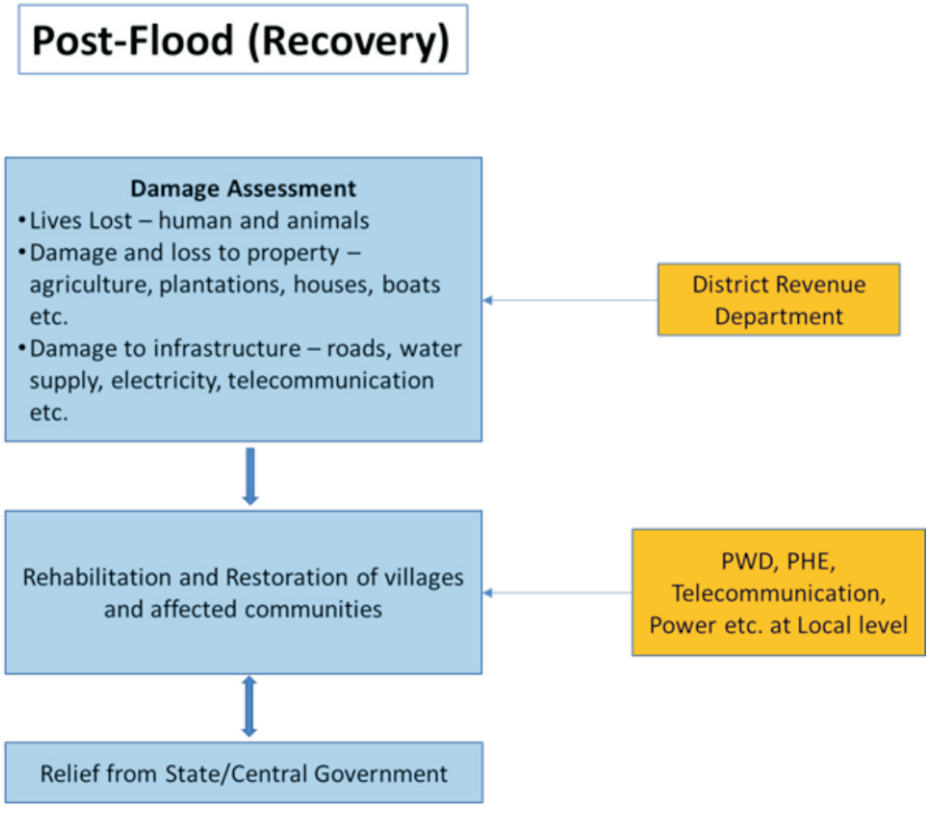


Figure 3: Present Post-Flood Framework for Flood Management in India

3. Measures for Flood Management

As per the Guidance document by World Meteorological Organization (WMO) on "Selecting Measures and Designing Strategies for Integrated Flood Management", effective and integrated flood management can be measured by a number of ways for example:

- Structural vs non-structural;
- Strategy (resistance - resilience - adaptation)[1];
- Engineering vs Nature based Solutions;
- Source to pathway to receptor (SPR).

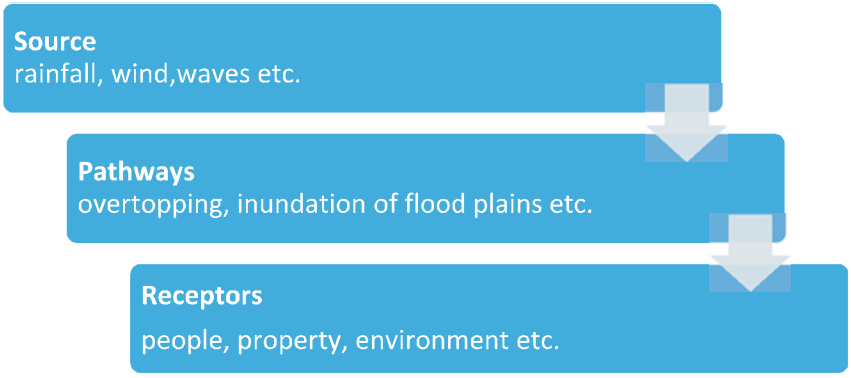


Figure 4: Chain from flood hazard to flood impact; (Source: WMO, 2017)

The cascade can be elaborated in a number of guiding principles for categories of measures:

a. Reduce the flood hazard;
b. Protect against floods (flood control);
c. Regulate/adapt land use;
d. Raise awareness/preparedness;
e. Mitigate residual risk.

[1]The flood resistance keeps out flood water to prevent flood damages by strategies like windows and doors to be closed, while flood resilience minimizes the impacts of floods once flooding occurs by management of ingressing flood waters - diverting them away from where they would cause the most damage. Adaptation to rising flood risk requires a diversified approach of interventions, which may include structural flood protection measures, early warning systems, risk-informed land planning, nature-based solutions, social protection and risk financing instruments

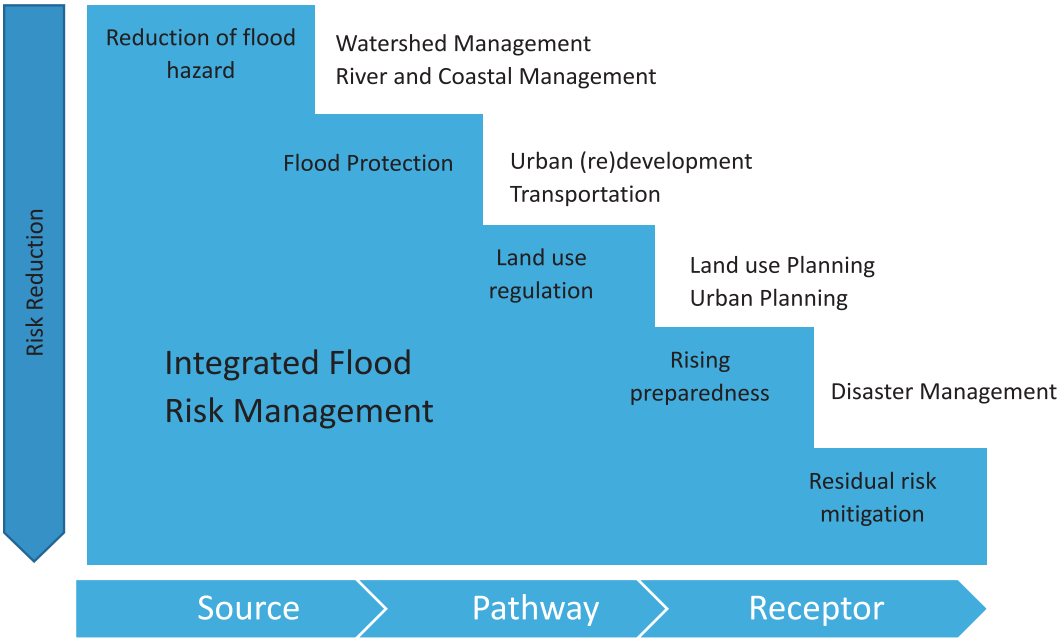


Figure 5: Cascade with potential integrated flood management measures and associated policy and management fields; (Source: WMO, 2017)

3.1 Reduction in Floods

The hazard of floods in rivers can be decreased by measures in the watershed area reducing the peak runoff and measures in the river itself reducing the peak discharge or flood levels.

3.1.1 Reduction of peak runoff

Vegetative cover can have a mitigating outcome on the impact of heavy rains in catchments and urban areas. Roots strengthen the soil and improve soil texture, which increases both infiltration rates and water-retention capacity.Floods can be aggravated by human activities such as deforestation, over-grazing, removal of wetlands etc. leading to quicker runoff from the steep hilly slopes resulting in flash floods as well as landslides.

Measures, such as increasing natural water retention, afforestation, reforestation and wetland reconstruction and protection can help reduce the peak runoff discharge.

NWP 2012 focusses on integrated watershed development activities with groundwater perspectives as well as irrigation. However, the need for afforestation and reforestation which will ultimately help in reducing peak runoff is still not mentioned as a way to reduce runoff from hilly catchments thus reducing floods and landslides.

3.1.2 Regulation of river flow

Peak river flows may be regulated/reduced by storing the water temporarily in reservoirs or by diverting to detention schemes.The engineering measures by which relief can be brought to the flood prone areas thereby reducing flood flows and the flood levels are

a. an artificial generated reservoir behind a dam across a river.

b. a natural depression suitably improved and regulated, if necessary or

c. by diverting a part of the peak flow to another river or basin where appreciable damage would not be caused

d. by constructing a channel parallel to the main channel by-passing a particular town/reach of the river which is prone to flooding.

The ability to reduce flood peaks depends upon the capacity and operation of the infrastructure. Reservoirs were primarily developed for irrigation, water supply and hydropower generation. To this end, they ought to be full at the beginning of the dry season. For optimal hydropower generation, it is also required that a reservoir is as full as possible. For flood-control purposes, however, the reservoir should be as empty as possible to have sufficient storage to manage peak flows. Timely release of water from dams/into detention schemes is crucial to make optimal use of storage. Reservoirs, with an appropriate operational plan and rule curves based on historical data of inflows and incorporating climate change scenarios, may provide a specific, quantifiable reduction in flood hazard.

NWP 2012 discusses increasing water storage through ponds as well as small and large reservoirs. It also discusses the need to evolve operational manuals of reservoirs to have a flood cushion and to reduce trapping of sediments during flood season.

3.1.3 Enhancement of river-flow conveyance

Rivers have been important carriers of economic development. Infrastructure has been built along the river as well as in the floodplain to support navigation and other economic activities. Bridges, piers, groynes and other such infrastructure, may create obstructions to stream flow, thereby raising the water level. Another factor hampering a smooth discharge of river water is the human settlements at the river front or encroaching into the floodway which may create bottlenecks thus creating backwater effects, i.e. water level increases upstream of the bottleneck. By making "room for the river", i.e. through smart river training and management works, significant improvements in flow conveyance can be achieved which may reduce water levels in specific reaches of the river (e.g. urban centres along the river). It may include various

channel improvements such as widening the channel, removing or altering obstructions that hinder the free flow of water and raising and/or widening of bridges and barriers that prevent free flow, as well as deepening the channel through dredging. Due consideration should be given to the impacts of such measures on downstream communities.

Another way of enhancing flow conveyance is through diversion of part of the flood waves by building by-pass channels and floodways. By using by-pass systems such as tunnels, open channels and/or green rivers (rivers that only convey water during flooding), excess floodwaters can be diverted from the main river system

Although encroachment has been discussed however, NWP 2012 discusses "Conservation of rivers, river corridors, water bodies and infrastructure should be undertaken in a scientifically planned manner through community participation. The storage capacities of water bodies and water courses and/or associated wetlands, the flood plains, ecological buffer and areas required for specific aesthetic recreational and/or social needs may be managed to the extent possible in an integrated manner to balance the flooding, environment and social issues as per prevalent laws through planned development of urban areas, in particular."

3.1.4 Dissipation of energy for coastal floods and coastline stabilization

Reduction of high waves is especially important in coastal environments, where storm surges and tsunamis are among the most destructive forces of nature. Coastal ecosystems, such as mangroves, coral reefs, seagrass beds and saltmarshes, can physically exert an effect on waves. They cause a hydraulic resistance that can break the waves and reduce their velocity, thereby reducing their energy. Mangroves can significantly reduce the energy of huge waves which are in the form of storm surges which are generally accompanied by cyclonic depressions. Coastal vegetation also plays a significant role in mitigating coastal erosion and promoting sediment deposition. With rising sea levels, mangroves and salt marshes are especially capable to grow with it.

NWP 2012 acknowledges that climate change may increase sea levels thereby increasing inundation in coastal regions. However, it does not mention ways to deal with it.

3.2 Protection against floods

3.2.1 Embankments and other structures for riverine floods

Many flat, lowland and deltaic rivers are embanked in order to protect agriculturaland urban areas from flooding. Protection of an entire area by building embankments,

levees or dykes has been and is being practiced in many flood-prone areas. The safeguarding of an entire area is dependent on proper functioning of protection systems. There is also the need for flood early warning systems to allow for emergency measures and evacuation, if the water level is expected to approach or exceed the design water-level of these systems. Furthermore, the construction of embankments along a river generally results in higher riverwater levels during high discharges in both the embanked area of the river, as well as upstream, simply due to non- expansion of water laterally as the embankments act as a constriction.

NWP, 2012 discusses planning, executing, monitoring and maintaining of revetment, spurs, embankments as a way to prevent loss of land eroded by the river.

3.2.2 Dykes, dunes and storm surge barriers for coastal floods

Engineering solutions such as groynes, detached breakwaters and artificial reefs are built to significantly reduce coastal beach erosion and to maintain a minimal beach for recreation.

Coastal floods may inundate areas by propagating inland through tidal rivers and estuaries. It is important to protect the areas along rivers and estuaries against such floods which may require raising and strengthening of embankments over considerable lengths. In such cases, an effective strategy is to shorten the length of the coastline by closing off the river mouth from the sea – temporarily or permanently – with a storm surge barrier, dam etc. Such structures will help in preventing extreme surge levels to propagate land inward.

NWP 2012 does not discuss the technological solutions for coastal floods. Itdiscusses planning and management of water infrastructures such as tidal embankments should incorporate coping strategies for climate change.

3.3 Regulation/adaptation of land use

Due to growing population pressure, urbanization and marginalization, as well as unregulated development, more people are living in hazardous places. Zoning regulations aim to monitor and tune the land use to the flood hazard and to keep the most hazardous places, i.e. the floodway, uninhabited. In less hazardous areas of the floodplain, certain uses of land can be allowed with prescribed or restricted use conditions e.g. parks, golf courses, cropland etc.

NWP 2012 focusses on avoidance of encroachment of water bodies and drainage channels which must be reversed and restored. It also agrees to the fact that due to changing land use as a result of change in characteristics of catchment areas of streams, rivers and recharge zones of aquifers which is affecting the water quantity

and quality. However, it does not mention flood plain zoning as a measure to reduce the effects of flooding in the country

Using satellite imageries, National Remote Sensing Centre (NRSC)/Indian Space Research Organisation and peer reviewed by NDMA, CWC, IMD and Bihar State Disaster Management Authority, flood zonation maps at district levels have been developed for the state of Bihar (based on data from 1998 – 2010) and NRSC in association with Assam State Disaster Management Authority for the state of Assam (based on data from 1998 – 2015) at present which can be seen in Annexure D – Flood Hazard Maps. Kerala State Disaster Management Authority (KSDMA) has legally implemented flood hazard zone informed landuse regulations from 2016 based on flood hazard susceptibility maps prepared using satellite images, topographic sheets and field survey. The map has been included at a Taluk level in the State Disaster Management Plan and is upheld by Hon'ble High Court of Kerala based on which amendments have been brought to the Kerala Municipal and Panchayath Building Rules. The maps were prepared by National Centre for Earth Science Studies. Further, in 2020, KSDMA has prepared and published the 1 in 10 years to 1 in 500 return probability flood inundation maps. Further, KSDMA has also prepared and published the flood inundation maps of 1 in 10 to 1 in 500 year return probability based on the RCP 8.5 climate change scenario. The initiative was funded by UNEP and technically supported by CIMA Foundation, Italy. The flood hazard zonation maps for the states of Odisha, West Bengal and Uttar Pradesh are in progress and the flood hazard maps are still to be prepared for the other states.

3.4 Raising of awareness/preparedness

Flood early warning can provide sufficient lead time to put in place temporary or emergency measures which can be taken prior to the arrival of flood events to reduce the risk of loss of life and damage by means of minimizing exposure to flooding. Such emergency measures relymainly on timely information on when and where the flood will come, the extent of flooding area, duration of the event etc. For this purpose, Flood Early Warning Systems (FEWS) are required. When forecasted water levelexceedsthe design water level, warnings should be sufficiently clear on how much time people will have to evacuate the area at risk.

Emergency action plans (EAP)/Disaster Management plans (DMP) should be known to the population at risk prior to the event as part of preparedness measures and are of equal importance as the warning system itself. These plans aim to define the actions and roles necessary to prepare for and respond to disaster situation viz., Issue of Flood Forecast to Flood Affected Areas, Preparation of EAP for Dams and reservoir as per the requirement of dam operatorsetc.

While FEWSs provides information about "when" the flooding will take place, flood-risk maps informs about "where" the flood will impact. They also comprise important input for emergency management, i.e. for planning the response to the flood event.

Besides an effective flood-warning system and action plans, community preparedness includes community disaster management programmes to increase their resilience. Local or regional disaster-management committees are essential to assist communities to prepare themselves before, during and after flood events.

NWP 2012 discusses flood forecasting measure for flood preparedness which should be expanded extensively across the country and modernized using real time data acquisition system and linked to forecasting models. It mentions preparation and periodic updating of DMPs and EAPs after involving affected communities to increase preparedness for sudden and unexpected flooding situations.

Another observation by CAG was that the flood forecasting data which was used in formulation of flood forecast was done only after comparing the telemetry data with manually observed data; and in case of a mismatch between the two sets of data, manual data was approved.

A number of states have also developed District Disaster Management Plans. For e.g. Haryana has developed a detailed flood control order for most of its districts which includes a list of trained officers, inventory of flood relief equipment and route diversions in case of flooding. (Annexure E –Flood Control Order for the district of Gurugram) (Flood Control Order 2020 | Haryana State Disaster Management Authority (HSDMA), Government of Haryana, India, n.d.)

However, as per the report submitted by CAG, 2017, out of 4,862 large dams, EAP/DMPs of only 349 large dams (seven per cent) were prepared as of March 2016 however, preparation of action plans to implement EAPs w.r.t these 349 dams was still under process. As of March 2016, mock drill in respect of only one dam was conducted.

For flood frequency-based inundation mapping, NWP 2012 stresses upon it in order to evolve coping strategies.

a. Himachal Pradesh: Out of 19 large dams in the State, inundation maps were prepared only for two dams.

b. Kerala: No dam-break analysis was conducted in respect of any of the 61 dams in the State.

3.5 Mitigation of Residual Risk

Once it is known that a flood will occur - or is in the process of occurring – emergency

measures can be taken to help mitigate its impacts. Effective and efficient emergency response is based on adequate flood preparedness. Such activities include planning for various emergency flood scenarios, simulation exercises, demonstrations and drills, as well as training and education in specific skills. Good coordination and management of organizations and activities are essential for containing the flood disaster and minimizing loss of life and injury during and after the event. Specific activities can also be planned to quick-start economic recovery through assistance and stimulus measures for businesses. Flood recovery plans are important to enable people to take up their lives again more quickly after the flood. Recovery and rehabilitation is a process that aims to restore public services and create conditions for socioeconomic activities and should aim at increasing the resilience of communities. Recovery provides opportunities to integrate risk reduction and preparedness measures into development planning. Such measures will help to reduce the impacts of future flood events such as build back better. Recovery also provides opportunities for institutional strengthening of disaster risk-management activities. The financial burden of flood impacts may be relieved somewhat by relief funds and flood insurance. Many countries have some or the other form of flood insurance coverage, which differs widely as per their treatment of risks. If residents in flood-risk areas expect the government to compensate them for their flood disaster loss, they will not be inclined to buy flood insurance. However, if governments are constantly making flood-related loss payments, it would be worthwhile for the governments to consider taking proactive measures to reduce exposure of their citizens to risk.

NWP 2012 mentions in its section 15, the research and training needs in the water sector. However, it does not discuss flood insurance as a means to reduce the financial burden both on the government and the population at risk.

4. Suggested Framework and Policy and Advocacy Interventions for Flood Risk Management in India

Detailed discussions with the stakeholders from the Department of Water Resources, Ministry of Jal Shakti, Institutions in the field of policy formulation, were done after which the framework and policy and advocacy interventions for flood risk management is suggested.

Need for an Integrated Reservoirs, Dams and River Basin Management Authority (IRDRBMA)

It is being suggested for the formation of an Integrated Reservoirs, Dams and River Basin Management Authority (IRDRBMA) under the aegis of Ministry of Home Affairs having a multitude of authorities working in coordination for an integrated approach to flood management in India including but not limited to the Central Government Departments, State Government Departments, District Level Administrations, Scientific Institutions, NGOs etc.

The role of IRDRBMA is to promote and operate schemes for irrigation, water supply management, drainage; generation, transmission and distribution of power within the basin and sub-basin as well as inter-basin transfer; flood control in the main river and its tributaries and distributaries; soil conservation; overall development of water resources. IRDRBMA will play an integral role which is at every step of flood risk management from the pre-flood phase to during the flood situation to post flood times.

The issue of setting up of River Basin Authorities has been under discussion for quite some time. However, action in this regard is yet to be taken, both by Central as well as State Governments. Integrated water resources management including integrated flood management can be better addressed with collaborative efforts of all the concerned States/agencies. While tackling floods in a large basin like Ganga, it is not just managing the river flows. It encompasses other associated aspects like river channelization, sediment management, watershed management, reservoir regulation etc. in upstream States wherein the focused cooperation and synergy among the riparian States is very vital.

Multi-stakeholder involvement for integrated flood management

Development activities carried out by various government agencies have an effect on flood risks within a basin. It is, therefore, important that all relevant departments at the national, state, district and municipal levels be part of the stakeholder group devising flood management strategies and take part in flood management planning. For successful public participation in integrated flood management, it is crucial to carefully identify all relevant stakeholders at the very beginning of the planning process. Each stakeholder has different perceptions of risk, and various community members and groups have different vulnerabilities and capacities, which are determined by age, gender, class, source of livelihoods, ethnicity, language, religion and physical location. Stakeholders can be divided into seven groups:

Government ministries, departments and agencies

Governments have the prime responsibility of ensuring the safety and well-being of its citizens. It is, therefore, important that all relevant departments at the national, state, district and municipal levels be part of the stakeholder group devising flood management strategies at the respective administrative level and take part in flood management planning.

Flood-prone communities

Flood-prone communities are at the core of all flood management activities and are major stakeholders. In order to ensure that their needs are met by flood management plans, it is essential to include representatives of flood-prone communities in the decision-making process and where appropriate to bundle their interests in an umbrella organisation so that their common interests can be identified.

Other basin communities

Given the fact that upstream communities can affect downstream flood risks and vice-versa, it is important to ensure the participation of representatives of other communities in the catchment/river basin.

Scientific institutions

Scientific expertise forms the basis for well-informed decision-making and can provide important input by presenting unbiased scientific studies.

NGOs

NGOs can influence the behaviour of stakeholders by building awareness and disseminating information and can help flood-prone communities organise themselves.

Voluntary organisations

In flood emergency situations voluntary organisations can play a crucial role during emergency response and recovery. In flood preparedness programmes they are important actors in raising flood risk awareness.

The private sector

The private sector is directly or indirectly affected by flooding and commands over extra-governmental resources which can play a crucial role in flood loss reduction, business continuity planning, emergency response, and the recovery process.

A detailed list of stakeholders which should be involved for an Integrated Flood Management can be seen in Annexure F –Stakeholder involved in Integrated Flood Management.

Local governing bodies as well as Water User Associations should be involved in planning of projects as well involving communities preparing action plans for dealing with the flood situations has been mentioned in NWP 2012.

4.1 Pre-Flood Framework for Flood Management

The Pre-flood framework (Figure 6) aims to establish a Flood Risk Management Agency which will include not only CWC and IMD for meteorological data but also the Irrigation, Flood Control and Agriculture Department for the flow in canals; Revenue Department for the inventory of flood relief items within the country, state or district level; Disaster Management Department for preparedness and evacuation at the flood affected area; Telecommunication, PWD, Power for flood resilient infrastructure and other departments for flood risk management (shown in green in Figure 6). IRDRBMA will play a pivotal role in coordination and managing the overall activities for flood management. Due consideration has to be given to the inter-agency communication to have an integrated approach.

In the Pre-flood phase, a number of structural measures and non-structural measures have to be taken up to reduce the impact of flooding which are as follows.

4.1.1 Structural Measures

a. Storage across rivers

Brahmaputra Basin: In Brahmaputra basin considering the high flood volumes of higher return periods viz. 25 to 100 years, non-structural measures and construction of dykes alone cannot provide relief to the population. As per study carried out by CWC, key

storages are essential on Siang, Dibang, Demwe and Subansiri rivers with adequate flood cushions in order to have an effective flood mitigation strategy.

Ganga Basin: As per study carried out in CWC for the large drainage area of Ganga basin, some dedicated flood storages are essential through construction of additional storage projects on Chambal, Ken, Betwa, Sind and Son rivers. Similarly, the flooding problems in Eastern UP and Northern Bihar is due to huge runoff contributions from Ghaghara, Gandak and Kosi. The proposed storage in Nepal with well-planned flood storage provisions may provide a significant relief from frequent flood occurrences.

Carryover Storage: The flood management plans should have linkage with drought management also, and should take measures to maximize the positive aspects of floods such as by retaining part of flood flows in carry over storages for use in drought management. In a country like India we hardly have any carry over storage. Where ever possible, attempts should be made to develop carry over storages

b. Flood Proofing

Structural measures such as dams, reservoirs, levees, floodwalls, channel alterations and diversions modify flooding by changing the volume of runoff, peak flow, flood duration and location and extent of flooding. Such flood control projects have saved a large amount of property damage and protected a number of people in floodplains. However, the high construction costs of large-scale structural measures have made some projects unaffordable. In addition, the structures are often criticized for damaging riparian habitat, deteriorating water quality, and creating a false sense of security to induce further development in flood hazard areas.

Flood proofing is described as structural measures to protect buildings or facilities from flood water. It is a combination of adjustments and/or additions of features to individual buildings that are designed to eliminate or reduce the potential for flood damage.(Federal Emergency Management Agency, 1986)If a building is located in an area that tends to become inundated, it can be protected by wetproofing or dry proofing. Dry proofing makes a building watertight and substantially impermeable to flood waters. Dry proofing can be done by flood barriers, sealing of the openings etc. The advantage of dry proofing is that a building is kept dry and the contents inside the building are not affected by flood. On the other hand, wetproofing allows flood water to enter a structure. It is a more cost-effective measure because the structure is not affected or compromised by the water flow. It can be done by raising the contents of the building, electrical appliances etc. above the expected flood level. (WMO, 2012)

c. Strengthening of Embankments, Flood Relief Channels

d. Design, Operation, Monitoring, Maintenance & Management of Dams, Flood Defences and Drainage Systems

4.1.2 Non-Structural Measures

a. Flood Plain Zoning and Land Use Planning

Flood Plain Zoning recognizes the basic fact that the flood plain of a river is essentially river's domain and any intrusion into or developmental activity therein must recognize the river's "right of way". Flood-plain zoning aims to demarcate areas or zones which are likely to be affected by floods of different magnitudes or frequencies and probability levels. It will also help in specifying the types of permissible developments and the kind of developments in these demarcated zones, to minimize the damages, if not avoided, in case of a flood event. (India WRIS, n.d.)

b. Flood Frequency based inundation mapping

Flood frequency-based inundation mapping helps in understanding the effects of flooding of a specific area and on significant structures such as roads, streets, buildings, railways, airport etc. for different return periods. It provides vital information, like depth and spatial extent of flooded zones, which will be of help to the local and state authorities to inform the citizens about the flood prone areas and adopt appropriate flood management strategies accordingly. The most important data which is required for flood frequency-based inundation mapping are

- watershed characteristics;
- storm precipitation dynamics;
- infiltration

To obtain accurate flood inundation maps, topographic data, both land surface digital elevation model and river bed bathymetry, in addition to hydrological as well as hydraulic models are required

c. Inflow Forecasting & Storage Management

The existing operation rule curves of reservoirs and dams depend mostly on the inflow and the available storage capacity in the reservoirs and dams. These rules are generally focused on the safety of the dams and often do not take flood management in the downstream region into account. With insufficient storage capacity in the reservoir, the emergency operating rules of the dams force the dam operator to release water through the gated spillways in order to avoid spilling overor dam break. Reservoir inflow forecasting, by comparing the available reservoir capacity with the future inflow, can help to avoid these unfavourable situations. It is possible to have the full reservoir capacity at the end of the reservoir flood operation by opening the spill gates before the flood peak increases the retained reservoir capacity and limit

the water releases during the peak discharge when probable inflow exceeds the available storage capacity. (Susila, 2014)

Although a number of inflow forecasting stations are present in different reservoirs in different states in the country, it is important to stress upon this and extend the inflow forecasting stations to all dams within the country.

The inflow forecasting stations across India can be seen in Annexure G - Flood Forecasting Stations across India.

d. Flood Insurance

As an insurance contract sold to individuals whose properties are exposed to flood risks, flood insurance is intended to compensate losses caused by flooding. Flood insurance helps ease a government's fiscal burden for disaster prevention and relief by involving individuals and private insurance providers. It also allows for a more automated transfer of payments from the non-affected persons to flood victims who are covered by the same insurance program. Second, flood insurance also has the potential to influence an individual's locative decision, which can counter the adverse incentives created by structural measures for people to migrate into or establish businesses in flood-prone areas. (Asian Development Bank, 2007)

e. Storages with flood cushion/ Interlinking to water scarce locations

The long-term solution to problems of recurrent floods and droughts lies in construction of dams and reservoirs with adequate flood-cushion and interlinking of water abundant and water scarce regions so that excess flood water is judiciously utilized and inherent agony of floods is turned to the benefit of people. However, due to technical, geographical and political constraints, construction of large reservoirs in every region appears to be a tough task. Some reservoirs were initially constructed without any flood cushion but with the development and population growth, the inhabitations have come up very close to the downstream river reaches of these reservoirs and as a result, operation of such reservoirs needs to be done carefully.

f. Flood Early Warning Systems

Flood Early Warning System is a system by which hazards induced by floods can be minimized and prevented. The most important input in a flood early warning system is the hydro-meteorological observations provided by weather satellites and automatic hydro-meteorological station network in real time. This data can be used in numerous ways to evaluate flood risks and issues of flood warning. Apart from real time data, probabilistic weather forecasts also play an important role in providing input for hydrological models to generate warning scenarios. Besides having forecasts of the

most important inputs, a model needs to be selected that characterizes and simulates the catchment responses for flood early warning. (Ministry of Personnel Public Grievances & Pensions, 2012)

All the above-mentioned measures have to be performed by different authorities/department/agencies as applicable.

Emphasis should also be given to monitoring and evaluation for every project/scheme/measure which have to be performed by external agencies/experts by respective organisations/authorities. Monitoring helps to understand if things are according to the plan and helps project managers to identify and resolve any problems arising. Monitoring helps keep track of all project related inputs and outputs activities such as: reporting and documentation, finances and budgets, supplies and equipment. On the other hand, evaluations help to keep a track of key outcomes and impacts related to the different project components, assessing whether the objectives, aims and goals are being achieved or not. Monitoring and evaluation gives an insight about the intervention, performance of the intervention and whether it is achieving its aims and objectives. It also guides for future intervention activities.

Proper monitoring and evaluation of projects and project components needs to be incorporated to understand the outputs as well as effects of interventions.

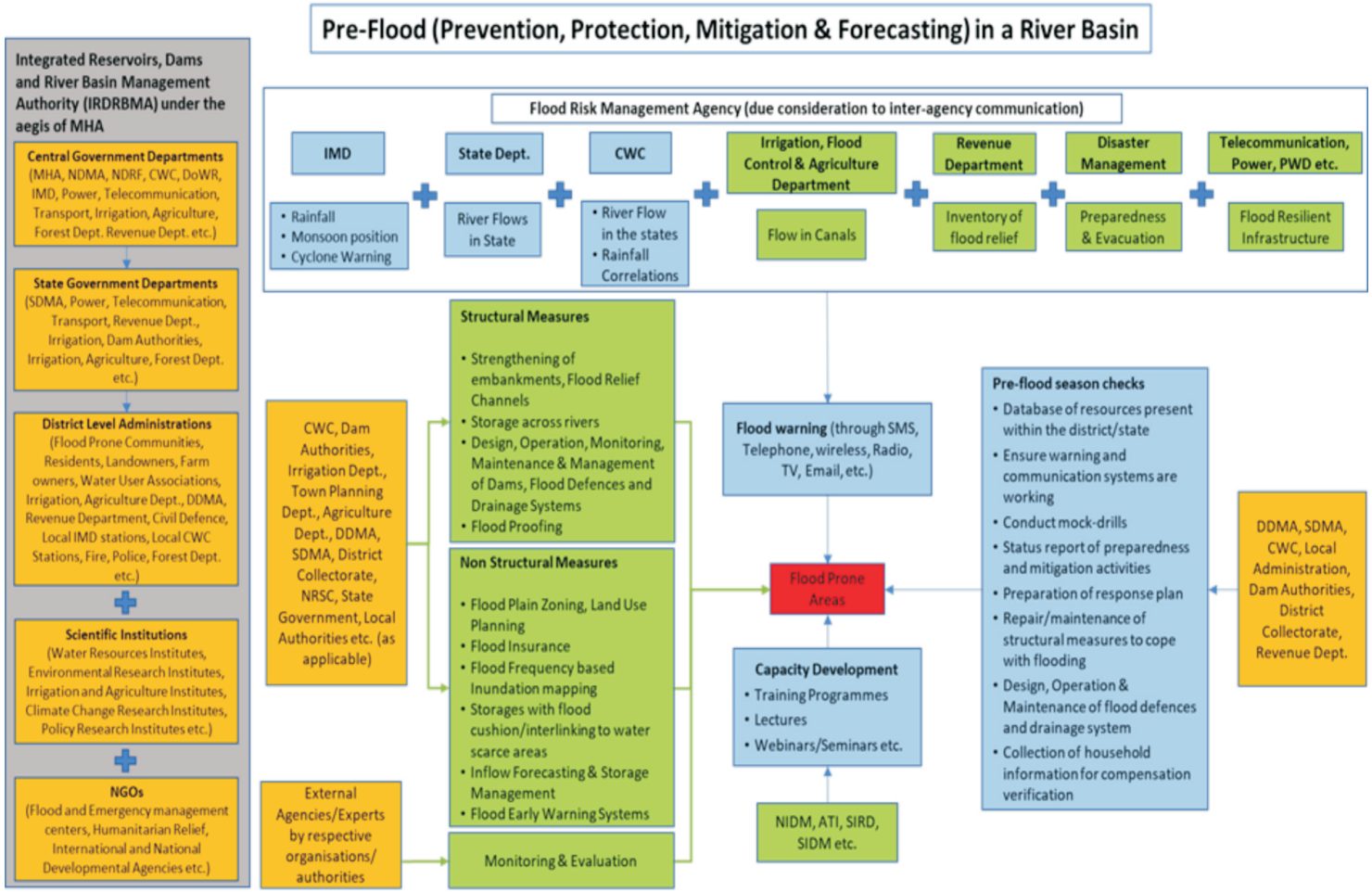


Figure 6: Suggested Pre-Flood Framework for Flood Management in India

4.2 During-Floods Framework of Flood Management in India

Most of the rivers in the country are inter-state rivers flowing through more than one State. Some of the Indian rivers are even international flowing through more than one country. Many river valley projects have been developed on these rivers by the State Governments within their jurisdiction and they are being operated as a single entity in most of the cases.

Water is stored in the dam as per the rule curves to provide water in the non-monsoon period for purposes like irrigation, drinking water supply, industrial water supply, domestic water supply etc. In reservoir operation, care is required, especially for multipurpose reservoirs where there may be a number of potentially conflicting objectives. For water supply, operations should keep reservoirs as full as possible, whereas flood control requires reservoirs to be kept as empty as possible to capture the flood water. Reservoirs should be neither partially empty at the end of the rainy season nor full at the time of a series of peak floods that lead to heavy releases, causing floods in downstream areas. The States are normally under compulsion to store water for non-monsoon period and generally do not resort to timely pre-depletion of reservoir even when very high inflows are received into the reservoir.

In the event of very high inflow into the reservoir, last moment decision for a release beyond the current safe carrying capacity of downstream channel creates inundation to large extent which is undesirable. This leads to a cascading effect of flooding if another dam is present downstream. It is thus suggested to update rule curves/storages with flood cushion in every dam in the river basin.

During an extreme event, having precise and reliable reservoir inflow forecasting with adequate lead time helps reservoir and dam operators in reducing the impact of floods downstream region. Forecasting for the season must be sufficiently accurate and timely to allow dam managers to release water gradually for flood control in downstream areas. (Shivaprasad Sharma et al., 2017)(Yang & Yang, 2014). Therefore, it is suggested to have inflow forecasting at every dam in the basin and sub basin

It is suggested, on the operational front, all major reservoirs and dams (from storage volume consideration) tocome under one unified control and command for integrated operation of the reservoirs during monsoon to ensure that the flood waters are efficiently routed and regulated for an integrated flood management in the entire basin. Further, for real time integrated operation of reservoir and dam, a robust state-of-art data acquisition, storage, retrieval and transmission system to and from the centralised control and command center is paramount. It is understood that it is not possible for each State to operate the reservoir in an integrated manner with the

reservoirs located in other State, without having institutional mechanism for the same. CWC is the central agency having its monitoring network in almost all inter-state rivers and is also having requisite experience of integrated operation in Damodar Valley Corporation. Presently, the concept of Integrated Reservoir Operation is practiced in Damodar Valley through Damodar Valley Corporation, Sutlej & Beas basin through Bhakra Beas Management Board and Narmada Basin through Narmada Control Authority.

Development of a Decision Support System (DSS) is recommended for every basin and sub basin at country, state and district level. A DSS allows users to explore as many potential intervention and/or scenarios as are available before making decisions that will ultimately impact real assets and real people. DSS helps to handle water management issues while ensuring all decisions are based on carefully explored knowledge, history, and potential risks and rewards. Fully understanding the impact of water as a vital resource is essential in managing it properly. The thoroughness of a DSS, combined with local knowledge, individual values associated with each water asset, and any other personalised information stakeholders and water users have, allows stakeholders to explore various aspects of each asset as DSS can create a well-rounded picture of what is needed for proper water management. (The Australian Water Partnership, 2017)

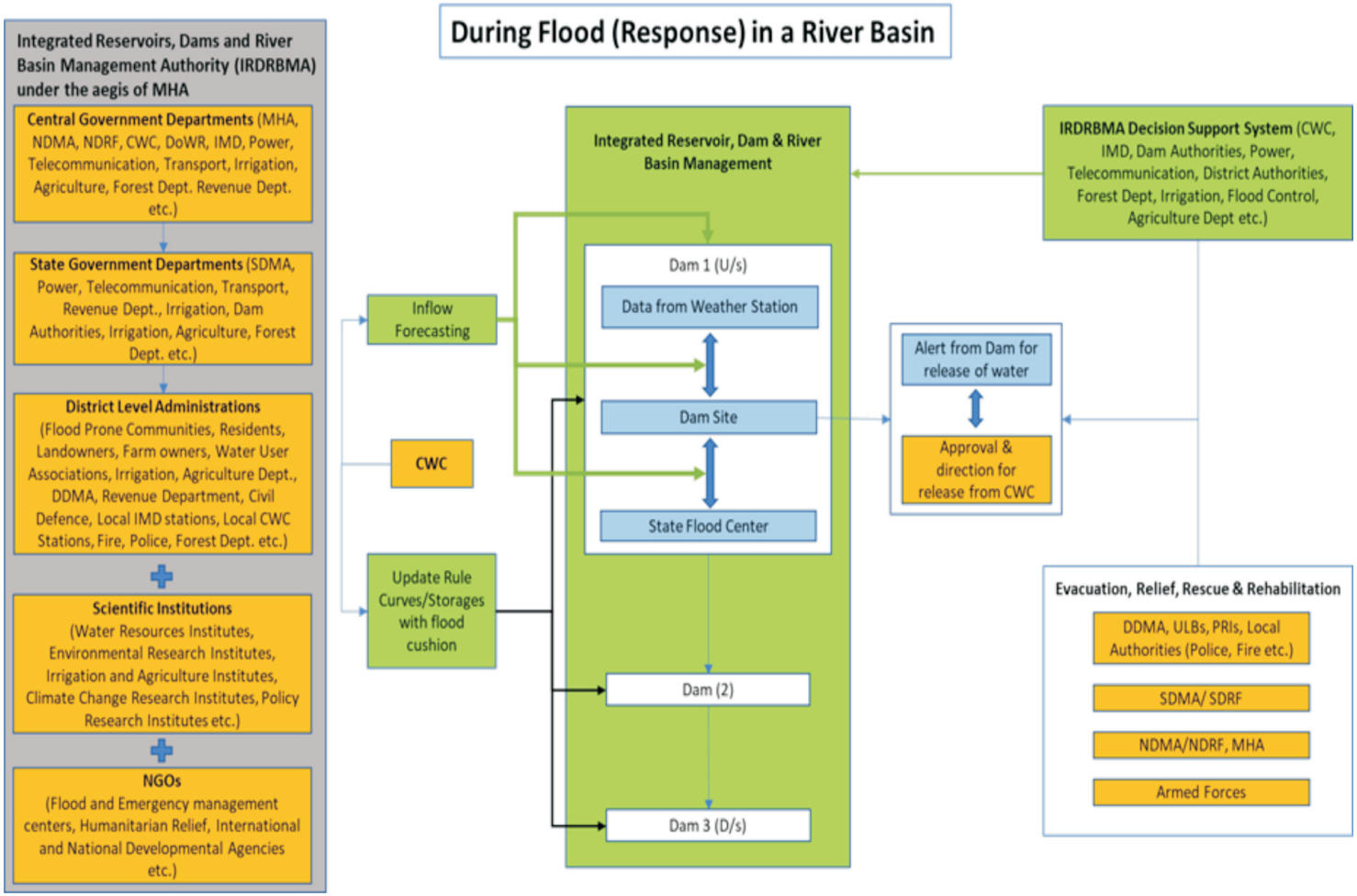


Figure 7: Suggested During-Flood Framework for Flood Management in India

4.3 Post Flood Framework of Flood Management in India

The assessment of disaster effects needs to be conducted in a bottom up approach that involves the estimation of the value of destruction of physical, durable assets and of the value of the disaster-induced disruption of production flows in all affected sectors of economic and social activity, and their subsequent aggregation to ascertain total disaster effects and impacts. To obtain a fully representative and valid estimation of total disaster effects and impacts, all affected sectors of economic and social activity are to be fully assessed, despite their respective ownership: i.e. those under the ownership by public and private entities. Leaving specific sectors out of the assessment constitutes a guarantee that certain parts of the affected society and economy would be left on their own and may not achieve recovery and disaster-resilient reconstruction or face longer periods of unnecessary suffering, in view of the existing inter-relations between sectors of the society. In addition, in order to achieve a holistic view of disaster impact and post-disaster recovery needs, the procedures to be adopted should be systematically applied across the board of all sectors to ensure their subsequent valid aggregation for the desired objectives. Using different words, each and all sectors of economic and social activity should follow the same coherent procedures to ensure that the subsequent impact analysis and needs estimation are valid throughout. (National Institute of Disaster Management (NIDM), 2019)

The PDNA is a multi-sectorial and multi-disciplinary structured approach for assessing disaster damages, losses, impacts and needs that will lead to the development of a recovery and reconstruction plan. As a tool for recovery and reconstruction planning and implementation, a PDNA is normally undertaken after the emergency phase or during the time when the post-disaster emergency operations are winding down and longer-term recovery is about to start. The following are the important features of a PDNA:

1. It should be led and undertaken by the government after a disaster with the collaboration of international development partners and even the private sector.
2. PDNA is intended to identify and/or estimate:

a. Damages caused by a disaster to physical infrastructure and the losses (changes in economic flows) in the various sectors of the economy, including an assessment of its macro-economic impacts or consequences as well as changes in the social or human development indicators.

b. Define the framework, strategies and financial requirements of programs and projects to achieveoverall post-disaster recovery, reconstruction and risk management.

3. The sectors assessed in a PDNA are those contained in the national accounting system such asagriculture, industry, trade and services etc. and the corresponding sub-sectors under them.
4. Various experts like engineers, economists, finance specialists, statisticians, etc. who have knowledgeon the valuation and estimation of damages, losses and needs in a certain sector should be membersof the assessment team for that given sector.

With a standardized assessment procedure across sectors, the priorities for post-disaster recovery and reconstruction can be determined by the government in terms of the affected sectors of the economy, the geographical areas and social or population groups. Specifically, a PDNA should show the following:

1. Total value of destroyed physical assets (damages) and of changes in the flows of production of goods and services (financial losses);
2. Ownership of the above, whether public or private in nature;
3. Identification of most affected sectors;
4. Spatial or geographical distribution of disaster effects;
5. Impact of disaster at macro-economic, sectorial, personal/household levels (social impacts) and cross-cutting issues/concerns;
6. Estimation of post-disaster needs for recovery, reconstruction and other cross-cutting issues like disaster risk reduction measures, environment, etc.; and
7. Suggested framework and strategies in implementing the recovery and reconstruction activities.

It is suggested that the Post Disaster Needs Assessment to be done by IRDRBMA with an integrated involvement of Revenue Department, Irrigation, Flood Control, Agriculture Department, PWD, PHE, Power, Telecommunication, Forest Department and other authorities at the state level.

As discussed in the pre-flood framework, flood insurance plays a key role in the early disbursement of funds to the affected population along with the relief from the State or Central Government.

The Post-Flood (Recovery) Framework for flood management in India can be seen in Figure 8

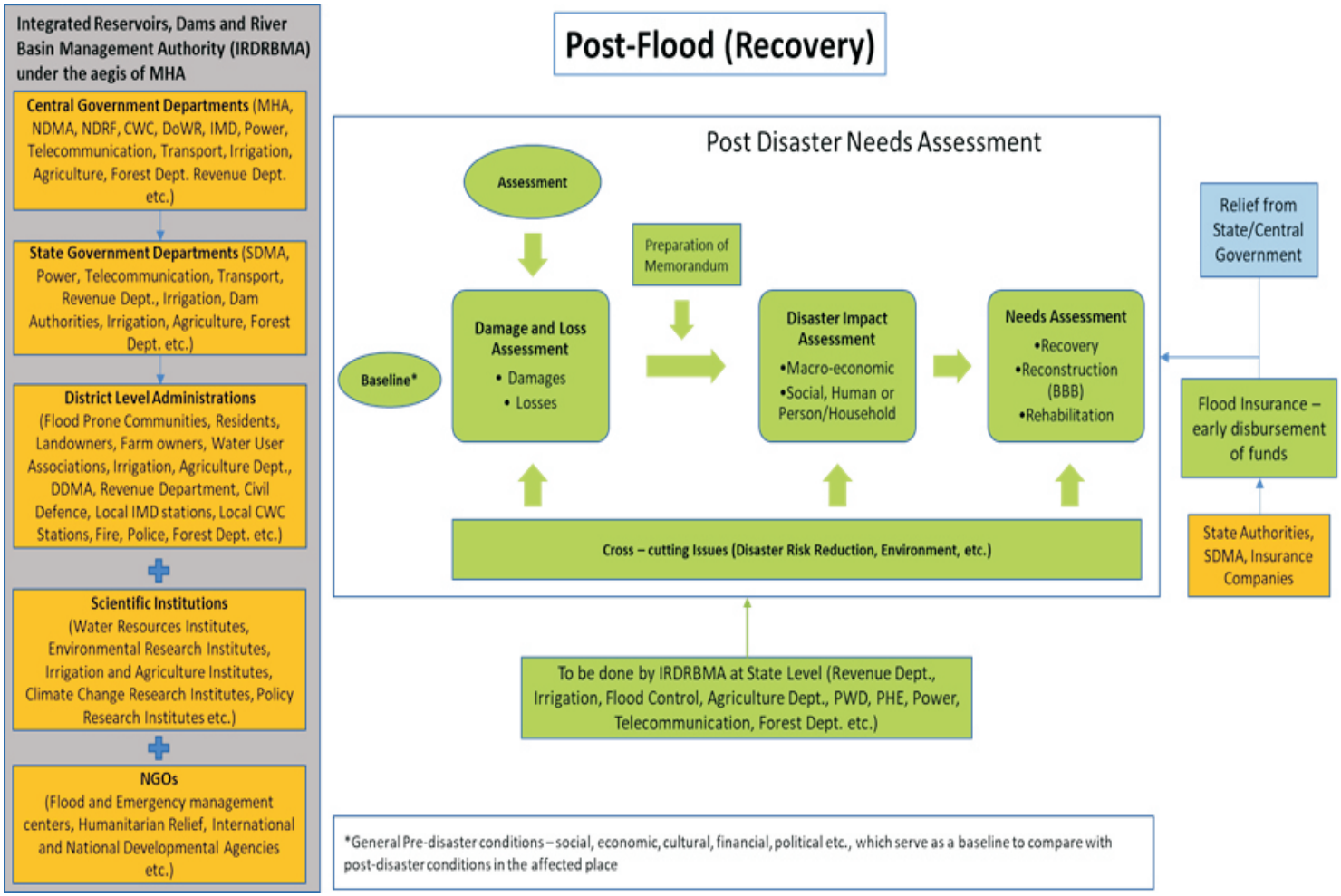


Figure 8: Suggested Post Flood Framework for Flood Management in India

4.4 Action Plan for Reservoir, Dam and Basin Flood Risk & Disaster Management

The development and implementation of effective floodplain management and flood emergency management plans requires the coordination and integration of various elements of the planning system, floodplain management at national/state level and floodplain management at district level. This action plan has been taken as a reference from Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000 as well as World Meteorological Organization, 2011 Tool "Flood Emergency Planning".

Planning System

Town plans, disaster management plans, local environmental plans and other formal planning instruments provide a basic foundation for the floodplain management process. The planning process provides a suitable and effective vehicle for the preparation of floodplain management plans and for the implementation of their land use provisions. The preparation of a floodplain management plan is the same as any other land use planning, with the additional need to account for the constraints of flood risk and flood hazard; that is, risk management.

Integrated Reservoir, Dam and River Basin Management Authority

The first step in the floodplain management process is to form a Integrated Reservoir, Dam and River Basin Management Authority. The principal objective of the authority is to assist the local agency in developing and implementing a plan for the management of the respective floodplain area. In addition to that, the authority also needs to formulate the objectives, develop strategies for implementation and direct and monitor the floodplain management policy and plan of the local agency.

Membership of the authority should comprise of stakeholders from different backgrounds such as elected, administrative and community representatives, together with technical experts.

The first tasks of the authority would be to:

a. establish policy and management objectives

b. initiate a flood study

c. initiate studies to collect and interpret social, economic and environmental data of relevance to community aspirations for future development and use of the river and floodplain environment.

by using data such as:

a. past flood data including principal flow paths, peak flood levels and flood damage

b. current levels of flood awareness

c. likely community disruption caused by flooding

d. current and proposed land use

e. population growth

f. locations of spare capacity in existing infrastructure (roads, water supply, sewerage)

g. feasibility and costs of infrastructure expansion

h. flora and fauna surveys of river and floodplain habitat, and the significance of this habitat within the context of the entire catchment.

Assessment of flood risk at Reservoir, Dam and Basin level

The flood study defines the nature and extent of flood hazard across the floodplain by providing information on the extent, level and velocity offloodwaters and on the distribution of flood flows. An assessment would include a comprehensive technical investigation of flood behaviour which will formthe basis for subsequent management studies. The assessment will help determine the flood discharges for floods of various severities (hydrologic aspects) and flood levels and velocities for the various flood events (hydraulic aspects).

A variety of analytical tools can be used in flood studies, depending on the availability of data, the nature of the flow situation, the nature and extent of existing development on the floodplain, and the level of detail required

The Reservoir, Dam & Basin Flood Management Plan

The flood management plan comprises a coordinated mix of measures that address the existing, future and residual flood problems upon the completion of the flood plain management study.

The flood management study identifies and compares options to manage flood hazard, including an assessment of social, economic and environmental costs and benefits, together with opportunities to enhance the river and floodplain environments. A successful floodplain management study requires a comprehensive multidisciplinary approach and active public consultation.

The hydrologic and hydraulic models developed during the flood study allow the assessment of the effect of structural mitigation measures and different land use

options on flooding behaviour and flood hazard. The data collected provide the necessary information to assess the social, economic and environmental costs and benefits of the various mitigation measures and future land use possibilities.

Flood maps provide general guidelines for the appropriateness of different types of land use and developments across the floodplain.

The plan should specify the objectives of managing the particular area of floodplain under consideration, as well as how this is to be done. It will include information describing how particular areas of land are to be used and managed to achieve specified objectives. The plan should also include a description and discussion of various issues, problems, special features and values of the area, together with specific management measures to be implemented, along with the means and timing of implementation.

The plan should include:

a. flood behaviour, including risk, prevailing hazard, changes occasioned by proposed future land developments arising from the results of the flood study and floodplain management study

b. linkage of the floodplain management plan with the flood emergency plan

c. economic analysis of potential works and measures

d. environmental factors, including enhancement and restoration of the river and floodplain environment

e. social factors, including the needs of the local community and intangible flood costs

f. local, regional and state planning needs, restrictions and opportunities.

Community consultation is essential in the formulation, acceptance and implementation of a floodplain management plan. Best practice principles require that local agencies actively involve representatives of the public, particularly owners of land in defined flood areas, in the preparation and review of the floodplain management plan.

The draft floodplain management plan should be exhibited and public comment sought and be taken into account before the plan is finalised.

Adoption and implementation of Flood Management Plan

Once a flood management plan has been adopted by the local agency, the next phase is its implementation.

Statutory planning instruments are the most effective means of controlling the development of flood-prone land. Local agencies should foster as a matter ofurgency the preparation or amendment of appropriate statutory planning instruments to give effect to proposed land use and development controls.

Not all provisions of a flood management plan can be implemented immediately. Certain components can be implemented relatively quickly, such as development and building controls, flood education and public awareness programs. Available funding will determine when certain options can commence (e.g. structuralmeasures, voluntary property purchase). Consequently, a strategy needs to be developed to implement the various elements of the plan over time. The strategy should include the staging of components that depend on availability of funds and the adoption of interim measures.

Review of plan

The plan is not a static document and should be reviewed regularly, perhaps every five to ten years, or after a severe flood that gives rise to revision of the flood study results. Such reviews need to examine changes in:

- flood behaviour (perhaps a large flood has occurred since the plan was formulated, or an upstream dam has been constructed)
- roles and responsibilities of the various agencies concerned with floodplain management
- aspirations of the community regarding future growth and development.

The Flood Disaster Management system at District Level

Operation of the flood disaster management systems at District level is the responsibility of local emergency management agencies and is aimed at reducing the hazard during actual flood events. This is done by the development of a local Flood Emergency Plan.

The first step in flood emergency planning is to carry out a hazard and vulnerability analysis of floodplain areas under consideration.This requires information concerning the extent, depth, velocity, duration and rate of rise of floodwaters, as well as topographic information.

Reservoir, Dam and Local Flood Emergency Plan

After completion of hazard analyses, the local emergency management committees will develop the reservoir, dam and local flood emergency plan which is a detailed document containing subplans that address among other things preparedness for,

response to and recovery from flood emergencies. Close liaison is required between emergency management staff and other members of the committee during the assessment of flood risk at reservoir, dam and local level to ensure that proposed structural, land use planning, and development and building control measures do not unduly increase hazards or put unreasonable claims on emergency management agencies during an actual flood.

The reservoir, dam and local flood emergency plan should also include activities to protect and reinstate essential infrastructure required during clean-up and recovery in the flood aftermath (e.g. sewerage, water supply, telephones).

Implementation of Plan for Reservoir, Dam & Basin Flood Risk and Disaster Management

Public awareness and public education are important elements of a flood emergency plan. It is important that the community understands the flood emergency plan and its provisions. Awareness and education needs to be fostered regularly

Best practice for the flood management process needs to include the following:

- public consultation at all stages of the process
- a suitable planning horizon (20—30 years) that encompasses and assesses opportunities for significant land use change and redevelopment of existing urban and rural areas
- planning process guided by an Integrated Reservoir, Dam and River Basin Management Authority (IRDRBMA) representing all principal stakeholders
- plans made in view of the multi-objective nature of floodplain management
- an assessment of flooding considerations together with environmental, ecological, economic, social and community expectations from within the broader principles of sustainable natural resource and environment management and of integrated or total catchment management
- recognition of existing, future and residual flood risk and flood hazard, and evaluation of these in the study area
- a formal risk management analysis to identify, evaluate and treat flood risk—this provides the most comprehensive assessment of these issues
- a risk-damage study to provide quantitative and reliable insights into the selection of floodplain management measures, and the effects of proposed new developments on risk—damage relationships
- appropriate technical studies undertaken to adequate standards
- consideration of a full range of flood events up to and including the PMF so that

residual flood risk can be assessed and an appropriate flood emergency plan devised to deal with residual risk

- assessment of effects of future development on flood hazard and behaviour on a cumulative basis
- identification and assessment of a full range of management measures and options that appropriately address the existing, future and residual flood problems of the study area
- precautions with respect to possible implications of the climate change on flooding
- implementation of adopted measures in an effective and timely way, especially land use planning controls, and the floodplain management plan is incorporated into the relevant statutory planning instruments
- recognition that a floodplain management plan is not a static document, but needs to be reviewed and updated regularly (e.g. every 5—10 years) to accommodate changes in, for example, community expectations and flooding behaviour.

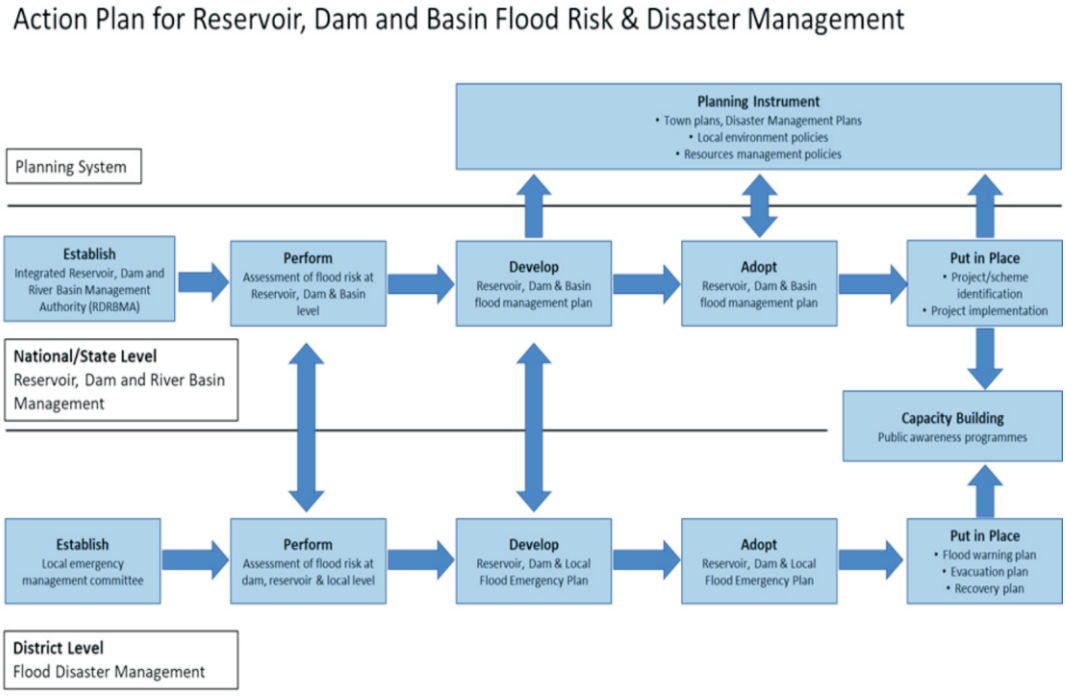


Figure 9: Action Plan for Reservoir, Dam and Basin Flood Risk & Disaster Management

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ANNEXURE A

Flood damages due to floods/heavy rains during 1953 – 2018 in India

Table 1: Statement showing damage due to floods/heavy rains during 1953 to 2018 in India, (Source: CWC 2020)

INDIA STATEMENT SHOWING DAMAGE DUE TO FLOODS / HEAVY RAINS DURING 1953 TO 2018											
S No.	Year	Area affected in m. ha.	Population affected in millions	Damage to crops		Damage to houses		Cattle lost	Human lives lost	Damage to public utilities	Total damages
				area in m. ha.	Value in Rs. Crore	Nos.	Value in Rs. Crore	Nos	Nos	Rs Crore	Crops, houses and public utilities in Rs. Crore
1	2	3	4	5	6	7	8	9	10	11	12
1	1953	2.29	24.28	0.93	42.08	264924	7.42	47034	37	2.9	52.4
2	1954	7.49	12.92	2.61	40.52	199984	6.561	22552	279	10.15	57.231
3	1955	9.44	25.27	5.31	77.8	1666789	20.945	72010	865	3.98	102.725
4	1956	9.24	14.57	1.11	44.44	725776	8.047	16108	462	1.14	53.627
5	1957	4.86	6.76	0.45	14.12	318149	4.979	7433	352	4.27	23.369
6	1958	6.26	10.98	1.4	38.28	382251	3.896	18439	389	1.79	43.966
7	1959	5.77	14.52	1.54	56.76	648821	9.418	72691	619	20.02	86.198
8	1960	7.53	8.35	2.27	42.55	609884	14.309	13908	510	6.31	63.169
9	1961	6.56	9.26	1.97	24.04	533465	0.889	15916	1374	6.44	31.369
10	1962	6.12	15.46	3.39	83.18	513785	10.655	37633	348	1.05	94.885
11	1963	3.49	10.93	2.05	30.17	420554	3.701	4572	432	2.74	36.611
12	1964	4.9	13.78	2.49	56.87	255558	4.588	4956	690	5.149	66.607
13	1965	1.46	3.61	0.27	5.87	112957	0.195	7286	79	1.07	7.513
14	1966	4.74	14.4	2.16	80.15	217269	2.544	9071	180	5.736	88.43

INDIA
STATEMENT SHOWING DAMAGE DUE TO FLOODS / HEAVY RAINS DURING 1953 TO 2018

S No.	Year	Area affected in m. ha.	Population affected in millions	Damage to crops		Damage to houses		Cattle lost	Human lives lost	Damage to public utilities	Total damages
				area in m. ha.	Value in Rs. Crore	Nos.	Value in Rs. Crore	Nos	Nos	Rs Crore	Crops, houses and public utilities in Rs. Crore
1	2	3	4	5	6	7	8	9	10	11	12
15	1967	7.12	20.46	3.27	133.31	567995	14.264	5827	355	7.857	155.431
16	1968	7.15	21.17	2.62	144.61	682704	41.112	130305	3497	25.373	211.095
17	1969	6.2	33.22	2.91	281.9	1268660	54.423	2720	1408	68.112	404.435
18	1970	8.46	31.83	4.91	162.78	1434030	48.606	19198	1076	76.441	287.827
19	1971	13.25	59.74	6.24	423.13	2428031	80.241	12866	994	129.113	632.484
20	1972	4.1	26.69	2.45	98.56	897301	12.46	58231	544	47.174	158.194
21	1973	11.79	64.08	3.73	428.03	869797	52.482	261016	1349	88.489	569.001
22	1974	6.7	29.45	3.33	411.64	746709	72.434	16846	387	84.942	569.016
23	1975	6.17	31.36	3.85	271.49	803705	34.097	17345	686	166.05	471.637
24	1976	11.91	50.46	6.04	595.03	1745501	92.16	80062	1373	201.495	888.685
25	1977	11.46	49.43	6.84	720.61	1661625	152.29	556326	11316	328.948	1201.848
26	1978	17.5	70.45	9.96	911.09	3507542	167.574	239174	3396	376.1	1454.764
27	1979	3.99	19.52	2.17	169.97	1328712	210.606	618248	3637	233.627	614.203
28	1980	11.46	54.12	5.55	366.37	2533142	170.851	59173	1913	303.283	840.504
29	1981	6.12	32.49	3.27	524.56	912557	159.63	82248	1376	512.314	1196.504
30	1982	8.87	56.01	5	589.4	2397365	383.869	246750	1573	671.607	1644.876

INDIA STATEMENT SHOWING DAMAGE DUE TO FLOODS / HEAVY RAINS DURING 1953 TO 2018											
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				area in m. ha.	Value in Rs. Crore	Nos.	Value in Rs. Crore	Nos	Nos	Rs Crore	Crops, houses and public utilities in Rs. Crore
1	2	3	4	5	6	7	8	9	10	11	12
31	1983	9.02	61.03	3.29	1285.85	2393722	332.327	153095	2378	873.429	2491.606
32	1984	10.71	54.55	5.19	906.09	1763603	181.308	141314	1661	818.164	1905.562
33	1985	8.38	59.59	4.65	1425.37	2449878	583.855	43008	1804	2050.043	4059.268
34	1986	8.81	55.5	4.58	1231.58	2049277	534.41	60450	1200	1982.535	3748.525
35	1987	8.89	48.34	4.94	1154.64	2919380	464.49	128638	1835	950.59	2569.72
36	1988	16.29	59.55	10.15	2510.9	2276533	741.6	150996	4252	1377.8	4630.3
37	1989	8.06	34.15	3.01	956.74	782340	149.82	75176	1718	1298.77	2405.33
38	1990	9.303	40.259	3.179	695.61	1019930	213.733	134154	1855	455.266	1708.92
39	1991	6.357	33.889	2.698	579.015	1134410	180.421	41090	1187	728.893	1488.329
40	1992	2.645	19.256	1.748	1027.578	687489	306.284	78669	1533	2010.67	3344.532
41	1993	11.439	30.409	3.206	1308.627	1926049	528.324	211193	2864	1445.534	3282.485
42	1994	4.805	27.548	3.963	888.622	914664	165.206	52315	2078	740.762	1794.59
43	1995	5.245	35.932	3.245	1714.787	2001898	1307.894	62438	1814	679.627	3702.308
44	1996	8.049	44.729	3.827	1124.491	726799	176.589	3208	1803	861.393	3005.743
45	1997	4.569	29.663	2.258	692.743	505128	152.504	27754	1402	1985.934	2831.181
46	1998	10.845	47.435	7.495	2594.167	1932874	1108.783	107098	2889	5157.771	8860.721

INDIA STATEMENT SHOWING DAMAGE DUE TO FLOODS / HEAVY RAINS DURING 1953 TO 2018											
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				area in m. ha.	Value in Rs. Crore	Nos.	Value in Rs. Crore	Nos	Nos	Rs Crore	Crops, houses and public utilities in Rs. Crore
1	2	3	4	5	6	7	8	9	10	11	12
47	1999	7.765	27.993	1.753	1850.873	1613260	1299.057	91289	745	462.83	3612.76
48	2000	5.382	45.013	3.58	4246.622	2628855	680.943	123252	2606	3936.979	8864.544
49	2001	6.175	26.463	3.964	688.481	716187	816.474	32704	1444	5604.461	7109.416
50	2002	7.09	26.323	2.194	913.092	762492	599.368	21533	1001	1062.083	2574.543
51	2003	6.12	43.201	4.268	7307.23	775379	756.481	15161	2166	3262.154	11325.866
52	2004	5.314	43.725	2.888	778.694	1664388	879.601	134106	1813	1656.09	3314.385
53	2005	12.562	22.925	12.299	2370.923	715749	380.531	119674	1455	4688.219	7439.672
54	2006	1.096	25.224	1.822	2850.668	1497428	3636.848	266945	1431	13303.926	19790.922
55	2007	7.145	41.402	8.795	3121.532	3280233	2113.108	89337	3389	8049.037	13283.677
56	2008	3.427	29.91	3.186	3401.563	1566809	1141.891	101780	2876	5046.481	9589.935
57	2009	3.844	29.537	3.592	4232.609	1235628	10809.795	63383	1513	17509.353	32551.758
58	2010	2.624	18.297	4.994	5887.38	293830	875.952	39706	1582	12757.253	19520.586
59	2011	1.895	15.973	2.718	1393.847	1152518	410.475	35982	1761	6053.57	7857.892
60	2012	2.141	14.689	1.95	1534.108	174526	240.572	31558	933	9169.968	10944.648
61	2013	7.546	25.927	7.484	6378.078	699525	2032.83	163958	2180	38937.843	47348.751
62	2014	12.775	26.505	8.007	7255.151	311325	581.978	60196	1968	7710.948	15548.077

INDIA STATEMENT SHOWING DAMAGE DUE TO FLOODS / HEAVY RAINS DURING 1953 TO 2018											
S No.	Year	Area affected in m. ha.	Population affected in millions	Damage to crops		Damage to houses		Cattle lost	Human lives lost	Damage to public utilities	Total damages
				area in m. ha.	Value in Rs. Crore	Nos.	Value in Rs. Crore	Nos	Nos	Rs Crore	Crops, houses and public utilities in Rs. Crore
1	2	3	4	5	6	7	8	9	10	11	12
63	2015	4.478	33.203	3.374	17043.948	3959191	8046.969	45597	1420	32200.182	57291.098
64	2016	7.065	26.555	6.658	4052.723	278240	114.676	22367	1420	1507.926	5675.325
65	2017	6.076	47.342	4.972	8951.978	1252914	9384.018	26673	2063	12329.849	30665.845
66	2018	7.718	37.399	2.515	3708.187	913414	2508.656	60279	1839	12132.92	21849.972
TOTAL		474.054	2125.006	258.533	114933.81	81631407	56283.018	6109628	109374	224192.922	400097.019

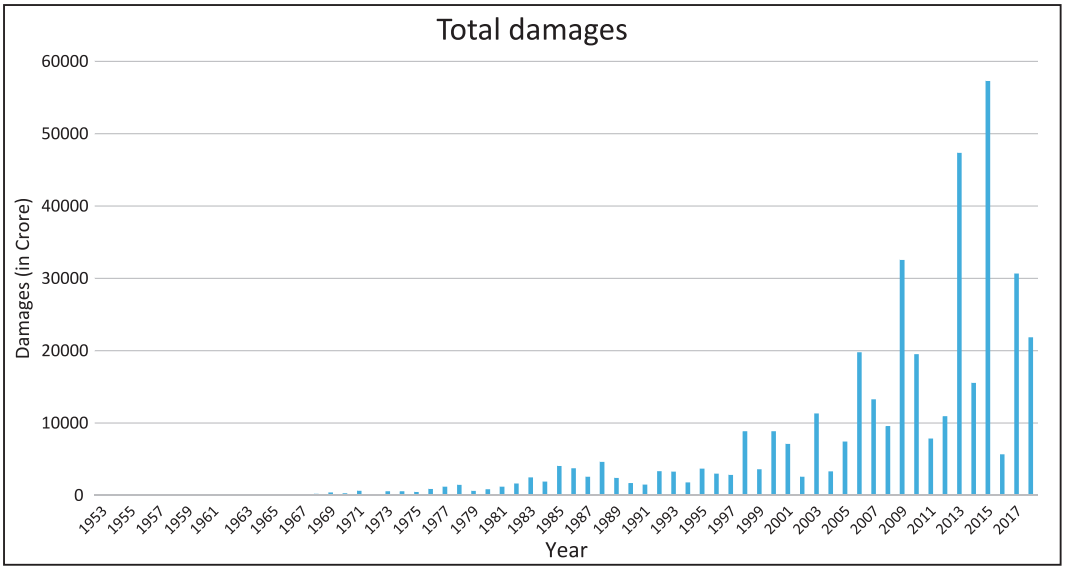


Figure 10: Total damages due to floods/heavy rains during 1953 to 2018 in India, (Source: CWC, 2020)

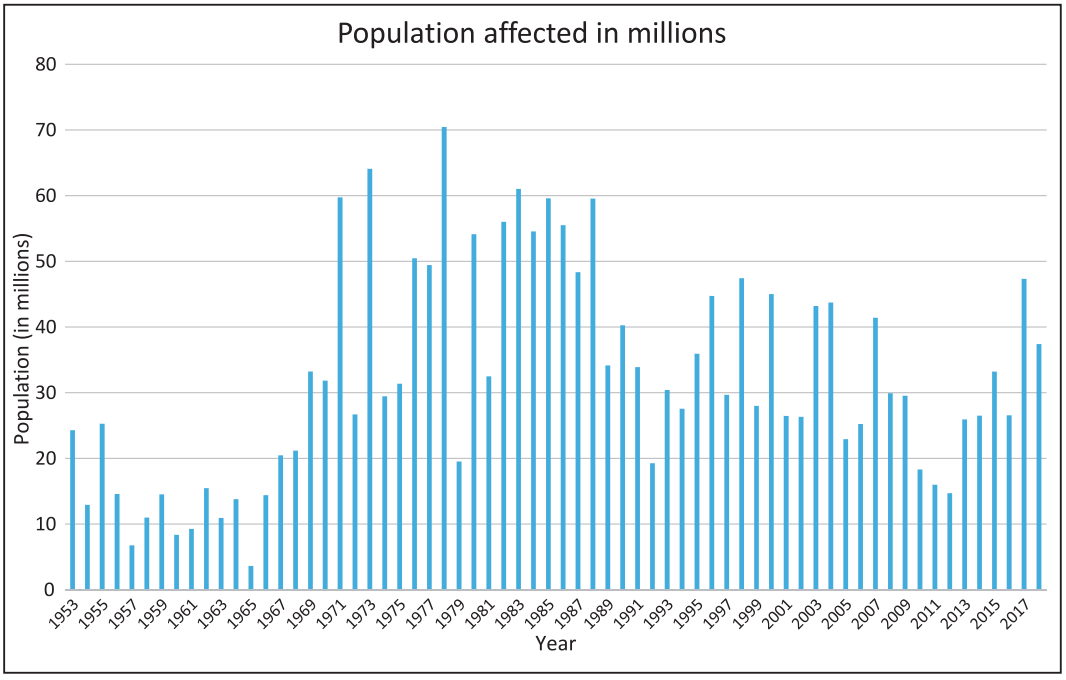


Figure 11: Population affected due to floods/heavy rains during 1953 to 2018 in India, (Source: CWC, 2020)

ANNEXURE B

National Water Policy, 2012

Government of India
Ministry of Water Resources

NATIONAL WATER POLICY (2012)

1. PREAMBLE

1.1 A scarce natural resource, water is fundamental to life, livelihood, food security and sustainable development. India has more than 18 % of the world's population, but has only 4% of world's renewable water resources and 2.4% of world's land area. There are further limits on utilizable quantities of water owing to uneven distribution over time and space. In addition, there are challenges of frequent floods and droughts in one or the other part of the country. With a growing population and rising needs of a fast developing nation as well as the given indications of the impact of climate change, availability of utilizable water will be under further strain in future with the possibility of deepening water conflicts among different user groups. Low consciousness about the scarcity of water and its life sustaining and economic value results in its mismanagement, wastage, and inefficient use, as also pollution and reduction of flows below minimum ecological needs. In addition, there are inequities in distribution and lack of a unified perspective in planning, management and use of water resources. The objective of the National Water Policy is to take cognizance of the existing situation, to propose a framework for creation of a system of laws and institutions and for a plan of action with a unified national perspective.

1.2 The present scenario of water resources and their management in India has given rise to several concerns, important amongst them are;

(i) Large parts of India have already become water stressed. Rapid growth in demand for water due to population growth, urbanization and changing lifestyle pose serious challenges to water security.

(ii) Issues related to water governance have not been addressed adequately. Mismanagement of water resources has led to a critical situation in many parts of the country.

(iii) There is wide temporal and spatial variation in availability of water, which may increase substantially due to a combination of climate change, causing deepening of water crisis and incidences of water related disasters, i.e., floods, increased erosion and increased frequency of droughts, etc.

(iv) Climate change may also increase the sea levels. This may lead to salinity intrusion in ground water aquifers / surface waters and increased coastal inundation in coastal regions, adversely impacting habitations, agriculture and industry in such regions.

(v) Access to safe water for drinking and other domestic needs still continues to be a problem in many areas. Skewed availability of water between different regions and different people in the same region and also the intermittent and unreliable water supply system has the potential of causing social unrest.

(vi) Groundwater, though part of hydrological cycle and a community resource, is still perceived as an individual property and is exploited inequitably and without any consideration to its sustainability leading to its over-exploitation in several areas.

(vii) Water resources projects, though multi-disciplinary with multiple stakeholders, are being planned and implemented in a fragmented manner without giving due consideration to optimum utilization, environment sustainability and holistic benefit to the people.

(viii) Inter-regional, inter-State, intra-State, as also inter-sectoral disputes in sharing of water, strain relationships and hamper the optimal utilization of water through scientific planning on basin/sub-basin basis.

(ix) Grossly inadequate maintenance of existing irrigation infrastructure has resulted in wastage and under-utilization of available resources. There is a widening gap between irrigation potential created and utilized.

(x) Natural water bodies and drainage channels are being encroached upon, and diverted for other purposes. Groundwater recharge zones are often blocked.

(xi) Growing pollution of water sources, especially through industrial effluents, is affecting the availability of safe water besides causing environmental and health hazards. In many parts of the country, large stretches of rivers are both heavily polluted and devoid of flows to support aquatic ecology, cultural needs and aesthetics.

(xii) Access to water for sanitation and hygiene is an even more serious problem. Inadequate sanitation and lack of sewage treatment are polluting the water sources.

(xiii) Low consciousness about the overall scarcity and economic value of water results in its wastage and inefficient use.

(xiv) The lack of adequate trained personnel for scientific planning, utilizing modern techniques and analytical capabilities incorporating information technology constrains good water management.

(xv) A holistic and inter-disciplinary approach at water related problems is missing.

(xvi) The public agencies in charge of taking water related decisions tend to take these on their own without consultation with stakeholders, often resulting in poor and unreliable service characterized by inequities of various kinds.

(xvii) Characteristics of catchment areas of streams, rivers and recharge zones of aquifers are changing as a consequence of land use and land cover changes, affecting water resource availability and quality.

1.3 Public policies on water resources need to be governed by certain basic principles, so that there is some commonality in approaches in dealing with planning, development and management of water resources. These basic principles are:

(i) Planning, development and management of water resources need to be governed by common integrated perspective considering local, regional, State and national context, having an environmentally sound basis, keeping in view the human, social and economic needs.

(ii) Principle of equity and social justice must inform use and allocation of water.

(iii) Good governance through transparent informed decision making is crucial to the objectives of equity, social justice and sustainability. Meaningful intensive participation, transparency and accountability should guide decision making and regulation of water resources.

(iv) Water needs to be managed as a common pool community resource held, by the state, under public trust doctrine to achieve food security, support livelihood, and ensure equitable and sustainable development for all.

(v) Water is essential for sustenance of eco-system, and therefore, minimum ecological needs should be given due consideration.

(vi) Safe Water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs (including needs of animals), achieving food security, supporting sustenance agriculture and minimum eco-system needs. Available water, after meeting the above needs, should be allocated in a manner to promote its conservation and efficient use.

(vii) All the elements of the water cycle, i.e., evapo-transpiration, precipitation, runoff, river, lakes, soil moisture, and ground water, sea, etc., are interdependent and the basic hydrological unit is the river basin, which should be considered as the basic hydrological unit for planning.

(viii) Given the limits on enhancing the availability of utilizable water resources and increased variability in supplies due to climate change, meeting the future needs will depend more on demand management, and hence, this needs to be given priority, especially through (a) evolving an agricultural system which economizes on water use and maximizes value from water, and (b) bringing in maximum efficiency in use of water and avoiding wastages.

(ix) Water quality and quantity are interlinked and need to be managed in an integrated manner, consistent with broader environmental management approaches inter-alia including the use of economic incentives and penalties to reduce pollution and wastage.

(x) The impact of climate change on water resources availability must be factored into water management related decisions. Water using activities need to be regulated keeping in mind the local geo climatic and hydrological situation.

2. WATER FRAMEWORK LAW

2.1 There is a need to evolve a National Framework Law as an umbrella statement of general principles governing the exercise of legislative and/or executive (or devolved) powers by the Centre, the States and the local governing bodies. This should lead the way for essential legislation on water governance in every State of the Union and devolution of necessary authority to the lower tiers of government to deal with the local water situation.

2.2 Such a framework law must recognize water not only as a scarce resource but also as a sustainer of life and ecology. Therefore, water, particularly, groundwater, needs to be managed as a community resource held, by the state, under public trust doctrine to achieve food security, livelihood, and equitable and sustainable development for all. Existing Acts may have to be modified accordingly.

2.3 There is a need for comprehensive legislation for optimum development of inter-State rivers and river valleys to facilitate inter-State coordination ensuring scientific planning of land and water resources taking basin/sub-basin as unit with unified perspectives of water in all its forms (including precipitation, soil moisture, ground and surface water) and ensuring holistic and balanced development of both the catchment and the command areas. Such legislation needs, inter alia, to deal with and enable establishment of basin authorities, comprising party States, with appropriate powers to plan, manage and regulate utilization of water resource in the basins.

3. USES OF WATER

3.1 Water is required for domestic, agricultural, hydro-power, thermal power, navigation, recreation, etc. Utilisation in all these diverse uses of water should be optimized and an awareness of water as a scarce resource should be fostered.

3.2 The Centre, the States and the local bodies (governance institutions) must ensure access to a minimum quantity of potable water for essential health and hygiene to all its citizens, available within easy reach of the household.

3.3 Ecological needs of the river should be determined, through scientific study, recognizing that the natural river flows are characterized by low or no flows, small floods (freshets), large floods, etc., and should accommodate developmental needs. A portion of river flows should be kept aside to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use.

3.4 Rivers and other water bodies should be considered for development for navigation as far as possible and all multipurpose projects over water bodies should keep navigation in mind right from the planning stage.

3.5 In the water rich eastern and north eastern regions of India, the water use infrastructure is weak and needs to be strengthened in the interest of food security.

3.6 Community should be sensitized and encouraged to adapt first to utilization of water as per local availability of waters, before providing water through long distance transfer. Community based water management should be institutionalized and strengthened.

4. ADAPTATION TO CLIMATE CHANGE

4.1 Climate change is likely to increase the variability of water resources affecting human health and livelihoods. Therefore, special impetus should be given towards mitigation at micro level by enhancing the capabilities of community to adopt climate resilient technological options.

4.2 The anticipated increase in variability in availability of water because of climate change should be dealt with by increasing water storage in its various forms, namely, soil moisture, ponds, ground water, small and large reservoirs and their combination. States should be incentivized to increase water storage capacity, which inter-alia should include revival of traditional water harvesting structures and water bodies.

4.3 The adaptation strategies could also include better demand management, particularly, through adoption of compatible agricultural strategies and cropping patterns and improved water application methods, such as land leveling and/or drip / sprinkler irrigation as they enhance the water use efficiency, as also, the capability for dealing with increased variability because of climate change. Similarly, industrial processes should be made more water efficient.

4.4 Stakeholder participation in land-soil-water management with scientific inputs from local research and academic institutions for evolving different agricultural strategies, reducing soil erosion and improving soil fertility should be promoted. The specific problems of hilly areas like sudden run off, weak water holding capacity of soil, erosion and sediment transport and recharging of hill slope aquifers should be adequately addressed.

4.5 Planning and management of water resources structures, such as, dams, flood embankments, tidal embankments, etc., should incorporate coping strategies for possible climate changes. The acceptability criteria in regard to new water resources projects need to be re-worked in view of the likely climate changes

5. ENHANCING WATER AVAILABLE FOR USE

5.1 The availability of water resources and its use by various sectors in various basin and States in the country need to be assessed scientifically and reviewed at periodic intervals, say, every five years. The trends in water availability due to various factors including climate change must be assessed and accounted for during water resources planning.

5.2 The availability of water is limited but the demand of water is increasing rapidly due to growing population, rapid urbanization, rapid industrialization and economic development. Therefore, availability of water for utilization needs to be augmented to meet increasing demands of water. Direct use of rainfall, desalination and avoidance

of inadvertent evapo-transpiration are the new additional strategies for augmenting utilizable water resources.

5.3 There is a need to map the aquifers to know the quantum and quality of ground water resources (replenishable as well as non-replenishable) in the country. This process should be fully participatory involving local communities. This may be periodically updated.

5.4 Declining ground water levels in over-exploited areas need to be arrested by introducing improved technologies of water use, incentivizing efficient water use and encouraging community based management of aquifers. In addition, where necessary, artificial recharging projects should be undertaken so that extraction is less than the recharge. This would allow the aquifers to provide base flows to the surface system, and maintain ecology.

5.5 Inter-basin transfers are not merely for increasing production but also for meeting basic human need and achieving equity and social justice. Inter-basin transfers of water should be considered on the basis of merits of each case after evaluating the environmental, economic and social impacts of such transfers.

5.6 Integrated Watershed development activities with groundwater perspectives need to be taken in a comprehensive manner to increase soil moisture, reduce sediment yield and increase overall land and water productivity. To the extent possible, existing programs like MGNREGA may be used by farmers to harvest rain water using farm ponds and other soil and water conservation measures.

6. DEMAND MANAGEMENT AND WATER USE EFFICIENCY

6.1 A system to evolve benchmarks for water uses for different purposes, i.e., water footprints, and water auditing should be developed to promote and incentivize efficient use of water. The 'project' and the 'basin' water use efficiencies need to be improved through continuous water balance and water accounting studies. An institutional arrangement for promotion, regulation and evolving mechanisms for efficient use of water at basin/sub-basin level will be established for this purpose at the national level.

6.2 The project appraisal and environment impact assessment for water uses, particularly for industrial projects, should, inter-alia, include the analysis of the water footprints for the use.

6.3 Recycle and reuse of water, including return flows, should be the general norm.

6.4 Project financing should be structured to incentivize efficient & economic use of water and facilitate early completion of ongoing projects.

6.5 Water saving in irrigation use is of paramount importance. Methods like aligning cropping pattern with natural resource endowments, micro irrigation (drip, sprinkler, etc.), automated irrigation operation, evaporation-transpiration reduction, etc., should be encouraged and incentivized. Recycling of canal seepage water through conjunctive ground water use may also be considered.

6.6 Use of very small local level irrigation through small bunds, field ponds, agricultural and engineering methods and practices for watershed development, etc, need to be encouraged. However, their externalities, both positive and negative, like reduction of sediments and reduction of water availability, downstream, may be kept in view.

6.7 There should be concurrent mechanism involving users for monitoring if the water use pattern is causing problems like unacceptable depletion or building up of ground waters, salinity, alkalinity or similar quality problems, etc., with a view to planning appropriate interventions.

7. WATER PRICING

7.1 Pricing of water should ensure its efficient use and reward conservation. Equitable access to water for all and its fair pricing, for drinking and other uses such as sanitation, agricultural and industrial, should be arrived at through independent statutory Water Regulatory Authority, set up by each State, after wide ranging consultation with all stakeholders.

7.2 In order to meet equity, efficiency and economic principles, the water charges should preferably / as a rule be determined on volumetric basis. Such charges should be reviewed periodically.

7.3 Recycle and reuse of water, after treatment to specified standards, should also be incentivized through a properly planned tariff system.

7.4 The principle of differential pricing may be retained for the pre-emptive uses of water for drinking and sanitation; and high priority allocation for ensuring food security and supporting livelihood for the poor. Available water, after meeting the above needs, should increasingly be subjected to allocation and pricing on economic principles so that water is not wasted in unnecessary uses and could be utilized more gainfully.

7.5 Water Users Associations (WUAs) should be given statutory powers to collect and retain a portion of water charges, manage the volumetric quantum of water allotted to them and maintain the distribution system in their jurisdiction. WUAs should be given the freedom to fix rates subject to floor rates determined by WRAs.

7.6 The over-drawal of groundwater should be minimized by regulating the use of electricity for its extraction. Separate electric feeders for pumping ground water for agricultural use should be considered.

8. CONSERVATION OF RIVER CORRIDORS, WATER BODIES AND INFRASTRUCTURE

8.1 Conservation of rivers, river corridors, water bodies and infrastructure should be undertaken in a scientifically planned manner through community participation. The storage capacities of water bodies and water courses and/or associated wetlands, the flood plains, ecological buffer and areas required for specific aesthetic

recreational and/or social needs may be managed to the extent possible in an integrated manner to balance the flooding, environment and social issues as per prevalent laws through planned development of urban areas, in particular.

8.2 Encroachments and diversion of water bodies (like rivers, lakes, tanks, ponds, etc.) and drainage channels (irrigated area as well as urban area drainage) must not be allowed, and wherever it has taken place, it should be restored to the extent feasible and maintained properly.

8.3 Urban settlements, encroachments and any developmental activities in the protected upstream areas of reservoirs/water bodies, key aquifer recharge areas that pose a potential threat of contamination, pollution, reduced recharge and those endanger wild and human life should be strictly regulated.

8.4 Environmental needs of Himalayan regions, aquatic eco-system, wet lands and embanked flood plains need to be recognized and taken into consideration while planning.

8.5 Sources of water and water bodies should not be allowed to get polluted. System of third party periodic inspection should be evolved and stringent punitive actions be taken against the persons responsible for pollution.

8.6 Quality conservation and improvements are even more important for ground waters, since cleaning up is very difficult. It needs to be ensured that industrial effluents, local cess pools, residues of fertilizers and chemicals, etc., do not reach the ground water.

8.7 The water resources infrastructure should be maintained properly to continue to get the intended benefits. A suitable percentage of the costs of infrastructure development may be set aside along with collected water charges, for repair and maintenance. Contract for construction of projects should have inbuilt provision for longer periods of proper maintenance and handing over back the infrastructure in good condition.

8.8 Legally empowered dam safety services need to be ensured in the States as well as at the Centre. Appropriate safety measures, including downstream flood management, for each dam should be undertaken on top priority.

9. PROJECT PLANNING AND IMPLEMENTATION

9.1 Considering the existing water stress conditions in India and the likelihood of further worsening situation due to climate change and other factors, water resources projects should be planned as per the efficiency benchmarks to be prescribed for various situations.

9.2 Being inter-disciplinary in nature, water resources projects should be planned considering social and environmental aspects also in addition to techno-economic considerations in consultation with project affected and beneficiary families. The integrated water resources management with emphasis on finding reasonable and

generally acceptable solutions for most of the stakeholders should be followed for planning and management of water resources projects.

9.3 Considering the heavy economic loss due to delay in implementation of projects, all clearances, including environmental and investment clearances, be made time bound.

9.4 Concurrent monitoring at project, State and the Central level should be undertaken for timely interventions to avoid time and cost over-runs.

9.5 All components of water resources projects should be planned and executed in a pari-passu manner so that intended benefits start accruing immediately and there is no gap between potential created and potential utilized.

9.6 Local governing bodies like Panchayats, Municipalities, Corporations, etc., and Water Users Associations, wherever applicable, should be involved in planning of the projects. The unique needs and aspirations of the Scheduled caste and Scheduled Tribes, women and other weaker sections of the society should be given due consideration.

9.7 All water resources projects, including hydro power projects, should be planned to the extent feasible as multi-purpose projects with provision of storage to derive maximum benefit from available topology and water resources.

10. MANAGEMENT OF FLOOD & DROUGHT

10.1 While every effort should be made to avert water related disasters like floods and droughts, through structural and non-structural measures, emphasis should be on preparedness for flood / drought with coping mechanisms as an option. Greater emphasis should be placed on rehabilitation of natural drainage system.

10.2 Land, soil, energy and water management with scientific inputs from local, research and scientific institutions should be used to evolve different agricultural strategies and improve soil and water productivity to manage droughts. Integrated farming systems and non-agricultural developments may also be considered for livelihood support and poverty alleviation.

10.3 In order to prevent loss of land eroded by the river, which causes permanent loss, revetments, spurs, embankments, etc., should be planned, executed, monitored and maintained on the basis of morphological studies. This will become increasingly more important, since climate change is likely to increase the rainfall intensity, and hence, soil erosion.

10.4 Flood forecasting is very important for flood preparedness and should be expanded extensively across the country and modernized using real time data acquisition system and linked to forecasting models. Efforts should be towards developing physical models for various basin sections, which should be linked to each other and to medium range weather forecasts to enhance lead time.

10.5 Operating procedures for reservoirs should be evolved and implemented in such a manner to have flood cushion and to reduce trapping of sediment during flood season. These procedures should be based on sound decision support system.

10.6 Protecting all areas prone to floods and droughts may not be practicable; hence, methods for coping with floods and droughts have to be encouraged. Frequency based flood inundation maps should be prepared to evolve coping strategies, including preparedness to supply safe water during and immediately after flood events. Communities need to be involved in preparing an action plan for dealing with the flood/ drought situations.

10.7 To increase preparedness for sudden and unexpected flood related disasters, dam/embankment break studies, as also preparation and periodic updating of emergency action plans / disaster management plans should be evolved after involving affected communities. In hilly reaches, glacial lake outburst flood and landslide dam break floods studies with periodic monitoring along with instrumentation, etc., should be carried out.

11. WATER SUPPLY AND SANITATION

11.1 There is a need to remove the large disparity between stipulations for water supply in urban areas and in rural areas. Efforts should be made to provide improved water supply in rural areas with proper sewerage facilities. Least water intensive sanitation and sewerage systems with decentralized sewage treatment plants should be incentivized.

11.2 Urban and rural domestic water supply should preferably be from surface water in conjunction with groundwater and rainwater. Where alternate supplies are available, a source with better reliability and quality needs to be assigned to domestic water supply. Exchange of sources between uses, giving preference to domestic water supply should be possible. Also, reuse of urban water effluents from kitchens and bathrooms, after primary treatment, in flush toilets should be encouraged, ensuring no human contact.

11.3 Urban domestic water systems need to collect and publish water accounts and water audit reports indicating leakages and pilferages, which should be reduced taking into due consideration social issues.

11.4 In urban and industrial areas, rainwater harvesting and de-salinization, wherever techno-economically feasible, should be encouraged to increase availability of utilizable water. Implementation of rainwater harvesting should include scientific monitoring of parameters like hydrogeology, groundwater contamination, pollution and spring discharges.

11.5 Urban water supply and sewage treatment schemes should be integrated and executed simultaneously. Water supply bills should include sewerage charges.

11.6 Industries in water short regions may be allowed to either withdraw only the make up water or should have an obligation to return treated effluent to a specified standard back to the hydrologic system. Tendencies to unnecessarily use more

water within the plant to avoid treatment or to pollute ground water need to be prevented.

11.7 Subsidies and incentives should be implemented to encourage recovery of industrial pollutants and recycling / reuse, which are otherwise capital intensive.

12. INSTITUTIONAL ARRANGEMENTS

12.1 There should be a forum at the national level to deliberate upon issues relating to water and evolve consensus, co-operation and reconciliation amongst party States. A similar mechanism should be established within each State to amicably resolve differences in competing demands for water amongst different users of water, as also between different parts of the State.

12.2 A permanent Water Disputes Tribunal at the Centre should be established to resolve the disputes expeditiously in an equitable manner. Apart from using the „good offices" of the Union or the State Governments, as the case may be, the paths of arbitration and mediation may also to be tried in dispute resolution.

12.3 Water resources projects and services should be managed with community participation. For improved service delivery on sustainable basis, the State Governments / urban local bodies may associate private sector in public private partnership mode with penalties for failure, under regulatory control on prices charged and service standards with full accountability to democratically elected local bodies.

12.4 Integrated Water Resources Management (IWRM) taking river basin / sub-basin as a unit should be the main principle for planning, development and management of water resources. The departments / organizations at Centre / State Governments levels should be restructured and made multi-disciplinary accordingly.

12.5 Appropriate institutional arrangements for each river basin should be developed to collect and collate all data on regular basis with regard to rainfall, river flows, area irrigated by crops and by source, utilizations for various uses by both surface and ground water and to publish water accounts on ten daily basis every year for each river basin with appropriate water budgets and water accounts based on the hydrologic balances. In addition, water budgeting and water accounting should be carried out for each aquifers.

12.6 Appropriate institutional arrangements for each river basin should also be developed for monitoring water quality in both surface and ground waters.

12.7 States should be encouraged and incentivized to undertake reforms and progressive measures for innovations, conservation and efficient utilization of water resources.

13. TRANS-BOUNDARY RIVERS

13.1 Even while accepting the principle of basin as a unit of development, on the basis of practicability and easy implementability, efforts should be made to enter into

international agreements with neighbouring countries on bilateral basis for exchange of hydrological data of international rivers on near real time basis.

13.2 Negotiations about sharing and management of water of international rivers should be done on bilateral basis in consultative association with riparian States keeping paramount the national interest. Adequate institutional arrangements at the Center should be set up to implement international agreements.

14. DATABASE & INFORMATION SYSTEM

14.1 All hydrological data, other than those classified on national security consideration, should be in public domain. However, a periodic review for further declassification of data may be carried out. A National Water Informatics Center should be established to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing, and maintain in open and transparent manner on a GIS platform.

14.2 In view of the likely climate change, much more data about snow and glaciers, evaporation, tidal hydrology and hydraulics, river geometry changes, erosion, sedimentation, etc. needs to be collected. A programme of such data collection needs to be developed and implemented.

14.3 All water related data, like rainfall, snowfall, geo-morphological, climatic, geological, surface water, ground water, water quality, ecological, water extraction and use, irrigated area, glaciers, etc., should be integrated with well defined procedures and formats to ensure online updation and transfer of data to facilitate development of database for informed decision making in the management of water.

15. RESEARCH & TRAINING NEEDS

15.1 Continuing research and advancement in technology shall be promoted to address issues in the water sector in a scientific manner. Innovations in water resources sector should be encouraged, recognized and awarded.

15.2 It is necessary to give adequate grants to the States to update technology, design practices, planning and management practices, preparation of annual water balances and accounts for the site and basin, preparation of hydrologic balances for water systems, benchmarking and performance evaluation.

15.3 It needs to be recognized that the field practices in the water sector in advanced countries have been revolutionized by advances in information technology and analytical capabilities. A re-training and quality improvement programme for water planners and managers at all levels in India, both in private and public sectors, needs to be undertaken.

15.4 An autonomous center for research in water policy should also be established to evaluate impacts of policy decisions and to evolve policy directives for changing scenario of water resources.

15.5 To meet the need of the skilled manpower in the water sector, regular training and academic courses in water management should be promoted. These training and academic institutions should be regularly updated by developing infrastructure and promoting applied research, which would help to improve the current procedures of analysis and informed decision making in the line departments and by the community. A national campaign for water literacy needs to be started for capacity building of different stakeholders in the water sector.

16. IMPLEMENTATION OF NATIONAL WATER POLICY

16.1 National Water Board should prepare a plan of action based on the National Water Policy, as approved by the National Water Resources Council, and to regularly monitor its implementation.

16.2 The State Water Policies may need to be drafted/revised in accordance with this policy keeping in mind the basic concerns and principles as also a unified national perspective.

In addition to the National Water Policy, a number of other bills however in model stage or draft bill stage is placed for it to become an act for the states to adopt it. These bills have been discussed in the following section.

1. Model Bill for Flood Plain Zoning, 1975

A Model Bill for Flood Plain Zoning was formulated on creating flood plain zones was circulated to all the states in 1975. The Model Bill provides for flood zoning authorities, surveys and delineation of floodplain area, notification of limits of floodplains, prohibition or restriction of the use of the floodplains, compensation and power to remove obstructions.

According to the bill:

a. The state government shall appoint the Collector of the District or such other authority as the Flood Zoning authority for the purposes of making a survey of the area.

b. The Flood Zoning Authority shall carry out surveys of flood plains of the rivers and determine the nature and the extend of flood plains of the rivers.

c. The Flood Zoning authority shall, on the basis of the survey, establish flood plain zones and delineate the areas which are subject to flooding including classification of land with reference to relative risk of flood plain use intended to safeguard the health, safety and property of the general public.

d. The Flood Zoning Authority shall exhibit records, charts, maps, registers and such other documents showing the river channel, flood channel and the flood plain area, specifying the nature and extent to which the use of limits of the area is either prohibited or restricted.

e. The State Govt. shall delineate and limit the areas to be the flood plain and the limits shall be marked either by boundary stones or other suitable marks.

The bill was circulated by the Union Government in 1975 to all the States. There has been resistance on the part of the States to follow the various aspects of flood plain management including possible legislation. The State of Manipur, Rajasthan and Uttarakhand have enacted the flood plain zoning legislation but the demarcation of flood zones/enforcement etc. is yet to be done. Other States are yet to take action for enactment of legislation. In fact, Government of India has been time and again impressing upon the States to adopt flood plain zoning.

2. Draft National Water Framework Bill, 2016

A Draft National Water Framework Bill was framed in 2016. The objective behind framing this bill was to conserve, manage, protect and regulate the use of water.

Section 20 deals with "Flood Mitigation and Management" -

(1) The Central Government shall develop a Decision Support System (DSS) for flood forecasting and flood inundation under the National Water Informatics Centre (NWIC).

(2) Each State Government shall also develop their own DSS to address state specific issues.

(3) The NWIC shall ensure that the central DSS and that of each State is provided adequate and effective linkage

(4) The appropriate Government shall strive towards mitigating water related disasters like floods, through structural and non-structural measures, with emphasis on flood plain zoning, rehabilitation of natural drainage systems, coping mechanisms and preparation and periodic updating of emergency action plans/disaster management plans

(5) The appropriate Government shall expand flood forecasting extensively across the country and modernize flood forecasting using real time data acquisition system and linked to forecasting models.

(6) The appropriate Government shall ensure that land use practices are such as to minimize and not aggravate the adverse impacts of floods, including by ensuring that interference in or encroachment upon natural channels and drainage paths are avoided.

(7) Operating procedures for reservoirs shall be evolved and implemented in such a manner to have flood cushion with adequate advance warning to downstream regions and to reduce trapping of sediment during flood season on the basis of sound decision support system.

Apart from the above-mentioned theme of flood management in the Draft National Water Framework Bill 2016, it also mentions the following related to water management in India.

- Conservation and restoration of the river basins by including participatory watershed management. It also mentions to have watershed development at Panchayat or Municipality level and further at sub basin and basin level.

- Operating procedures for reservoirs should be evolved and implemented to have flood cushion with adequate advance warning to downstream regions and to reduce trapping of sediment during flood season.
- Removal of obstructions of water bodies and water sources, including their catchment areas.
- Planning and management of water infrastructure, such as, dams, flood embankments, tidal embankments.
- It emphasizes on flood plain zoning as a non-structural measure for mitigating floods.
- Expansion of flood forecasting extensively across the country and modernize flood forecasting using real time data acquisition system and linked to forecasting models as a measure to mitigate floods. It also emphasizes on preparation and periodic updating of emergency action plans/disaster management plans as a measure to mitigate floods.
- It also focusses on making sure that land use practices are such as to minimize and not aggravate the adverse impacts of floods, including by ensuring that interference in or encroachment upon natural channels and drainage paths are avoided and where water sources, catchments, drainage paths, river flows, water bodies, aquifers, wetlands, flood plains or riverbeds have already been encroached upon or interfered with, efforts shall be made to stop further encroachment or interference and reverse the adverse impact already made, to the utmost extent possible.
- The Draft National Water Framework Bill discusses "The appropriate government shall establish a regular system for water related data sharing, sensitization and capacity building of Gram Panchayats, and WUAs and for their involvement in planning and implementation of water resources projects so as to ensure sustainable management of water and improvement of water quality." However, there is no mention of training and capacity building for flood related scenarios.
- Addresses the need for establishment of River Basin Authorities for inter-state river basin by the Central Government. The River Basin Authority shall be responsible for creation of a Master Plan for the river basin for efficient utilization of water resources.

However, the following things were not mentioned in the draft bill

- Coastal flooding and ways to mitigate it. It only mentions river rejuvenation systems through community participation through "clean and aesthetic river banks with ecological integrity, keeping the river banks as close as possible to

natural conditions along with riparian vegetation in the midlands and plains and mangroves in the coastal areas."

- Flood frequency-based inundation mapping.
- Flood insurance as a means to reduce the financial burden both on the government and the population at risk.

ANNEXURE C

Notification chart for dissemination of flood forecast by CWC Control Rooms

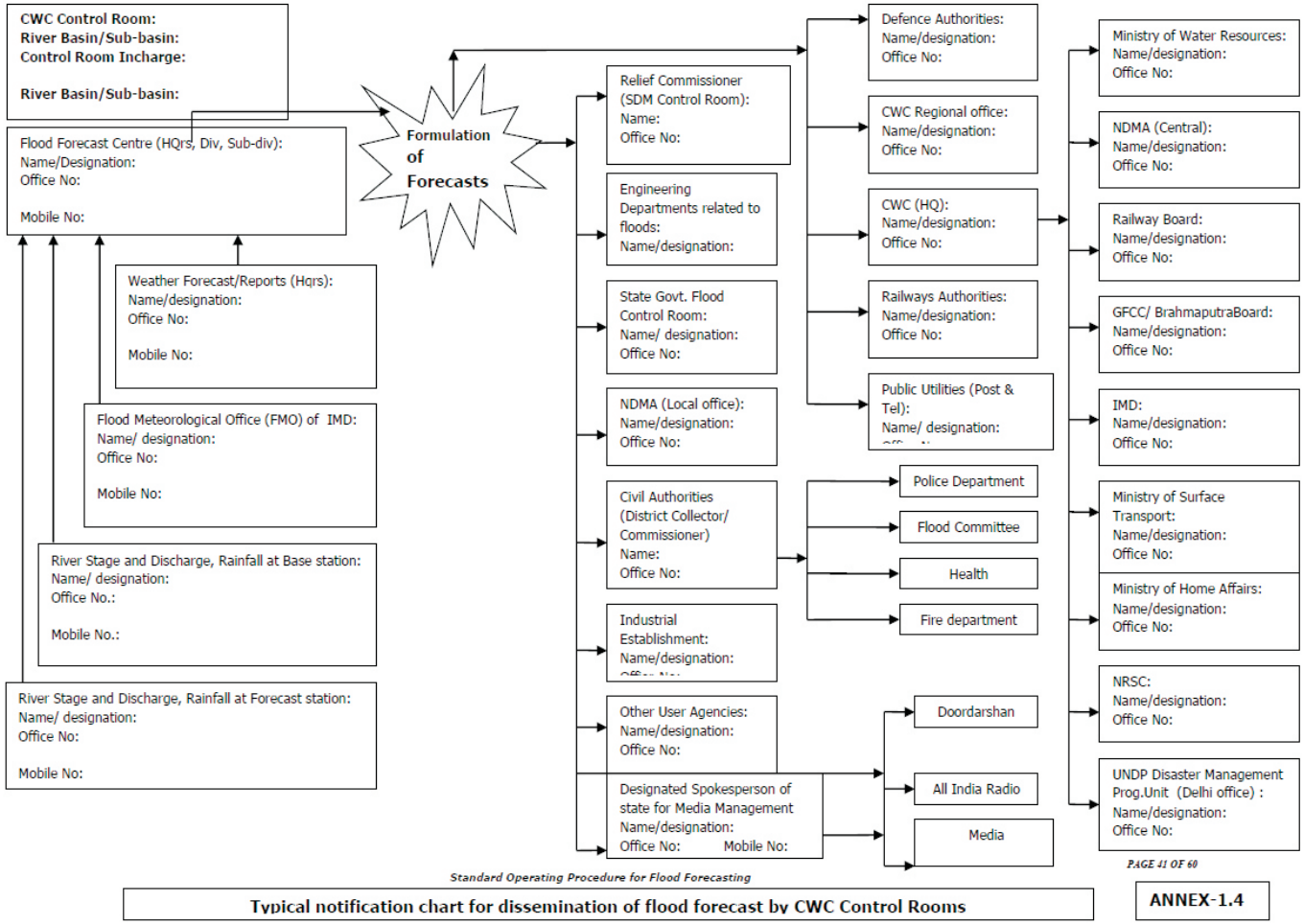


Figure 12 : Notification chart for dissemination of flood forecast by CWC Control Rooms;
(Source: Central Water Commission, 2020)

ANNEXURE D

Flood Hazard Maps

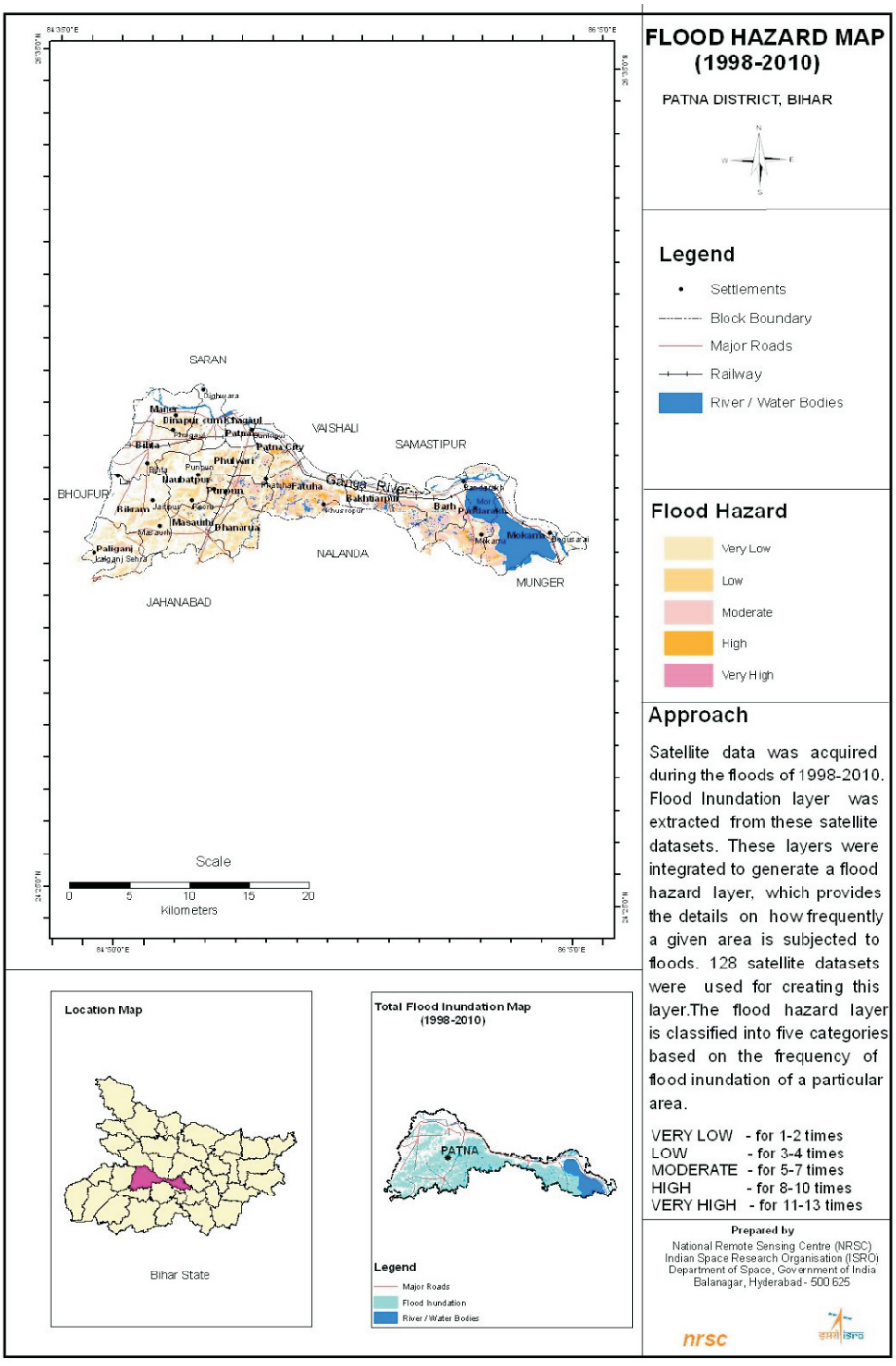


Figure 13: Flood hazard map for Patna district of Bihar,
(Source: Bihar State Disaster Management Authority, n.d.)

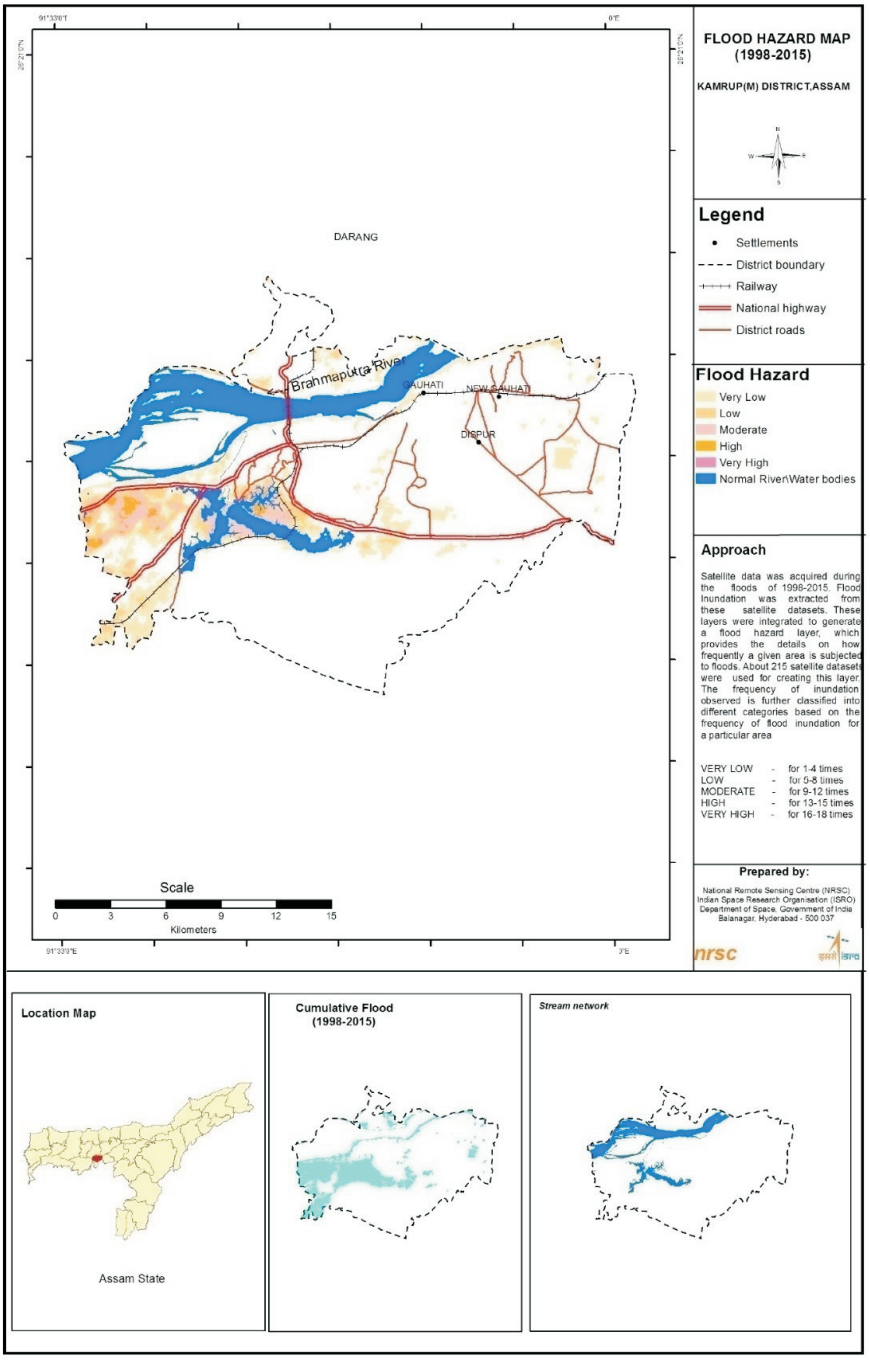


Figure 14: Flood hazard map for Kamrup (M) district of Assam,
(Source: National Remote Sensing Centre, 2016)

ANNEXURE E

Flood Control Order for the district of Gurugram

Government of Haryana

Department of Revenue & Disaster Management

FLOOD CONTROL ORDER
DISTRICT GURUGRAM
2020-21

PREPARED BY

Sh. Basti Ram
District Revenue Officer
Gurugram

Sh. Amit Khatri, IAS
Deputy Comissioner
Gurugram

DISTRICT DISASTER MANAGEMENT AUTHORITY
ROOM NO.208A IInd FLOOR MINI SECRETARIATE NEAR RAJIV CHOWK
GURUGRAM-122001

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1 Introduction

1.1 General Information

The District of Gurugram has been in existence since the times of Mahabharata. It was earlier known as Guru-gram, a name derived from the name of Guru Dronacharya. In the course of time the name got distorted to Gurrgram. With decay of Mughal Empire, the District remained in a turbulent state till 1803 AD and thereafter most of it came under the British rule through the treaty of Surji Arjungaon with Sindhiya. In Later on in 1861 the District was rearranged into five tehsils Gurugram, F.P. Jhirka, Nuh, Palwal and Rewari.

Since the beginning of the twentieth century various changes have occurred in the territorial composition of the District. In 1912, a part of Ballabhgarh tehsil was transferred to Gurugram District. Under the province and state order 1950, 9 villages of the District including Shahjahanpur were transferred to Rajasthan, and with merger of Pataudi State it gained two villages from Rajasthan and 78 villages from PEPSU. In 1972, Rewari tehsil was removed from Gurugram and got included in Mahendragarh District. In 1934, thrity four villages were excluded from Palwal tehsil. On 15 August, 1979, a new District Faridabad, consisting of tehsils of Ballabhgarh and Palwal, was formed out of Gurugram District. On 4th April, 2005, Mewat District has been carved out of Gurugram District.

1.2 District Profile

1.2.1 Location and Boundaries

Gurugram District falls in the southern most region of the state of Haryana. Its headquarters is at Gurugram. It lies in between the 27° 27' 20" and 28° 32'25'' latitude, and 76° 39' 39'' and 77° 20' 50'' longitude. Being in the vicinity of Delhi, Gurugram falls under National Capital Region. On its north, it is bounded by the District of Jhajjar and National Capital Territory of Delhi; Faridabad District lies to its east; Palwal District lies to its south east. On south it shares boundaries with Mewat whereas Rewari lies to its west. To its South, lies the state of Rajasthan. The District spreads over 1254 sq. km.

1.2.2 Population

Table 1.1: Population Details of District

Gurugram	Total	Male	Female
District Population	**15,14,085**	**81,7274**	**6,96,811**
Rural Population	4,72,085	2,51,520	2,20,565
Urban Population	10,42,000	5,65,754	4,76,246
0-6 Age Group Population	**1,98,299**	**1,08,591**	**89,708**
Rural Population	66,381	36,950	29,431
Urban Population	1,31,435	71,362	60,073
Literate Population	**11,11,042**	**6,39,969**	**4,71,073**
Rural Population	3,29,009	1,95,928	1,33,081
Urban Population	7,82,499	4,44,042	3,38,475

Source: Census 2011(P)

1.2.3 Administrative setup of the District

Table 1.2: District Organizational Structure

Assembly Constituencies	Sub-Division	Tehsil	Sub-Tehsil	Blocks	No. of Villages Tehsil - Sub Tehsil wise	Municipal Corporation /Committee /Council
1.Gurugram 2.Pataudi 3.Badshapur 4.Sohna	1.Gurugram 2.Pataudi 3.Badshapur 4.Sohna	1.Gurugram 2.Manesar 3.Pataudi 4.Sohna 5.Farrukhnagar 6. Wazirabad	1.Garhi-harsaru 2.Kadipur 3 .Badshapur	1.Gurugram 2.Pataudi 3.Sohna 4.Farrukhnagar	**Tehsil-** 1.Gurugram-14 2.Manesar- 39 3.Pataudi-68 4.Sohna-60 5.Farrukhnagar-40 6. Wazirabad-20 **Sub Teshil-** 1.Garhi harsaru-17 2.Kadipur-16 3 .Badshapur-17	1.Municipal Corporation, Gurugram 1.Municipal Council, Sohna 1.Municipal Committee Farrukhnagar 2.Municipal Committee, Haily Mandi 3.Municipal Committee, Pataudi

Source: District Revenue Office Gurugram

The Deputy Commissioner is the Chief District Officer of the Administration. He is assisted by Sub-Divisonal Magistrate heading a sub-division. The Additional Deputy Commissioner is in-charge of District Rural Development Agency for development of the District and is also nodal officer for Disaster Management in the District. Sectoral development is looked after by the District head of each development department. For the purpose of general as well as developmental view, the District has been divided into the District organizational structure as displayed in table 1.2.

1.3 Topography

The height above mean sea level of the District is 190 to 280 m. The District comprises of hills on the one hand and depressions on the other, forming irregular and diverse nature of topography. Two ridges i.e. Firojpur Jhirka-Delhi ridge forms the western boundary and Delhi ridge forms the eastern boundary of the District. These hills are northern continuation of Aravalli hills. The north-western part of the District is covered with sand dunes lying in the westerly direction due to south-western winds.

1.3.1 Soil

Major soil type in Gurugram is loamy sand soil which covers 101 thousands Ha constituting around 84.2 % of total geographical area. The alluvium in the area comprises silt, sand, gravel, clay and kankar.

1.4 Land Use and Land Cover

Table 1.3: Land Use and Land Cover Pattern

Land Use/ Cover	Area (Ha)	Percentage
Built –up	22567.1326	18
Agriculture	85000	67.78
Forest	2381.55	1.90
Wasteland	15190	12.11
Water Bodies	199.3174	0.16
Others	62	0.05
Total	125400	100

Source: Sub Regional Plan for Haryana Sub-Region of NCR-2021: Interim Report –

1.5 Climate

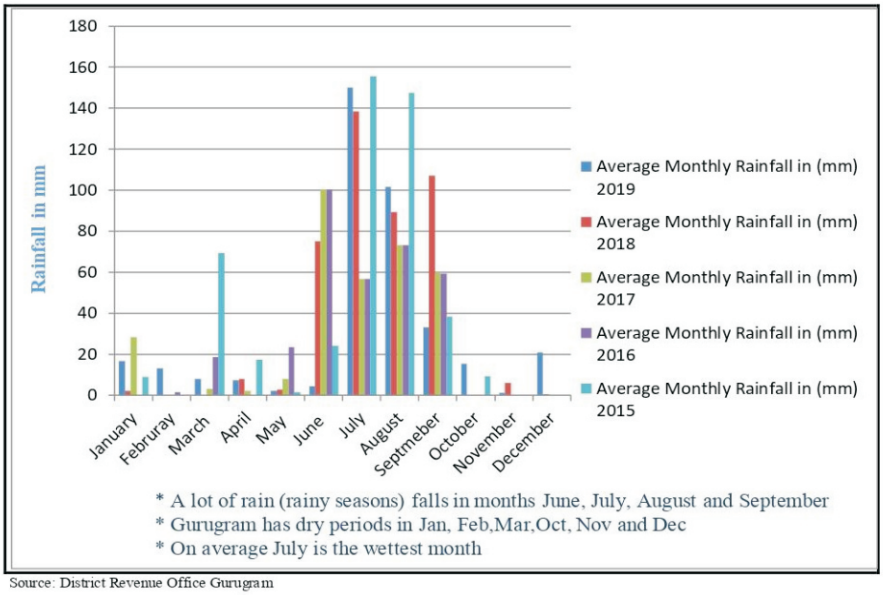
1.5.1 Temperature

The mean daily maximum temperature is about 41°C in the months of May and June. It may go up to 45°C or more in June. During winter the mean daily maximum temperature in January is 21°C and minimum is about 3-4°C. May and June are the hottest months and January is the coldest month.

1.5.2 Rainfall

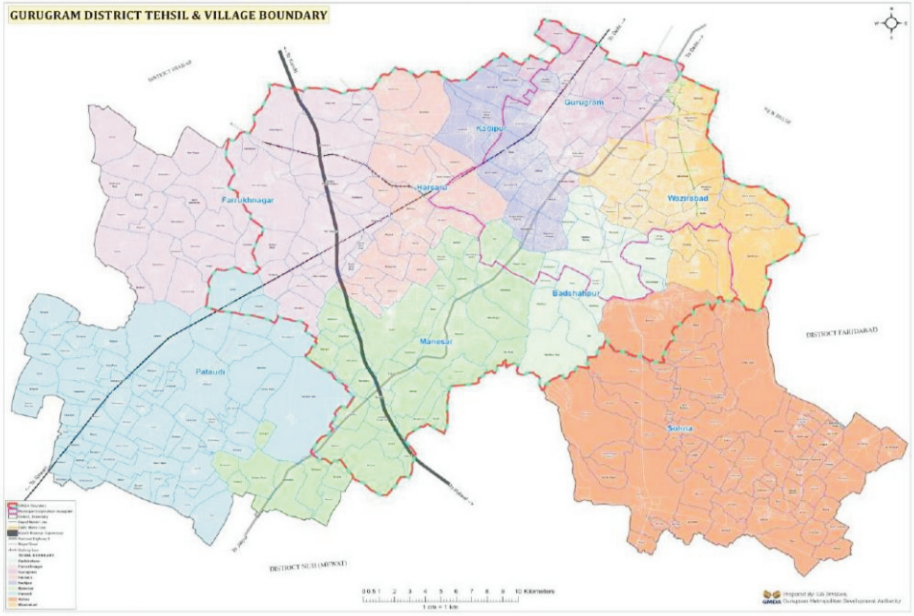
The District experiences dry air except during the monsoon, hot summer and cold winter. About 77 per cent of annual rainfall in the District is received during the monsoon months. The normal annual rainfall in Gurugram District is about 596 mm spread over 28 days. The south west monsoon sets in the last week of June and withdraws towards the end of September and contributes about 85% of the annual rainfall. July and August are the wettest months.15% of the annual rainfall occurs during the non-monsoon months in the wake of thunder storms and western disturbances. The month-wise distribution of rainfall over the past five years is displayed in fig. 1.1.

Fig. 1.1: Month wise Distribution of Rainfall (in MM) in District Gurugram



Source: District Revenue Office Gurugram

Fig.1.2: Details Map of Gurugram District



Source: GIS LAB, HARSAC, Gurugram

2 Drainage System of the District

2.1 Drainage Pattern

The drainage of the District is typical of the arid and semi arid areas. It comprises of large depressions and streams. The drainage is peculiarly complex owing to most of the streams tending to converge towards inland depressions instead of flowing into Yamuna. The important depression in the level of the district in this region is Najafgarh Lake. Sabi and Indrori are two important seasonal streams of the district.

2.1.1 Areas under Sabi River

These areas fall on the western side of Gurugram Tehsil. Sabi River is a powerful seasonal stream originating in the Aravali ranges falling in District Jaipur of Rajasthan and after travelling a distance of about 80 miles in Jaipur and Alwar Districts of Rajasthan, it enters Rewari Distirct in Haryana from the south -eastern directions and then runs towards Pataudi Tehsil of Gurugram District. After traversing across falls Pataudi Tehsil it enters in Drain No.8 in Jhajjar District. Drain No.8 falls enter in Najafgarh Jheel, from where the flood water go to Najafgarh Drain through Dhasa Bund Regulator (falling in Delhi state), from where the flood water ultimately join river Jamuna, Sabi is notorious for flashfloods as it flows on ground level and keeps on changing its course every year.

In addition, there are a number of rivulets in Rajasthan area, which ultimately fall in Sabi River. There are a series of Bandhs over those rivulets. In the season of heavy rains in catchment areas there is always a danger of breach of such Bundhs which further aggravates the might of Sabi Nadi.

A barrage namely "Massani Barrage" has been constructed on the Sabi Nadi by the H.N.A. Irrigation Department in 1982-83 near village Dharuhera on Delhi-Jaipur National Highway in District Rewari, for storage of water for Irrigation purpose besides moderation of floods caused by Sabi Nadi in District Rewari and Gurugram.

Apart from causing extensive damage in Pataudi Tehsil, Sabi Nadi also affects and inundates a number of villages of Gurugram Tehsil falling near Najafgarh Jheel area. This is because of the fact that when River Sabi and river Yamuna are simultaneously inspate, the Najafgarh drain starts back flowing causing accumulation of large quantity of water in Najafgarh Jheel. Spread of water in Najafgarh Jheel affects about 15 villages of Tehsil Gurugram for example, Jhanjrola, Mankrola, Ikbalpur, Kherki Majra, Chandu Budhera, Dharampur, Daultabad Jahazgarh, Kaliwas, Sultanpur, etc.).

There is a difference in the extent of damage caused by Sabi in Pataudi and Gurugram Tehsils whereas flooding in Pataudi area lasts for a fortnight only. The accumulation of water in the above mentioned villages of Gurugram Tehsil lasts for two to three months. These villages of Gurugram Tehsil get relief only when there is less pressure on Dhasa Bandh. As soon as flood starts receding in Yamuna, the Najafgarh Drain becomes capable of receiving larger quantities of water through Dhasa regulator and this whole process takes two to three months.

Coming to Pataudi Tehsil, Sabi flows under Delhi-Bikaner section of Northern Railway. As the river has been changing its course every year, the railway authorities have provided fifteen large and small bridges/culverts under the railway track spreading over a distance of about 15 k.m. between Khalilpur and Pataudi railway stations. Sabi brings and carries a large quantity of sand along with it resulting in silting of these culverts/bridges with the result that their discharge

capacity is reduced to a great extent. When all this happens, there is always a possibility of either accumulation of large quantity of water on the Southern side of the railway track or even threat of the breach of the railway track at so many places.

2.1.2 Areas under Indori River

Another source of flood in this area is Indori river. This is also a hill torrent which orginates in the hilly tract of Rajasthan falling between Tauru and Tijara. This rivulet enters Haryana near Tauru (in Mewat District) and after crossing Delhi-Jaipur National Highway near village Sidhrawali, it ultimately joins Sabi river beyond Pataudi. There are a series of moderate Bandhs over this rivulet, both in Alwar District of Rajasthan and Gurugram District of Haryana. During the season of heavy rain-fall in the catchment area, there is always a danger of breach of these bandhs which results in flooding of about 20 villages of Pataudi Tehsil.

From the year 1983-84 there is no accumulation of water in Dharuhera Bandh and no such threat of water or flood from this river wrong has happened so far.

2.1.3 Details of Link Drains

(I)	Nathupur -	Falling in to Najafgarh drain
(II)	Parasoli -	downstream of village Budhera.
(III)	Kaliyaka -	It covers Bijupur, Baikhera
(IV)	Outfall channel of RD 63015 GC	and Sarhol, Village of tehsil
		B.garh and village Sarmathla
(V)	Badshahpur- Tehsil Gurugram.	
(VI)	Sultanpur	
(VII)	Mohamadpur Link Drain	

3 Flood Risk in the District

3.1 Brief History of Past Floods in the District

During 1977 floods a large quantity of Sabi water was accumulated on one side of the railway track and sudden breach of railway line at a number of places resulted in severe damage to villages falling down-stream of Khalilpur Railway station. This also resulted in breach of Pataudi-Rewari road (which run almost parallel to the railway track) at a number of places.

3.2 Flood risk and causes of flood

The main cause of floods in the District can be attributed to the heterogeneous topography of the District. It consists of hillocks, valleys, big and small land-locked depressions and undulated terrain. Another interesting feature of the topography of the District is that no perennial river flows through it. However, there are a number of "Barsati Nallahs/hill torrents, that criss-cross the entire District. Besides these, rapid urbanization in the District has also lead to heavy pressure of infrastructural development over the natural drainage system, again leading to urban flooding. From the point of view of causes of floods, the whole District can be divided into two catchment areas based on two rivers as follows:-

3.2.1 Areas affected by Sabi River

These areas fall on the western side of Gurugram Tehsil. Sabi River is a powerful seasonal stream originating in the Aravali ranges falling in District Jaipur of Rajasthan and after travelling a distance of about 80 miles in Jaipur and Alwar Districts of Rajasthan, it enters Rewari Distirct in Haryana from the south -eastern directions and then runs towards Pataudi Tehsil of Gurugram District. After traversing across falls Pataudi Tehsil it enters in Drain No.8 in Jhajjar District. Drain No.8 falls enter in Najafgarh Jheel, from where the flood water go to Najafgarh Drain through Dhasa Bund Regulator (falling in Delhi state), from where the flood water ultimately join river Jamuna, Sabi is notorious for flashfloods as it flows on ground level and keeps on changing its course every year.

In addition, there are a number of rivulets in Rajasthan area, which ultimately fall in Sabi River. There are a series of Bandhs over those rivulets. In the season of heavy rains in catchment areas there is always a danger of breach of such Bundhs which further aggravates the might of Sabi Nadi.

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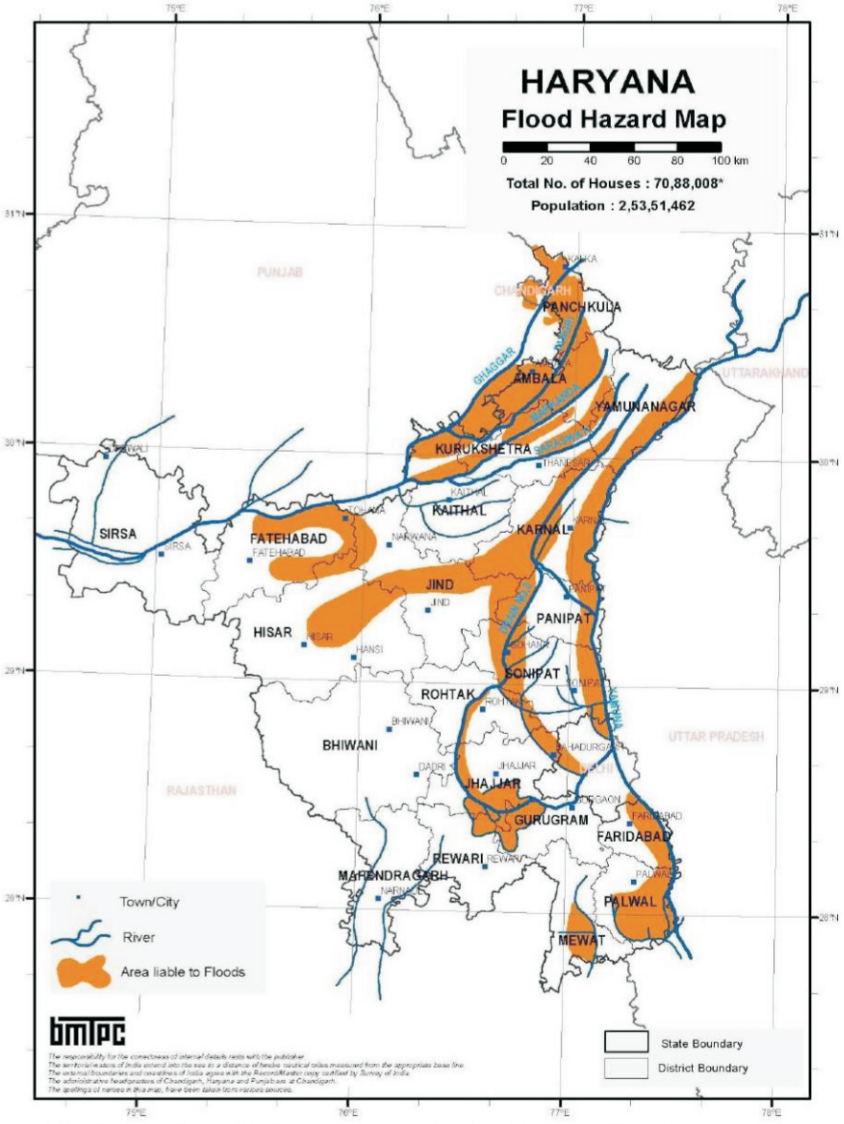
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From the year 1983-84 there is no accumulation of water in Dharuhera Bandh and no such threat of water or flood from this river wrong has happened so far.

Fig: 3.1 Flood Hazard map of the Haryana State



BMTPC : Vulnerability Atlas - 3rd Edition; Peer Group, MoHUA; Map is Based on digitised data of SOI, GOI; Census of India 2011; Flood Atlas (1987), Task Force Report (2004), C.W.C., G.O.I. Houses/Population as per Census 2011; * Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic representation

Fig: 3.2 Hazard Seasonality Map, Gurugram

Hazard	Probable Months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Earthquake												
Flood												
Drought												
Epidemics												
Food Poisoning												
Heat Wave												
Cold Wave												
Hailstorm												
Fire												
Industrial Hazards												
Radiations												
Accidents												
Terrorist Attack												
Legends	High Probability				Moderate Probability			Low/ Negligible Probability				

3.3 Flood prone area/vulnerable villages in the District

From the point of view of intensity of floods, the affected areas are classified into the following categories:

3.3.1 Dangerously exposed areas

3.3.2 List of Villages likely to be marooned

3.3.3 Moderately exposed areas

3.3.4 Urban areas

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3.3.1 Dangerously exposed Areas

Table 3.1 Tehsil-wise list of such areas is as follows

Sr. No.	Name of Tehsil	Name of Village	Causes of Flood
1.	Gurugram	1. Bajghera	Overflow of Najafgarh Drain
		2. Chandu	
		3. Budhera	
		4. Daultabad	
2.	Farrukhnagar	1. Sultanpur	
		2. Kaliawas	
		3. Jhanjrola	
3.	Sohna	1. Sarnathla	Overflow of Sarhala Drain
		2. Lohsingan	
		3. Ghangola	
4.	Pataudi	1. Khor	Overflow of Sabi and Indori River
		2. Goriawas	
		3. Khanpur	
		4. Hera Heri	
		5. Mumtazpur	
		6. Turkapur	
		7. Dewlawas	
		8. Mubarakpur	
		9. Muzaffra	
		10. Shahpur Jat	
		11. Inchapuri	
		12. Bapas	
		13. Barheri rehnwa	
		14. Khalilpur	
		15. Ghilnawas	
		16. Rajpura	
		17. Gudhana	
		18. Jasat	
		19. Brijpura	
		20. Chhawan	
		21. Mau	
		22. Lokra	
		23. Darapur	
		24. Baspadamka	
		25. Uncha Majra	
		26. Narhera	
		27. Bohra Khurd	
		28. Lokri	

3.3.2 List of villages likely to be marooned in the District

Table 3.2 List of villages likely to be marooned in case of floods SubTehsil Kadipur Gurugram and Pataudi

Sr. No.	Name of Tehsil	Name of Village
1.	Gurugram	Mohammadhari Daultabad
2.	Pataudi	Rajpur Jataula Khalilpur Bapas Mehniawas

3.3.3 Moderately exposed areas

Table 3.3 List of Moderately exposed areas

Sr. No.	Name of Tehsil	Name of Village	Causes of Flood
1.	Gurugram	Mohammadhari	Overflow of Najafgarh Drain
		Sadharana	
		Bhora Khurd	
		Rathiwas	
		Pathrari	
		Bhudka	
		Bilaspur	
2.	Farrukhnagar	Mubarakpur	Overflow of Najafgarh Drain
		Palri	Overflow of Sabi and Indori River
		Faridpur	
		Garhi Nathe Khan	Overflow of Sarhala Drain
		Alimuddinpur	
		Dooma	
		Baduna	
		Daboda	Overflow of Sabi and Indori River
		Rajpura	
		Tirpadi	
		Khurampur	

3.3.4 Urban Areas

Table 3.4 List of Identified Critical Points Prone to Storm Water Stagnation

Sr. No.	Location/Area	Zone	Ward
1	Shani Mandir Near Maruti, Old Delhi Road	II	02
2	Palam Vihar	II	02
3	Old Delhi Road, Near Sirhole Chowk, Jwala Mill, Sector- 22/23 Chowk	II	03
4	Sector-21, 22 & 23,	II	03
5	Atul Kataria Chowk, Old Delhi Road (LHS)	II	06
6	MDI Chowk	II	06
7	Old Dlf Colony Sector-14	II	06
8	Sector-14 Market	II	06
9	CRPF Chowk	II	08
10	Mata Mandir	II	08
11	Sector-5 Chowk	II	09

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12	Sector-4/7 and Laxman Vihar dividing Near MPS Dhanwapur	I	10
13	Rajendera Park, Mahalaxmi Garden, Councillor Wali Gali, Ekta Wali Gali,	I	11
14	Basai Road Near Flyover	I	12
15	Madanpuri, gali No. 1, 2, 3, 10 & 11	I	16
16	Near PHED Offive and Arjun Nagar	I	16
17	Mahavir Chowk	II	18
18	Bus Stand Road	II	18
19	Sector-31 near Silver Jubilee Park	II	19
20	Sector-15 Part-I & II Near Bandh	II	19
21	Housing Board Colony Near Patel Nagar	II	19
22	Civil Lines Near PHED Office	II	19
23	Khandsa Road near Subzi Mandi	I	23
24	Service Road on both sides of NH-48 Near Village Narsingpur	I/IV	24
25	Sohna Road near Govt. School Badshahpur	IV	25
26	Vatika Chowk	IV	25
27	CD School	IV	25
28	Ramgarh Ki dhani	IV	25
29	SPR near St. Xavier School	IV	26
30	Behrampur Road Near Ultratech RMC Plant	IV	26
31	Storm Water disposal in Sector-34 near Badshanpur Drain	IV	27
32	Underpass at Hero Honda Chowk	IV	27
33	Subhash Chowk	IV	28
34	Bakhatawar Chowk	III	28
35	Mayfield Garden Chowk near Cloud 9 Hospital Sector-46/47	IV	29
36	GH-01, Sector-56 Society	III	30
37	Sushant Lok-1, A & C-Block, near Community Centre	III	30
38	Ghata Village underpass, Sector-55	III	30
39	Culvert on Faridabad- Gurugram Road near Vally View Society	III	30
40	Huda City Centre	III	32
41	Gold Souk Chowk	III	32
42	Tempo Stand, Kanhai More	III	32
43	Sector-28 near Bandh	III	34
44	Ambedkar Bhawan, Harijan Basti, Nathupur	III	35

4 Flood Preparedness

4.1 Activities for Flood Preparedness

Department wise flood preparedness activities have been identified which are given below. It is also mentioned here that all the flood preparedness activities should be supervised by the concerned Deputy Commissioner.

✓ **Activities related to Revenue Department /Office of Deputy Commissioner**

1. **Trainings and Mock Drills** - Imparting trainings to all the concerned officers and staff on disaster management, SOPs etc shall be ensured.
2. **Inspection-** Inspection of Relief Stocks, Rescue Equipments and submit report to the Government.
3. **Evacuation Plan-** Prepare an evacuation plan for the flood prone areas.
4. **Joint Inspection** - Conduct Joint Inspection of flood prone areas in the District.
5. Inspect, Repair and Check culverts on railway lines in liaison with railways.
6. **Flood Control Order-** Preparation and review of Flood Control Order as per the format provided vide this office letter no ER-CBO-2015/4584 dated 17.04.2015. The updated Flood Control Order should be submitted at the State level by 15th May, 2020.
7. Circulation of Flood Control Order to all concerned offices, officers and Staff.
8. **Liaison-** Establish Liaison with army, railways, voluntary agencies, NGO's at local level.
9. Posting of Staff required for duty in flood affected areas touring and familiarizing with the area under charge of each of the officers in coordination with the concerned departments.
10. **Search and Rescue Teams-** The village level committee of concerned Patwari, Gram Sachiv, ANM, Asha Worker, Anganwari Worker and concerned Teacher of the school may be constituted for rural area and similar teams consisting of Councilors concerned Patwari, ANM, Anganwari worker, concerned Teacher, Tehsildar/Naib Tehsildar be constituted for the cities.
11. **Temporary Shelters & Relief Camps-** Identify the Safe School buildings/ Dharamshalas and other community structures for organizing relief camps for person evacuated from low lying areas. Review the adequacy of these shelters in the District. So, that those could be used in the event of floods for relocating peoples where seems necessary.
12. **Pre- Contract-** Prepare a list of relief material required in bulk during emergency response based on past experiences. It is also advised to enter into pre contract for the items which are not available within your jurisdiction to ensure the timely available of relief items.

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13. **Coordination-** Co-ordination with the adjoining District and state be got made on daily basis so that advance information about the floods could be received well in time.
14. **Identification of Nodal Officers-** Prepare a list of nodal officer in various departments of the District. The name, designation, telephone nos, Fax no and Email Address of identified nodal officer is to be prepared, printed and circulated to all concerned.

✓ **Activities related to Irrigation Department**

15. Inspect & strengthen all flood protection embankments, ring bunds and other bunds.
16. Inspect all drains, link drains through responsible officers & remove congestion.
17. Test Pump Houses & Mobile pumps and complete necessary repairs.
18. Complete all ongoing works on link drains, ring bunds.
19. Stock sufficient quantities of sand bags, ballies & material at (a) all villages protected by ring bunds (b) flood protection works.
20. Check Flood Warning Systems.
21. Inspect, Repair and Check culverts on canals.
22. The State/District authorities to be fore-warned 02-03 days before a river actually start rising at particular place after watching the rain and the inflow in the rivers.
23. To check all the vulnerable & problem points which cause flooding during the previous year.

✓ **Activities related to PWD (B&R) Department**

24. Inspect & strengthen & repair all approach roads to villages to ensure that the roads will remain open during floods.
25. Inspect & strengthen and repair all culverts on village approach roads so that drainage is not obstructed.
26. Inspect, Repair and Check culverts on highways and District roads.

✓ **Activities related to Police Department**

27. Identify and organise Police Patrolling on canal banks, embankments, roads etc which are usually cut by villagers during floods.
28. Provide mobile wireless sets to villages likely to be cut off.
29. Check and Repair communication, teleprinters and wireless systems.

✓ **Activities related to Health Department**

30. Stock sufficient quantity of Medicines and other medical stores at appropriate points

✓ **Activities related to Animal Husbandry Department**

31. Stock sufficient quantity of vaccine for cattle at appropriate points.

✓ **Activities related to Public Health Department/ HUDA/ Urban Local Bodies**

32. Stock sufficient quantity of Bleaching powders for disinfecting wells.
33. Supply of safe drinking water during crisis and transportation of drinking water.
34. Arrange adequate number of Pumps/hand pumps in villages/cities/town where wells/areas are likely to be flooded
35. Inspect Sewerage and storm channels of cities / town, remove congestion and obstructions, if any, and render them suitable for use in case of flooding.

✓ **Activities related to Power Department**

36. Inspection of Transmission lines, Electric poles etc. to ensure safety of people in flood marooned areas.

✓ **Activities related to Food & Supplies Department**

37. Identification of areas where floods are likely to cut off people from supply of essential commodities and making appropriate arrangements to ensure supply of food grains, kerosene oil, salt, edible oil and other necessities until the flood recede.
38. Any other activities which may help in mitigate the flood.

Note: As mentioned above points it is necessary to take effective measures of social distancing in regard to COVID-19 pandemic.

5 Ongoing Flood Protection Scheme in District

It is expected that the city of Gurugram will face a flash flood or storm water flood owing to more than average rainfall as predicted by Indian meteorological Department. As a consequence the peak flow across and along Badshahpur drain is estimated to beapproximately 1500 cusecs. Further, cleaning up and clearing impediments for water flow at upstream locations like Ghata is going to add to the pace of the flow. At the outset, khandsa forms the bottleneck with a capacity of less than 400 cusecs. While flowing through vatika chowk till NH 8, enormous inundation is expected in the intermediate region. It is also observed that since years there has been no desilting undertaken in storm water drains and other outflow points across the city. If it all they were major problems in managing storm water floods during 2015 monsoons, a lot should be attributed to this omission on the part of civic authorities and District Administration. Conceding on these omissions following strategy is to be adopted so that general public suffers from least of the predicaments during the monsoon season we are fast approaching.

5.1 List of Critical Points Prone to Storm Water Stagnation and Action Taken

Table 5.1 List of Identified Urban Areas in Gurugram & Action Taken by Irrigation Dept.

Sr. No.	Location/Area	Zone	Ward	Name of Concerned Department	Preventive steps taken to drain out the storm water during rains by the concerned organization
1	Shani Mandir Near Maruti, Old Delhi Road	II	02	MCG	The Storm water Drain is functional
2	Palam Vihar	II	02	MCG	Work of De-silting of storm water drain is completed.
3	Old Delhi Road, Near Sirhole Chowk, Jwala Mill, Sector- 22/23 Chowk	II	03	MCG	The road sides berms have been lowered down and the storm water will be passed through the master sewer line.
4	Sector-21, 22 & 23,	II	03	MCG	Work of De-silting of storm water drain is completed
5	Atul Kataria Chowk, Old Delhi Road (LHS)	II	06	MCG	The Storm water of LHS connected with main storm water drain on RHS and is functional.

6	MDI Chowk	II	06	MCG	The Storm water has been connected on other side of the road with Leg-II
7	Old Dlf Colony Sector-14	II	06	MCG	De-silting of drains had been completed and the rain water harvesting existing in the park adjoining to this drain had also been cleaned and is functional.
8	Sector-14 Market	II	06	MCG	New sewer line has been laid and the storm water will be drained through this sewer line.
9	CRPF Chowk	II	08	MCG	Storm water from RHS connected with Leg-II and problem had been resolved.
10	Mata Mandir	II	08	MCG	Storm water from RHS connected with Leg-II and problem had been resolved.
11	Sector-5 Chowk	II	09	MCG	The storm water had been connected in Leg-II and problem had been resolved.
12	Sector-4/7 and Laxman Vihar dividing Near MPS Dhanwapur	I	10	MCG	The storm water from all the leading roads and area of Laxman Vihar, Sector-4/7, Sector-7/7 Extn., Surya Vihar, Old Railway road, New Railway Road etc. reaches near MPS existing adjoining to Railway Line. A kachcha drain had been excavated upto the culvert under railway Line to drain off this huge quantity of storm water.
13	Rajendera Park, Mahalaxmi Garden, Councillor Wali Gali, Ekta Wali Gali,	I	11	MCG	Master drain under construction along Northern Peripheral Expressway. As there is no. outfall, Storm Water Discharge will be pumped into sewer master line.
14	Basai Road Near Flyover	I	12	MCG	Drain has been desalted. Further, discharge will be routed through Master sewer line ultimately connected to GDMA Master Line made functional.
15	Madanpuri, gali No. 1, 2, 3, 10 & 11	I	16	MCG	De-silting of storm water drain completed. 01 no. RWHs have also been newly installed which will drain out most of the discharge.
16	Near PHED Offive and Arjun Nagar	I	16	MCG	De-silting of storm water drain completed. 01 no. RWHs have also been newly installed which will drain out most of the discharge.

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17	Mahavir Chowk	II	18	MCG	De-silting of storm water drains is completed.
18	Bus Stand Road	II	18	MCG	De-silting of storm water drains is completed.
19	Sector-31 near Silver Jubilee Park	II	19	MCG/GDMA	The Work of construction of RCC storm water drain has been completed and connected to master storm water line being maintained by GDMA. By the construction of this storm water drains, the overflow of storm water from sec-31 into sec-15 part-II will be controlled
20	Sector-15 Part-I & II Near Bandh	II	19	MCG	The storm water will be drained off through the sewerage disposal existing in sec-15 part-I and sec-15 part-II (chandar Nagar). The overflow from sec-31 had been diverted by construction of RMC storm water drain and connection of the same has also been made in master storm drain.
21	Housing Board Colony Near Patel Nagar	II	19	MCG	Rain water Harvesting System had been provided.
22	Civil Lines Near PHED Office	II	19	MCG	The storm water has been de-silted and new Rain Water Harvesting system has also been provided near PHED office.
23	Khandsa Road near Subzi Mandi	I	23	MCG	The work of de-silting of storm water drain is completed.
24	Service Road on both sides of NH-48 Near Village Narsingpur	I/IV	24	NHAI	The de-silting work is in progress by NHAI and the motor pumps have been installed by NHAI and are functional.
25	Sohna Road near Govt. School Badshahpur	IV	25	GDMA/NHAI	Storm water drains are made functional.
26	Vatika Chowk	IV	25	NHAI	Storm water drains are made functional.
27	CD School	IV	25	NHAI	Storm water drains are made functional.
28	Ramgarh Ki dhani	IV	25	MCG/GDMA	Low lying area (assistance from GDMA is required for running of already installed disposal opposite to St.Xavier School).

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29	SPR near St. Xavier School	IV	26	GDMA	Storm water drains are made functional.
30	Behrampur Road Near Ultratech RMC Plant	IV	26	GDMA/MCG	Drain had been de-silted and connected to main drain on NH-48
31	Storm Water disposal in Sector-34 near Badshanpur Drain	IV	27	GDMA & MCG	The storm water disposal has been provided by NHAI as a deposit work of MCG with operation & maintenance to drain out the surplus water stagnated near Badshahpur Drain and is functional.
32	Underpass at Hero Honda Chowk	IV	27	NHAI/GDMA	The drainage system of all the four underpasses is with GDMA. The motor pumps have been installed along with gensets at Hero Hond Chowk by GMDA.
33	Subhash Chowk	IV	28	GDMA	The Storm water from all the leading roads i.e. from Cyber Park/Bakhtawar Chowk, Rajiv Chowk and Sohna Road reaches at Subhash Chowk. The de-silting of drains is being done by GMDA/MCG.
34	Bakhatawar Chowk	III	28	GDMA	The Storm water from all the three leading roads i.e. from Medicity, Cyber Park, Secor-46/47dividing road reaches at this chowk and the de-silting of drains have been completed by GMDA.
35	Mayfield Garden Chowk near Cloud 9 Hospital Sector-46/47	IV	29	GDMA	The work of de-silting of drain has been completed.
36	GH-01, Sector-56 Society	III	30	GDMA	The storm water of GH-01 Society has been made in the master storm water drain across the SPR and de-silting of manholes has been completed. Motor pumps has additional capacity to discharge the surplus storm water.
37	Sushant Lok-1, A & C-Block, near Community Centre	III	30	MCG	The de-silting work has been completed.
38	Ghata Village underpass, Sector-55	III	30	MCG	Submersible motor pump has been installed to drain out the surplus storm water.
39	Culvert on Faridabad-Gurugram Road Vally View Society	III	30	PWD/GDMA	The de-silting work of existing kachcha nala has been completed and is functional.

40	Huda City Centre	III	32	GDMA	The work of de-silting of drain has been completed.
41	Gold Souk Chowk	III	32	GDMA	The storm water from all the 04 leading roads reaches at this location. The de-silting work of drains has been completed.
42	Tempo Stand, Kanhai More	III	32	MCG	The de-silting of drains is completed.
43	Sector-28 near Bandh	III	34	MCG/GDMA	The de-silting work has been completed.
44	Ambedkar Bhawan, Harijan Basti, Nathupur	III	35	MCG	The de-silting work has been completed.

5.2 Procurement plan is in process by Water Services Mechanical Sub Division, Gurugram

Table 5.2 Flood agenda approved in 51st meeting of HSDR&FCB For the year 2020-21

Sr.no.	Description of material	Quantity	Estimated rate (INR)	Amount(in lacs)
1	Purchase of One Diesel Truck of payload 7.8 Ton with 17ft length full frame chasis (Eicher make)	1	16,00,000	16.00
	Purchase is in process		**Grand Total**	**16.00**

6 Flood Action Plan

6.1 Set up of Flood Control Room

There shall be a Central Control Room at the District headquarters and the same shall be located in the Office of the District Revenue Officer at Mini Secretariat, Gurugram 2nd Floor. It will functional on Telephone No. 0124-2322877 (Office), 2304444 (R).

Table no. 6.1 Details of District Control Room

S.No.	Site of Control Room	Officer In-charge	Telephone No.
1.	D.C. Office Gurugram	D.C. Gurugram	0124-2321144 0124-2325500 0124-2303333 0124-2320508
2.	DRO Office	DRO, Gurugram	0124-2322877

In addition to this, Toll free No. **1077** has been installed at D.C. Camp Office and round the clock duty has been assigned on it. An Officer (or an official not below the rank of an Assistant along with one clerk and peon shall be put on duty by the Officer In-charge at all hours during the rainy season for the purpose of receiving public messages and Police Radio Message (wireless). In case of a grave emergency, assistance from the Indian Army and the Indian Air Force may also be sought.

These Control Rooms shall function at all hours during the rainy seasons and duty rosters shall accordingly be prepared by respective Officers In-charge. A copy of the duty roster shall be sent to the Central Control Room daily. Arrangements shall be made in such a manner that there is always a person on duty in the Control Room.

6.2 Activities of Flood Control Room

6.2.1 Functions of Central Control Room

i. To receive flood warnings and other information through any source and to receive all messages/ instructions from the State Control Room and to pass it on to the Officer In-charge, who, if required, shall direct it to be passed on further to Sub Divisional Control Room and Tehsil control room.

ii. To convey flood situation reports to the Additional Chief Secretary-cum-Financial Commissioner, Revenue & Disaster Management, Govt. of Haryana, and Chandigarh in the proforma prescribed by the Government, every evening.

iii. To issue necessary directions and organizational details relating to evacuation and flood relief measures etc. The concerned SDMs, Tehsildars and other concerned officers wherever required.

iv. To maintain statements showing up-to-date flood situation in various parts of the District and convey the same to the officer-in-charge who in turn will take necessary orders from the Deputy Commissioner for timely action.

v. To arrange air droppings of food articles and other relief supplies marooned villages, the Deputy Commissioner shall requisite the help from the Air Force after consulting with the Chief Secretary, Revenue & Disaster Management, Govt. of Haryana, Chandigarh.

vi. To keep proper liaison with Army authorities for seeking Army help in evacuation operations and maintenance of means of communications, if necessary. For this purpose, the Deputy Commissioner shall contact the Commanding Officer, Gurugram Military Station.

6.2.2 Functions of Tehsil Control Room

These Control Rooms shall be equipped with necessary maps of their area showing vulnerable points. The functions of these Control Rooms are detailed here under:

i. To receive all information regarding flood situation in their respective areas from the sector officers.

ii. To receive all information pertaining to flood relief operations from the Central Control Room or any other source as to convey the same to the Sector officers and other officials /non official organizations as the case may be.

iii. To remain in touch with the work and requirement of sector officers and relief parties regarding evacuation and relief measure and also to place demand and obtain necessary instructions from the Officer In-charge, Central Control Room.

iv. To receive flood situation reports from various Sector Officers in their respective areas at the end of the day and send a comprehensive report covering all items to the Central Control Room by 6.00 P.M every day.

v. Issue directions regarding evacuation and supply of relief articles, medicare to human beings and cattle and all other precautionary measures according to flood situation prevailing in their respective areas.

6.3 Flood Warning System

District is regularly receivning Weather Forecasting Report from IMD Department via. Email, Whats app Group etc. Regarding Flash flood in River Sabi, it is the duty of XEN, JLN Water Services Divison Rewari to send a daily report to the Deputy Commissioner, Gurugram about the water level of Sabi River at Dharuhera Bridge.

6.4 State Control Room

Table 6.2 Details of State Control Room

S.No.	Address	Contact no. & Fax No.
1	Near Financial Court, Ground floor, New Secretariat Building, Haryana, Sector-17 Chandigarh	0172-2545938

6.5 District Headquarter Control Rooms

There shall be a Central Control Room at the District headquarters and the same shall be located in the Office of the District Revenue Officer at Mini Secretariat, Gurugram 2nd Floor. It will functional on Telephone No. 0124-2322877 (Office), 2304444 (R).

Table 6.3 Details of District Control Room

Sr.No.	Site of Control Room	Officer In-charge	Telephone No.
1.	D.C. Office Gurugram	D.C. Gurugram (dcgrg@hry.nic.in)	0124-2321144 0124-2325500 0124-2303333 0124-2320508
2.	DRO Office	DRO, Gurugram (drogrg@gmail.com)	0124-2322877
3.	MCG Office	SE, Gurugram (ce@mcg.gov.in)	0124-22371032
4.	Huda Office	SE-II, Huda,Gurugram (sehuda2gurgaon@gmail.com)	0124-2305644

In addition to this, Toll free No. **1077** has been installed at D.C. Camp Office and round the clock duty has been assigned on it. An Officer (or an official not below the rank of an Assistant along with one clerk and peon shall be put on duty by the Officer In-charge at all hours during the rainy season for the purpose of receiving public messages and Police Radio Message (wireless). In case of a grave emergency, assistance from the Indian Army and the Indian Air Force may also be seeken.

The Central Control Room shall be equipped with necessary maps of all Tehsils.

6.5.1 Tehsil Control Room

There shall be set up a control room at each Tehsil headquaters, the details of which are given as under:

Table 6.4 Details of Tehsil Control Room

S.No.	Name of Tehsil	Site of Control Room	Officer In-charge/Mail address	Telephone No.
1.	Gurugram	Tehsil Office	Tehsildar Gurugram (tehsilgrg@gmail.com)	0124-2321808
2.	Sohna	Tehsil Office	Tehsildar Sohna (sohnatehsil@gmail.com)	0124-2225042
3.	Farrukh Nagar	Tehsil office	Tehsildar Farrukh Nagar (tehsil.fng@gmail.com)	Sh. Sanjeev Nagar 9897291064 0124-2275000
4.	Pataudi	Tehsil office	Tehsildar Pataudi (tehsildarpataudi@gmail.com)	Sh. Ram Niwas 9416325377 0124-2672900
5.	Manesar	Tehsil office	Tehsildar Manesar (manesartehsil@gmail.com)	Sh. Bijender Rana (9958700798)
6.	Wazirabad	Tehsil office	Tehsildar Wazirabar (tehsilwazirabad@gmail.com)	Sh. Manish (8395924258)

These Control Rooms shall function at all hours during the rainy seasons and duty rosters shall accordingly be prepared by respective Officers In-charge. A copy of the duty roster shall be sent to the Central Control Room daily. Arrangements shall be made in such a manner that there is always a person on duty in the Control Room.

6.6 Ring Bunds

1. Kherki Majra 2. Baluda 3.Iqbalpur 4.Dharampur 5.Mankraula 6.Sidhrauli 7.Sidhravli B.Ed.College 8.Mauzamabad 9.Khalilpur 10.Maniwas 11.Sherpur 12.Khentiawas 13.Balewa 14.Haqdarpur 15.Dadawas 1 6 . Jataula 17. Sheikhpur Majra(to be maintained by BDPOs)**6. 7 Responsibility of various concerned departments before, during and after flood**

Table 6.5 Arrangements of filled sandbags, Kassies and tokris (along with Telephone No. & incharge name)

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. R.K. Mittal	Xen PWD B&R, Div. No. 1 Gurugram.	9416101339
2.	Sh. Narender Singh	Xen PWD B&R, Div. No. 2 Gurugram.	9466206369

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Table 6.6 Provision of Dewatering operation of flood/ rainwater (along with Telephone No. & incharge name)

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh.Sudhir Ransival	XEN Public Health, Gurugram.	9711411813 0124-4238801
2.	Sh. Prem Singh Singhal	XEN Public Health, Sohna, Gurugram.	0124-2362260
3.	Sh. Vijay Dhaka	XEN Water MCG	8826794016, 9873011990
4.	Sh. S.P.Garg	Excutive Engineer	9560573807
5.	Sh. Jaivir Singh	Nodal Officer of NHAI	7056600710

Table 6.7 Provision of Distribution of essential commodities (like wheat, rice, etc. sugar to the flood affected people)

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh.Ram Avtar	DFSC, Gurugram.	0124-2320379

Table 6.8 Provision of Health coverage to affected population

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Dr. J.S.Punia	CMO, Gurugram.	9654231756

Table 6.9 Provision of Drinking water

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. Krishan Dahiya	SE, Public Health, Gurugram.	9416877685, 0124-2320988
2.	Sh. Sudhir Ransival	XEN, Public Health, Gurugram.	9711411813,0124-4238801

Table 6.10 Preventive steps for the care of livestock's population during flood

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Smt. Punita Gehlawat	Deputy Director Animal Husbandry	9810626465, 0124-220215

Table 6.11 Communication information regarding flood situation

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. Basti Ram	DRO, Gurugram	9416245209 /0124-2322877

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Table 6.12 Set up of mobile wireless stations

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh.Rishi Pal	Police Control Room	0124-2223968/2316100/ 2320100

Table 6.13 Zonationof flood prone areas (Detail list along with telephone No's and Incharge name)

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. J.R Maan	BDPO, Gurugram	9416077293,0124-2321203
2.	Sh. Arun Kumar	BDPO, Pataudi	9466324524, 0124-2672867
3.	Sh. Parminder Singh	BDPO, Sohna	8278330733, 0124-2362246
4.	Sh. Sh. Ankit Chauhan	BDPO, Farrukhnagar	9999570052, 0124-2375269

Table 6.14 Relief and evacuation centre (Safe School buildings/ dharm shala & other community structures be identified for relocating people in case ofneed)

Sr. No.	Name of the Person.	Designation.	Telephone No.
1.	Sh. Amit Khatri	DC, Gurugram	0124-2321144, 8901241678
2.	Smt. Manisha Sharma	CTM, Gurugram.	8816835555, 0124-2320305
3.	Sh. Basti Ram	DRO, Gurugram	9416245209, 0124-2322877
4.	Sh. N.D Vashisht	SE (MC), Gurugram Chief Engineer	9991102343, 0124-22371032 9821395270
5.	Smt. Premlata	DEO, Gurugram	9717399160, 0124-2322081
6.	Sh. J.R Maan	BDPO, Gurugram	9416077293, 0124-2321203
7.	Sh. Arun Kumar	BDPO, Pataudi.	9466324524, 0124-2672867
8.	Sh. Parminder Singh	BDPO, Sohna	8278330733, 0124-2362246
9.	Sh. Ankit Chauhan	BDPO, Farrukhnagar.	9999570052, 0124-2375269

Table 6.15 Provision of funds for carrying out relief operations

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. Basti Ram	DRO, Gurugram	9416245209, 0124-2322877

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Table 6.16 Constitution of Village Disaster management Committee (In the chairmanship of village sarpanch, members including patwari, gram sachiv, ANM, Asha worker, anganwadi worker and concerned teacher of the school)

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. Amit Khatri	DC, Gurugram	0124-2321144, 8901241678
2.	Smt. Manisha Sharma	CTM, Gurugram.	8816835555, 0124-2320305
3.	Sh. Basti Ram	DRO, Gurugram	9416245209, 0124-2322877
4.	Vacant	SE (MC), Gurugram	9991102343, 0124-22371032
5.	Smt. Premlata	DEO, Gurugram	9717399160, 0124-2322081
6.	Sh. J.R Maan	BDPO, Gurugram	9416077293, 0124-2321203
7.	Sh. Arun Kumar	BDPO, Pataudi.	9466324524, 0124-2672867
8.	Sh. Parminder Singh	BDPO, Sohna	8278330733, 0124-2362246
9.	Sh. Ankit Chauhan	BDPO, Farrukhnagar.	9999570052, 0124-2375269

Table 6.17 Constitution of Block Disater Management Committee

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. Narender Sarwan	DDPO, Gurugram	9813488223,0124-2328834
2.	Sh. J.R Maan	BDPO, Gurugram	9416077293, 0124-2321203
3.	Sh. Arun Kumar	BDPO, Pataudi	9466324524, 0124-2672867
4.	Sh. Parminder Singh	BDPO, Sohna	8278330733, 0124-2362246
5.	Sh. Ankit Chauhan	BDPO, Farrukhnagar	9999570052, 0124-2375269

Table 6.18 Liaisons with the army authorities for air dropping of flood and other essential items (Telephone No's and In charge name)

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. Amit Khatri	DC, Gurugram	0124-2321144, 8901241678
2.	Sh. Basti Ram	DRO, Gurugram	9416245209, 0124-2322877

Table 6.19 Liaison with National Disaster Response Force

Sr. No.	Name of the Person	Designation	Telephone No.
1.	Sh. N.C. Sharma	Sec. Sainik Board,Opposite Apna Bazar Civil Lines, Gurugram	7065522206, 0124-2320730

7 Flood Resource Inventory

7.1 Flood Relief equipments and trained personnel in the District

Table 7.1. List of equipment available within the District

S.No.	Name of Equipments	Quantity	Condition	Name and No's of contact person
1.	OBM	3	Working	Sh. Ramniwas Tehsildar Pataudi (0124-2672901, 9416325377)
2.	Life Jacket	42	Very good	Sh.Satyawan,FSO 0124-2392101,102, 103, 8800811669 Sh. Pankaj Parashar, AFSO 0124-2320101, 2328868, 9821395342
3.	Motor Boats	0	-	-
4.	Sand Bags	0	-	-
5.	Kassies	0	-	-
6.	Tokris	0	-	-

Table 7.2 List of JCB available within the District

S.No.	Name of Equipments	Quantity	Condition	Name and contact details
1.	PWD (B&R)	1	Good	Mr. O.P.Mehra, Sub- division Engineer PWD (B&R) (9812162627)
2.	Municipal Corporation, Gurugram	2	Working	Mr. Vijay Dhaka(9971673033)
3.	Chauhan (Private Supplier)	1	Working	9813082121
4.	Deshwal (Private Supplier)	1	Working	9811837026
5.	Krishan (Private Supplier)	1	Working	9810721475
6.	Naresh (Private Supplier)	1	Working	9899700743

7.	Jalui (Private Supplier)	1	Working	9812177046
8.	Lalit (Private Supplier)	1	Working	9811535638
9.	Modi (Private Supplier)	1	Working	9810018633
10.	Rajesh (Private Supplier)	1	Working	9899549335

Table 7.3 List of Dewatering pumps available within the District

Sr. No.	Name of Equipments	Quantity	Condition	Name and contact details
1.	Dewatering Pumps (Irrigation Department)	24 14- Diesel operated 10- Electricity Operated	Good	Sh. Sachinder Attri, SDE, (9888964274)
2.	Dewatering Pumps (Public health and Engineering Dept.)	2 Diesel operated	Working	Sh. Pardeep, SE (9316000067)

Table 7.4 List of officials trained in OBM Operations

Sr.No.	Name of the Diver	Contact Details
1.	Manoj Kumar	8930992975
2.	Vinod Kumar	9466088041
3.	Ravindra Kumar	9467705039

Table 7.5 List of Divers in the District

Sr. No.	Name of the Diver	Contact Details
1.	Sanjeev	9468318593
2.	Jagbir singh	9810132261
3.	Ravindra Singh	9990187006
4.	Smt. Saloni Chaudary	9896247058
5.	Sanjay Kadian	9416383185

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Table 7.6 List of Home Guards officials trained in flood relief operations

Sr. No.	Name	Contect No.	Post
1.	Farahim	0124-2223106	Home Guard Gurugram
2.	Banwari lal	0124-2223106	Home Guard Gurugram
3.	Din Mohmad	0124-2223106	Home Guard Gurugram
4.	Kamurudin	0124-2223106	Home Guard Gurugram
5	Akhtar Hussain	0124-2223106	Home Guard Gurugram
6	Hurmat	0124-2223106	Home Guard Gurugram
7	Anil Kumar	0124-2223106	Home Guard Gurugram
8	Virender	0124-2223106	Home Guard Gurugram
9	Rajinder	0124-2223106	Home Guard Gurugram
10	Sukhbir	0124-2223106	Home Guard Gurugram
11	Sunil	0124-2223106	Home Guard Gurugram
12	Manoj Kumar	0124-2223106	Home Guard Gurugram
13	Raj Kumar	0124-2223106	Home Guard Gurugram
14	Ram Avtar	0124-2223106	Home Guard Gurugram
15	Deegh Ram	0124-2223106	Home Guard Gurugram
16	Suresh Kumar	0124-2223106	Home Guard Gurugram
17	Harish Kumar	0124-2223106	Home Guard Gurugram
18	Sukhbir (II)No.96	0124-2223106	Home Guard Gurugram
19	Siri Bhargwan No. 86	0124-2223106	Home Guard Gurugram

7.2 Impotant Telephone No's.

7.7 List of Patwaris, of villages (along with telephone numbers)

S. No.	Name of Tehsil/Sub Tehsil	Patwar Circle	Name of Village	Name of Patwari and Phone No
1.	Gurugram	Gurugram	1.Gurgaon, 2.Hidayatpur, 3.Chhawani, 4.Inayatpur	Sh.Anil Kumar 9871700085
		Sarhol	1.Sarhol, 2.Molahera, 3.Shahpur, 4.Dundahera	Sh.Subhash Chand-II 9416217121
		Sukhrali	Sukhrali	Sh.Mandeep Hooda 9253222224
		Bajghera	1.Bajghera, 2.Babupur, 3.Cartarpuri, 4.Sarai Allawardi, 5.Choma	Sh.Bhupender Singh 9466290725
			Naharpur Rupa (Halka Islampur)	Sh.Parveen Kumar-I 9818840832
2.	Tehsil Wazirabad	Wazirabad	1.Wazirabad, 2.Haidarpur Viran	Sh.Jagdish Chander 9811644494
		Ulhawas	1.Ulhawas, 2.Bandhwari, 3.Kadarpur, 4.Ghata, 5.Gawalpahari, 6.Balola, 7.Behrampur	Sh.Lalit Mohan 9873235800
		Jharsa	1.Jharsa, 2.Tigra, 3.Shamshpur, 4.Bindapur, 5.Fatehpur, 6.Adampur	Sh.Laxman Singh 9810102685
			1.Chakkarpur (Halka Sukhrali), 2.Kanehi, 3.Silokhra	Sh.Mandeep Hooda 9253222224
			1.Nathupur (Halka Sarhol), 2.Sikanderpur Goshi	Sh.Subhach Chand-II 9416217121
3.	Sub Teh. Badshahpur	Badshahpur	1.Badshahpur, 2.Aklimpur, 3.Nangli Umarpur, 4.Dhumaspur, 5.Medawas	Sh.Parmod Kumar 9466076040
		Islampur	1.Islampur, 2.Behrampur, 3.Ghasaula, 4.Tikri, 5.Fazilpur Jharsa	Sh.Parveen Kumar-I 9818840832
		Tikli	1.Tikli, 2.Palra, 3.Nurpur Jharsa, 4.Gairatpur Bas	Sh.Leela Ram 9813717397
			1.Sakatpur (Halka Sikhohpur), 2.Hassanpur, 3.Darbaripur	Parveen Kumar -II 9992437390
4.	Sub Teh. Kadipur	Basai	1.Basai, 2.Kadipur, 3.Garoli Kalan, 4.Garoli Khurd	Sh.Sanjay Saini 9873668345

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		Daultabad	1.Daultabad, 2.Dhanwapur, 3.Pawala Khasrupur, 4.Dharampur, 5.Mohmadheri, 6.Tikampur	Sh.Satvinder Bhandari 9871288080
		Khandsa	1.Khandsa, 2.ohammadpur, 3.Jharsa, 4.Narsingpur, 5.Begampur Khatola	Manoj Kumar -II
		Dhankot	1.Dhankot, 2.Kherki Majra	Sh.Ashok Kumar -I 8750892880
5.	Sub Teh. Harsaru	Garhi Harsaru	1.Garhi Harsaru, 2.Harsaru, 3.Gopalpur, 4.Sadhrana	Sh.Krishan Kumar 8295723243
		Wazirpur	1.Wazirpur, 2.Hamirpur, 3.Meoka, 4.Dhorka, 5.Hayatpur	Sh.Siya Ram 8901345485
		Bhangrola	1.Bhangrola, 2.Basharia, 3.Kankrola, 4.Baskusla, 5.Dhana	Sh.Bijender 9899186073
6.	Manesar	Shikohpur	Shikohpur	Sh.Rohit 9999179972
			Kheri Daula	Parveen Kumar -II Adl. 9992437390
		Manesar	1.Manesar, 2.Bar Gujar, 3.Naurangpur	Sh.Parveen Kumar -II 9992437390
		Sidhrawali	1.Sidhrawali, 2.Bhokarka, 3.Bhoara Khurd, 4.Nurpur, 5.Bhoda, 6.Prasauli	Sh.Ajay Hooda 8060118748
		Rathiwas	1.Rathiwas, 2.Dinokri, 3.Bhudka, 4.Bilaspur	Sh.Subhash Chand-I Adl 9971635829
		Chandla Dungarwas	1.Chandla Dungarwas, 2.Kukrola, 3.Binola, 4.Fazalwas, 5.Baghanki, 6.Kherki, 7.Gwaliar	Sh.Ajay Hooda Adl. 8060118748
		Pathrari	1.Pathrari, 2.Udepuri, 3.Langra	Sh.Subhash Chand -I 9971635829
		Sihi	1.Sihi, 2.Sikanderpur Badha, 3.Nawada Fatehpur, 4.Badha, 5.Naharpur Kasan, 6.Lakhnola	Sh.Ajay Verma 7206229200
		Kasan	1.Kasan, 2.Khoh, 3.Sehrawan, 4.Nainwal	Sh.Sumit Saini 8254103755
		Mokalwas	1.Mokalwas, 2.Kharkhari, 3.Bas Lambi 4.Fakarpur,Tatarpur	Sh.Subhash Chand -I 9971635829
7.	Farrukh Nagar	Farrukh Nagar	Farrukh Nagar	Sh.Devender Kumar 9871405833
		Khurampur	1.Khurampur, 2.Sarbasirpur, 3.Daboda	Sh.Sidharth Bhardwaj 7496070517
		Patli Hajipur	1.Patli Hajipur, 2.Judola	Sh.Surender Singh Adl. 9891396840
		Mubarikpur	1.Mubarikpur, 2.Jhanjrola	Sh.Manoj Kumar -I 9466026464

		Mushedpur	1.Mushedpur, 2.Birhera, 3.Hari Nagar, 4.Garhi Nathekhan	Sh.Raj Kumar Adl 9992104919
		Khandewla	1.Khandewla, 2.Tirpari, 3.Basonda, 4.Bakainka	Sh.Surender Singh 9891396840
		Tajnagar	1.Tajnagar, 2.Fazilpur Badli, 3.Babra Bakipur, 4.Joniawas	Sh.Sidharth Bhardwaj Adl. 7496070517
		Khantawas	1.Khantawas, 2.Saidpur, 3.Mohammadpur, 4.Jhund Sarai Viran, 5.Jhund Sarai Abad, 6.Dhanawas	Sh.Surender Singh Adl 9891396840
		Mehachana	1.Mehachana, 2.Palri, 3.Rajupur, 4.Faridpur, 5.Karola, 6.Alimudinpur	Sh.Sidharth Bhardwaj Adl. 7496070517
		Sultanpur	1.Sultanpur, 2.Iqbalpur, 3.Kaliawas	Sh.Raj Kumar 9992104919
		Siwari	1.Siwari, 2.Jaraou, 3.Shekhupur majri, 4.Gugana, 5.Khawaspur (Halka Mokalwas), 6.Jamalpur	Sh.Manoj Kumar -I 9466026464
8.	Sohna	Sohna	1.Sohna, 2.Raipur, 3.Jakopur	Sh.Asgar Khan 9813861205
		Bhondsi	1.Bhondsi, 2.Rithoj, 3.Sehjawas	Sh.Sunder Singh 8860100200
		Harchandpur	1.Harchandpur, 2.Ishaki, 3.Nimot, 4.Tolni, 5.Chuharpur, 6.Ranika Singhola, 7.Nunera, 8.Mandawar	Sh.Yugal Kishor Adl 9466287556
		Silani	1.Silani, 2.Lakhuwas, 3.Ratikanoabad, 4.Sancholi, 5.Bhogpur, 6.Hajipur, 7.Karanki, 8.Khuntpuri	Sh.Satbir Singh Rathi 8802019590
		Daula	1.Daula, 2.Jalalpur, 3.Baluda, 4.Khaika, 5.Siraska, 6.Abheypur, 7.Khobri, 8.Kharoda	Sh.Mahender Singh 8059317980
		Ghamroj	1.Ghamroj, 2.Alipur, 3.Lohatki, 4.Berka, 5.Dhunela	Sh.Ramesh Kumar 8901484810
		Ghangola	1.Ghangola, 2.Rahaka, 3.Satlaka, 4.Bidhwaka, 5.Bilaka, 6.Johlaka, 7.Khatrika	Sh.Hem Chand Adl 9416994591
		Saramthala	1.Saramthala, 2.Badshapur, 3.Tethar, 4.Kuliaka, 5.Tethar, 6.Kherli Lala, 7.Loh Singhani, 8.Bai Khera	Sh.Hem Chand 9416994591
		Garhi Bazidpur	1.Garhi Bazidpur, 2.Kherla, 3.Mahendawara, 4.Pulhawas, 5.Rojka Gujar, 6.Behlpa, 7.Damdma	Sh.Ashok Kumar - II 9466122249
		Raisina	1.Raisina, 2.Sanpki Nagli, 3.Hariahera, 4.Mohammadpur Gujar	Sh.Yugal Kishor 9466287556

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9.	Pataudi	Pataudi	1.Pataudi, 2.Rampur	Sh.Rajesh Malhan 9323263926
		Jatauli	Jatauli	Sh.Vinod Kumar -II 9991633534
		Narhera	1.Narhera, 2.Bas Padamka, 3.Uncha Majra, 4.Bir Khurd	Sh.Virender Singh 9813357276
		Nurgarh	1.Nurgarh, 2.Husainka, 3.Mangwaki, 4.Haliaki, 5.Brahmanwas, 6.Chhilarki, 7.Ghudana	Sh.Charan Jeet 8683829651
		Sherpur	1.Sherpur, 2.Haqdarpur, 3.Brijpura, 4.Jasat, 5.Barheri Rahnwa	Sh.Virender Singh Adl 9813357276
		Pahari	1.Pahari, 2.Shahpur Jat, 3.Rajpura, 4.Muzaffra, 5.Dadawas, 6.Mozamabad, 7.Inchhapuri	Sh.Rajender Singh 9468105981
		Khalilpur	1.Khalilpur, 2.Gagli, 3.Bhogpuri, 4.Khetiawas, 5.Bapas, 6.Ghilnawas, 7.Ahmadpur, 8.Balewa, 9.Mehniawas	Sh.Rajender Singh Adl 9468105981
		Nanu Kalan	1.Nanu Kalan, 2.Daultabad, 3.Telpuri, 4.Nanu Khurd, 5.Gadaipur,6.Sayyad Shahpur, Goriawas	Sh.Rajender Singh Adl 9468105981
		Khor	1.Khor, 2.Mirzapur, 3.Lohaka, 4.Ransika, 5.Malikpur, 6.Dewlawas, 7.Hansaka, 8.Mubarikpur	Sh.Vinod Kumar -II Adl 9991633534
		Lokra	1.Lokra, 2.Mumtajpur, 3.Hera Heri, 4.Turkapur, 5.Chhawan, 6.Khanpur, 7.Sapedar Nagar	Sh.Rajesh Malhan Adl 9323263926
		Jataula	1.Jataula, 2.Sanpka, 3.Jouri, 4.Janaula, 5.Ghoshgarh	Sh.Karam Jeet Adl 8683829651
		Mao	1.Mao, 2.Darapur, 3.Lokri, 4.Lochab, 5.Bastpur	Sh.Samar Deep Adl 8901587307
		Bohara Kala	Bohara Kala	Sh.Samar Deep 8901587307

Table 7.8 List of Gram Sachivs of villages Block Gurugram (along with telephone numbers)

Sr.No.	Gram Sachiv's Name	Mob. No.	Head Office	Gram Panchayat' Name
1	Sh.Kuldeep Kumar	9540671620	Daultabad	Daultabad, Garhi Harsaru, Babupur
2	Sh.Praveen Kumar	8826402656	Dhorka	Dhorka, Dhankot, Sadhrana
3	Sh.Amit Kumar	9717523089	Nawada Fatehpur	Nawada Fatehpur, Chandu, Kakrola

4	Sh.Gopi Ram	9911772727	Kasan	Kasan, Khoh, Sehravan
5	Sh.Yogesh Yadav	9999808003	Badha	Badha, Hayatpur, Hasanpur, Garatpur, Sakatpur
6	Sh.Ashok Kumar	9416213970	Manesar	Manesar, Sikanderpur, Badha, Rampura
7	Sh.Dharambir	8860973740	Baghanki	Palda, Baghanki, Kherki
8	Sh.Bhagat Singh	95555555681	Dharampur	Dharampur, Norangpur, Tikli
9	Sh.Harish Yadav	9468290225	Nanvaal	Bajghera, Mohammad Hedi, Nainwal
10	Sh.Pawan Kumar	8588023271	Babupur	Babupur
11	Sh.Ankit	9999720021	Wazirpur	Kherki Mazra, Dharampur, Naharpur Kasan.
12	Sh.Hariom	9899608414	Bamdoli	Bamdoli, Bar Gujar, Aklimpur
13	Sh.Avatr Singh	7988282240	Shikohpur	Maidawas

Table 7.9 List of Gram Sachivs of villages Block Farrukhnagar (along with telephone numbers)

Sr.No.	Gram Sachiv's Name	Mob. No.	Gram Panchayat' Name
1	Sh. Shish Pal		Patli, Budhera, Musedpur.
2	Sh.Satya Prakash	9992441040	Sultanpur, Kaliyawas
3	Sh.Pinki Kumari	9728791340	Joniyawas, Khetawas, Hazipur, Saidpur, Mohmadpur.
4	Sh. Shiv Kumar	9812565925	Jamalpur, Jodi Kalan
5	Sh.Gagandeep	7011864752	Faridpur, Mubarikpur, Ikbalpur
6	Sh.Mohan	9991340035	Ghoshgarh, Gugana, Rajpur, Khurrampur, BaSunda, Daboda
7	Sh. GajenderAnil Kumar	9991473098	Janola, Sampka, Birhera, Jodi Kurd,
8	Sh.Gajraj	9671765699	Tajnagar, Fazilpur Badli, Mokalwas, Kharkari, Jhund Sarai, Judola.
9	Sh. Anil Kumar	9813187803	Bhangrola, Baskushla, Kheda Jhanjrola, baslambi
10	Sh. Kuldeep	9050098905	Bashariya, Dhana.
11	Sh. Sandeep Dahiya	9813857725	Mehchana, Karola, Gadinathekhan, Paldi
12	Sh. Krishan	9991514760	Khandwla, Tirpadi, Jatola

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Table 7.10 List of Gram Sachivs of villages Block Sohna (along with telephone numbers)

Sr.No.	Gram Sachiv's Name	Mob. No.	Gram Panchayat' Name
1	Sh.Parveen Gujjar	9896507035	Bhondsi, Ghangola, Kherki.
2	Sh.Vikash	9050669769	Damdama, Sehjawas, Chuhadpur, B.Pur Tenther, Mandawar, Abheypur.
3	Sh.Baljeet	9416763029	Ghamroj, Hazipur, Kuliyaka, Jojlaka
4	Sh.Irshad Ali	9813528786	Rahaka, Lohsinghani, Nimoth, Rithoj, Hasanpur, Alipur, Hariahera.
5	Sh.Deepak Dahiya	7042244344	Baaikhera, Ullawas, Kadarpur
6	Sh.Vijay Singh	8920083161	Behlpa, Kharoda, Mahenderwara, Harchandpur, Khera
7	Sh.Ganga Ram	9991174451	Nunera, Kiranki Kherli,Nayagaon, Behrampur, Sarmathla
8	Sh.Paramveer Singh	9643558429	Sancholi, Daulha, Garhi wazidpur.

Table 7.11 List of Gram Sachivs of villages Block Pataudi (along with telephone numbers)

Sr.No.	Gram Sachiv's Name	Mob. No.	Head Office	Gram Panchayat' Name
1	Sh.Sanjay Kumar	9416594445	Khalilpur	Khalilpur,Ghilnawas, Balewa, Pahari, Inchhapuri, Bhokarka, Mahniawas.
2	Sh.Kanwarpal	8826707988	Fazalwas	Fazalwas, Fakurpur, Chandla Dungarwas, Gwalior, Dadawas.
3	Sh.Neeraj Kaushik	9992228908	Gadaipur	Gadaipur, Daulatabad, Goriawas, Khanpur, HeriyaHeri.
4	Sh.Deengram	9416501517	Dewlawas	Dewlawas, Brajpura, Bhramanwas, Haliyaki.
5	Sh.Dharmender	7027098720	Nurgarh	Nurgarh, Mangwaki, Brahamanwas, Haliyaki.
6	Sh.Umesh Kumar	9971246888	Dhani Kumbhawas	Dhani Shankar, Dhani Kumbhawas, Dhani Chitrasen Khor, Binola
7	Sh.Devendra Ranga	9728978303	Husainka	Husainka, Gudana Rajpura Jasat, Chhilarki.
8	Sh.Renu	8826322178	Jatshahpur	On Leave

9	Sh.Dinesh	9991408098	Bhorakalan	Bhorakalan, Bhora khurd, Milakpur, Mirzapur, Said Shahpur.
10	Sh.Hari Prakash	8059158279	Uchcha Mazra	Uchcha Mazra, Noorpur, Turkapur, Tatarpur, Rampur.
11	Sh.Ajay Singh	8689036860	Ransika	Narhera, Ransika, nanukhurd, Bastpur, Nanukalan
12	Sh.Mahavir	9991008875	Haqdarpur	Haqdarpur, Mauzabad, Mau, Chhawan Telpuri, Ban Rahanwa, Sidhrawali.
13	Sh.Sanjeev	8813884246 7015718455	Pathreri	Bilaspur Kalan, Pathreri, Langra, Mumtajpur
14	Sh.Ravi Rathee	8053331388	Sidhrawali	Baspadmka, Khetiyawas, Lokra, Darapur, Ratheewas, Dinokri.

Table 7.12. List of Sarpanch of villages (along with telephone numbers)

SR.No.	Name of Sarpanch	Name of Gram Panchayat & Address	Name of Blcok	Contact No.
1	Sh.Sonu Devi	Kherki Majra	Gurugram	7838200365
2	Sh.Rajender Singh	Khoh	Gurugram	9811002565
3	Sh.Vijay Pal	Naharpurkasan	Gurugram	9313033732
4	Sh.Suman Devi	Sehrawan	Gurugram	9540909540
5	Sh.Satdev	Kasan	Gurugram	-
6	Sh.Pooja Kumari	Manesar	Gurugram	9728387186
7	Sh.Harjas	Rampura	Gurugram	9999741377
8	Sh.Sunderlal	Sikanderpurbadha	Gurugram	9811121209
9	Sh.Om Bati	Bargujjar	Gurugram	9871570077
10	Sh.Meenakshi	Dharampur	Gurugram	9716419063
11	Smt.Rinki	Mohmad Heri	Gurugram	9911356187
12	Sh.Sanjamdeep	Nakhdola	Gurugram	8527665423
13	Sh.Rambir	Baghanki	Gurugram	9992225210
14	Sh.Niwas Rana	Bajghera	Gurugram	9810612318
15	Sh.Ishwar Singh	Kherki	Gurugram	9812768381

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16	Smt.Suman	Nainwal	Gurugram	9871982355
17	Sh.Yogesh	Babupur	Gurugram	7838003433
18	Sh.Yogender	Daultabad	Gurugram	9871343655
19	Smt.Seha Lata	Garhi Harsaru	Gurugram	9711600038
20	Sh.Kuldeep	Chandu	Gurugram	7911580111
21	Sh.Dinesh	Dhankot	Gurugram	9873315968
22	Sh.Fakir Chand	Kankrola	Gurugram	9811345870
23	Sh.Jai Pal	Makdola	Gurugram	9812730842
24	Smt.Poonam Kumari	Sadhrana	Gurugram	9818780751
25	Smt.Seema	Badha	Gurugram	9718924634
26	Sh.Sadhuram	Bamroli	Gurugram	9910480621
27	Sh.Narender	Hayatpur	Gurugram	9910043130
28	Smt.Anita Devi	Nawada fatehpur	Gurugram	9599920032
29	Sh.Subhash Chand	Dhorka	Gurugram	9582351717
30	Sh.Pardeep Yadav	Naurangpur	Gurugram	9910044429
31	Sh.Lakhan Singh	Shikohpur	Gurugram	9810947156
32	Sh.Sher Singh	Wazirpur	Gurugram	8920143693
33	Sh.Ram parkash	Budhera	Farrukhnagar	8920143693
34	Sh.Uday Singh	Dooma	Farrukhnagar	9813772669
35	Smt.Rachna	Mushedpur	Farrukhnagar	9813141561
36	Sh.Sahender Singh	Palri	Farrukhnagar	860776878
37	Smt.Rajni	Bash Khusla	Farrukhnagar	9992276104
38	Sh.Ishwar Singh	Bhangrola	Farrukhnagar	9711313602
39	Smt.Babita Devi	Jhanjhrola Khera	Farrukhnagar	9728700335
40	Sh.Rakesh kumar	Sultanpur	Farrukhnagar	9811407049
41	Smt.Sunita	Alimuddenpur	Farrukhnagar	9991743519

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42	Smt.Pooja Yadav	Shekhpur Majri	Farrukhnagar	9050956645
43	Smt.Geeta Kumari	Babda Vakipur	Farrukhnagar	9992474274
44	Smt.Kiran Yadav	Birhera	Farrukhnagar	9992084722
45	Smt.Geeta	Jarau	Farrukhnagar	9992554482
46	Smt.Sapna	Jori	Farrukhnagar	9416536468
47	Sh.Khajan Singh	Jori kalan	Farrukhnagar	9813077876
48	Sh.Hansraj Saini	Sampka	Farrukhnagar	9812819002
49	Sh.Govind Singh	Fazilpur Badli	Farrukhnagar	9999809090
50	Sh.Anil Kumar	Jhund Sarai	Farrukhnagar	9996393940
51	Sh.Subhashchand	Judola	Farrukhnagar	9828123119
52	Smt.Mukesh Kumari	Mokalwas	Farrukhnagar	9953750075
53	Sh.Devender	Siwari	Farrukhnagar	8053784370
54	Sh.Lalit Kumar	Taj Nagar	Farrukhnagar	9466624021
55	Sh.Ramesh Kasak	Garhi Nathey Khan	Farrukhnagar	9999012070
56	Sh.Prahlad Singh	Khawaspur	Farrukhnagar	8607392186
57	Sh.Ramniwas	Kherakhurampur	Farrukhnagar	9992250598
58	Sh.Dhani Ram	Bashunda	Farrukhnagar	9810955758
59	Sh.Krishan Kumar	Jatola	Farrukhnagar	9992453620
60	Smt.Suraj Mukhi	Khandewla	Farrukhnagar	9992870363
61	Sh.Rakesh Kumar	Tirpadi	Farrukhnagar	999202307
62	Smt.Seema	Bassharia	Farrukhnagar	9873334646
63	Sh.Parveen Kumar	Dhana	Farrukhnagar	9718817000
64	Sh.Satya Prakash	Faridpur	Farrukhnagar	9654666891
65	Sh.Sunder Singh	Ghosh garh	Farrukhnagar	8221815076
66	Smt.Usha Devi	Gugana rajupur	Farrukhnagar	9812664977

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67	Smt.Sunita	Karola	Farrukhnagar	9050548878
68	Smt.Sarita Devi	Khar Khari	Farrukhnagar	9310270688
69	Sh.Vinod Kumar	Khurampur	Farrukhnagar	8059737690
70	Sh.Jile Singh	Dhanawas	Farrukhnagar	9728565103
71	Smt.Sharmila	Hazipur	Farrukhnagar	9416062983
72	SmtRenu	Khentawas	Farrukhnagar	9050380035
73	Sh.Bir Singh	Bas Lambi	Farrukhnagar	9992781645
74	Smt.Reetu	Jamalpur	Farrukhnagar	9813330830
75	Sh.Gajraj Singh	Janola	Farrukhnagar	9416861298
76	Sh.Pritam Pal	Kaliawas	Farrukhnagar	9811032701
77	Smt. Suresh	Mubarikpur	Farrukhnagar	9728124801
78	Smt.Mukesh Devi	Patli	Farrukhnagar	9992624199
79	Sh.Ranvir Singh	Ikbalpur	Farrukhnagar	9810324964
80	Sh.Suresh Kumar	Mehchana	Farrukhnagar	9812156595
81	Sh.Inderjeet	Sahidpur Mohmadpur	Farrukhnagar	9811008501
82	Smt.Neeta Yadav	Dabodha	Farrukhnagar	9812188188
83	Smt.Meena Devi	Joniawas	Farrukhnagar	9991720275
84	Sh.Yajvinder	Bhora kalan	Pataudi	9991272134
85	Smt.Rajni devi	Fazilwas	Pataudi	9694594873
86	Smt.Swati	Binola	Pataudi	9992536210
87	Smt.Sunita Devi	Sayed Shahpur	Pataudi	9818006763
88	Sh.Balbir Singh	Telpuri	Pataudi	9416834785
89	Sh.Satbir Singh	Hussainka	Pataudi	9050500391
90	Sh.Vikram Singh	Rajpura	Pataudi	9416425700

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91	Sh.Mukesh Kumar	Gudana	Pataudi	8053270599
92	Smt.Anuradha	Jasat	Pataudi	9812830458
93	Sh.Gyan Singh	Barahari Rehnawa	Pataudi	9992341789
94	Smt.Karan Singh	Brijpura	Pataudi	8684837669
95	Sh..Mahender Singh	Chhilraki	Pataudi	9416817255
96	Sh..Inderjeet	Bhudka	Pataudi	9813316628
97	Smt.Shakuntla Devi	Dinokri	Pataudi	9813636836
98	Smt.Manita Devi	Pathredi	Pataudi	8683808758
99	Sh..Attar Singh	Noorpur Bhura	Pataudi	9810855955
100	Sh.Amit Kumar Sharma	Rampura	Pataudi	9813157503
101	Sh.Virender Singh	Tatarpur	Pataudi	9992331417
102	Sh.Ramu	Turkapur	Pataudi	9991972215
103	Smt.Priyanka Devi	Ucha Majra	Pataudi	9466393417
104	Sh.Harish Chander Yadav	Dhani Chitrasen	Pataudi	9728406888
105	Smt.Rekha	Chhawan	Pataudi	9671196785
106	Sh.Jaibir	Sherpur	Pataudi	9671226537
107	Sh.Vijay Kumar	Hakdarpur	Pataudi	9813782007
108	Smt.Manju	Milkapur	Pataudi	8053957542
109	Smt.RajBala	Mirzapur	Pataudi	9812320834
110	Sh.Satya Parkash	Nanukhurd	Pataudi	9728172324
111	Smt.Meena Kumari	Ransika	Pataudi	9560052424
112	Sh.Ajit Singh	Daultabad	Pataudi	9212525547
113	Sh.Rakesh Kumar	Gadaipur	Pataudi	8607489718
114	Smt.Reeta	Goriawas	Pataudi	9991181653
115	Smt.Sumitra Devi	Basatpur	Pataudi	9896702201
116	Smt.Rekha Devi	Brahmanwas	Pataudi	9050981428
117	Smt Geeta	Managwaki	Pataudi	9812082500
118	Sh.Radheshyam	Noorgarh	Pataudi	9468191366

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119	Smt Rekha	Haliaaki	Pataudi	9813277715
120	Sh.Vinod Kumar	Baspadmka	Pataudi	9813399701
121	Sh.Rakesh Kumar	Bhora Khurd	Pataudi	9050571133
122	Smt Sudha	Narhera	Pataudi	9671510198
123	Sh.KeshuRam	Maujabad	Pataudi	9991418652
124	Smt Usha Devi	Mujphara	Pataudi	9813394904
125	Smt Sunita	Shahpur-Jat	Pataudi	9017070562
126	Smt Bimla devi	Khetiawas	Pataudi	8930716555
127	Smt Suman Yadav	Bhokarka	Pataudi	9896115577
128	Sh.Ramavtar	Darapur	Pataudi	9416611195
129	Sh.Pankaj Sheel	Lokara	Pataudi	9813890297
130	Sh.Ashok Kumar	Lokari	Pataudi	9813796126
131	Smt Sunil Kumari	Mau	Pataudi	8930776555
132	Sh.Ajit Singh	Mumtaj Pur	Pataudi	9728024311
133	Smt.Renu	Parasoli	Pataudi	9992029316
134	Smt.Vijayshree	Rathiwas	Pataudi	9416712472
135	Sh.Om Parkash	Sidhrawali	Pataudi	8221020138
136	Smt.Premlata	Fakharpur	Pataudi	9873042023
137	Sh.Ishwar Singh	Dadawas	Pataudi	8901487702
138	Sh.Hansraj	Bilaspur Kalan	Pataudi	9467255379
139	Smt.Saroj Bala	Dhani Shankarwali	Pataudi	8685046771
140	Smt Manju Kumari	Dhani Kumbhawas	Pataudi	9350905935
141	Sh.Jai Bhagwan	Khor	Pataudi	9813607501
142	Smt Anita Devi	Lohchab	Pataudi	9416548720
143	Smt Kavita	Manukalan	Pataudi	8053896514
144	Sh.Rajbir	Herahedi	Pataudi	9992188821
145	Sh.Pawan Kumar	Khanpur	Pataudi	9813371574

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146	Sh.Darshan Kumar	Balewa	Pataudi	8930090661
147	Sh.Hariom	Bapas	Pataudi	9416710970
148	Sh.Manoj Kumar	Ghilnawas	Pataudi	9991187255
149	Sh.Ved Parkash	Mahniawas	Pataudi	9467141868
150	Smt Asha Devi	Khalilpur	Pataudi	9050995717
151	Sh.Satbir Singh	Devlawas	Pataudi	8930534457
152	Sh.Pardeep Kumar	Pahari	Pataudi	9671942942
153	Sh.Bijender Singh	Ichha Puri	Pataudi	8059107109
154	Sh.Rameshwar Dayal	Bilaspur	Pataudi	9355603051
155	Sh.Subey Singh	Chandla Dungarwas	Pataudi	9350164242
156	Smt Sunita Yadav	Gwalior	Pataudi	9810737572
157	Smt Bala Devi	Kukdola	Pataudi	9971155304
158	Sh.Anand Kumar	Aklimpur	Sohna	9999509045
159	Smt Mamta	Alipur	Sohna	9899105551
160	Smt Munesh Devi	Behlpa	Sohna	9811441041
161	Smt Poonam	Gairatpur Bas	Sohna	8800559467
162	Smt Aasha	Garhi Wajidpur	Sohna	9811681450
163	Smt Savita	Harchandpur	Sohna	9812495969
164	Sh.Abdul Sattar	Hariyaheda	Sohna	9991201799
165	Sh.Virender Singh	Hasanpur	Sohna	9911964900
166	Sh.Baljeet	Hazipur	Sohna	9999356047
167	Sh.Hasan Mohhmad	Jairanki Kherli	Sohna	9812195554
168	Sh.Narender Kumar	Kherla	Sohna	9999335058
169	Sh.Nishar	Nunera	Sohna	9813148114
170	Sh.Satish Kumar	Rithoj	Sohna	9899291454
171	Sh.Paritam Singh	Sakatpur	Sohna	9810805287
172	Smt Jyoti	Sancholi	Sohna	9992146818

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173	Sh.Shyamveer	Baal khera	Sohna	9818135809
174	Smt Kavita	Badshahpur Thedar	Sohna	987132454
175	Smt Mamta	Behrampur	Sohna	9811559411
176	Sh.Rajbeer	Chuhadpur	Sohna	9992666194
177	Smt Santosh	Damdama	Sohna	9812377276
178	Sh.Sanjeet	Kadarpur	Sohna	9711920039
179	Sh.Ramniwas	Kherli Lala	Sohna	8059186276
180	Sh.Nirmal	Abheypur	Sohna	9996445577
181	Sh.Brahamprakash	Maidawas	Sohna	9999421042
182	Sh.Dhansingh	Mandawar	Sohna	9992369005
183	Sh.Surgyan Singh	Naya Gaon	Sohna	9899193148
184	Sh.Munesh	Palra	Sohna	8447002088
185	Sh.Rajkumar	Saihjawas	Sohna	9599451907
186	Smt Ravina Devi	Teekli	Sohna	9818290250
187	Sh.Anil	Ullawas	Sohna	9643530061
188	Smt Durga Devi	Bhondsi	Sohna	9990448007
189	Smt Sunita	Bilhaka	Sohna	9991305177
190	Sh.Balkishan	Daula	Sohna	9050131572
191	Smt Nirmal Devi	Ghamroj	Sohna	9811123612
192	Smt Sushma	Ghangola	Sohna	8607832832
193	Sh.Satpal	Johlaka	Sohna	9812001072
194	Smt Pinki	Kharoda	Sohna	9813463770
195	Smt.Bala Devi	Khuntpuri	Sohna	9813991440
196	Sh.Vijaypal	Kuliaaka	Sohna	9812617561
197	Sh.Ajay Kumar	Kohsinghani	Sohna	9654237492
198	Sh.Hari Om	Mahindarwada	Sohna	9654299146
199	Sh.Suresh Kumar	Nimoth	Sohna	9813484615
200	Sh.Jakriya	Rahaka	Sohna	9812420726

201	Smt Sapna	Sarmathla	Sohna	9992383801
202	Sh.Om Parkash	Silani	Sohna	9812243331

Table 7.13 List of Namberdars of villages (along with telephone numbers)

Sr.No.	Name of the Person.	Village	Telephone No.
1.	Sh. Bharat Singh	Wazirabad Gurugram	-
2.	Sh. Balinder Kumar	Aklimpur	987355084
3.	Sh.Satish Kumar	Aklimpur	9899539893
4.	Sh. Satbir Bhardwaj	Babupur	-
5.	Sh.Sunil Kumar	Babupur	-
6.	Sh.Vijay Singh	Badshahpur	9311245957
7.	Sh.Chiranji Lal	Badshahpur	9910458831
8.	Sh.Dharam Singh	Badshahpur	9891437283
9.	Sh.Devender	Badshahpur	9654749919
10.	Sh.Yograj	Badshahpur	9312995500
11.	Sh. Jagdish	Badshahpur	-
12.	Sh.Partap	Behrampur	9811746857
13.	Sh.Satbir Singh	Bajghera	-
14.	Sh.Bhram Singh	Balola	-
15.	Sh.Dharampal	Bandhawadi	9312552713
16.	Sh.Sh.Chainpal	Bandhwadi	9899266228
17.	Sh.Shera	Bandhwadi	-
18.	Sh.Surender Singh	Bashariya	-
19.	Sh.Anil Kumar	Basai	9411475232
20.	Sh. Dayanand	Basai	9555470287
21.	Sh.Sukhbir	Basai	9311878038
22.	Sh.Ranbir	Bashariya	9990282673
23.	Sh.Surender Singh	Bashariya	9718792839

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24.	Sh.Jhan Singh	Baskushla	9818222564
25.	Sh.Virpal	Baskushla	-
26.	Sh.Birpal	Baskhusla	9990253599
27.	Sh.Tarun Kumar	Begampur Khatola	9313809241
28.	Sh.Hariom	Bhangrola	9953628510
29.	Sh.Thakurdass	Bhangrola	9811171416
30.	Sh.Rohtas	Bhangrola	9999570330
31.	Sh.Prem Chand	Behrampur	971144555
32.	Sh. Kewal Krishan	Budhera	9810403830
33.	Sh.Abhey Singh	Budhera	-
34.	Sh. Omkar nath	Budhera	-
35.	Sh. Manohar lal	Caterpuri	-
36.	Sh. Surender Singh	Chakkarpur	-
37.	Sh.Yogender Kumar	Chakkarpur	-
38.	Sh. Vinod kumar	Chakkarpur	-
39.	Sh. Gajraj	Chakkarpur	-
40.	Sh.Balraj Singh	Chakkarpur	-
41.	Sh.Surjeet Kumar	Chandu	-
42.	Sh. Sohan Lal	Choma	-
43.	Sh.Randhawa	Choma	-
44.	Sh. Ranjeet Singh	Choma	-
45.	Sh. Krishan Singh	Daultabad	9811371400
46.	Sh.Noraj Sarbrai	Daultabad	9911271976
47.	Sh. Chander Bhan	Daultabad	-
48.	Sh. Jile Singh	Daultabad	9990419797
49.	Sh. Rajbir Singh	Daultabad	-
50.	Sh.Om Parkash	Dhankot	8259510238
51.	Sh.Harikrishan	Dhankot	98919442141

52.	Sh.Vinod Kumar	Dhankot	9811828040
53.	Sh.Ram Kumar	Dhana	9717839064
54.	Sh.Jagpal Singh	Dhanwapur	9212797059
55.	Sh. Sanjay Singh	Dhanwapur	9891677761
56.	Sh.Kanwar Lal	Dhorka	9899115141
57.	Sh. Rameshwar Dayal	Dhorka	8800313215
58.	Sh.Suresh Kumar	Dhorka	9654851311
59.	Sh.Radha Krishan	Dhumaspur	9811562700
60.	Sh.Satya Narayan	Dundahera	9268291564
61.	Sh.Chandan Singh	Dundahera	9312320372
62.	Sh. Devender Singh	Dundahera	9654350407
63.	Sh.Narsingh	Dundahera	9810644199
64.	Sh. Mahender pal	Fazilpur Jharsa	0124-2715511
65.	Sh. Geeta nand	Fazilpur Jharsa	9999474631
66.	Sh.Om Parkash	Gadoli Khurd	-
67.	Sh. Prabhu Nath	Gadoli Kalan	9818165106
68.	Sh. Om Parkash	Gadoli Kalan	9910275028
69.	Sh. Gyan Singh	Gadoli kalan	9873953031
70.	Sh.Mange Ram	Gadoli kalan	9953563008
71.	Sh. Om Parkash	Gadoli kalan	9873129025
72.	Sh. Sunil Kumar	Garatpur bas	9871366664
73.	Sh.Hanif	Garatpur Bas	9811565852
74.	Sh.Surjeet Kumar	Gadhi Harsaru	9212279101
75.	Sh.Khatri lal	Gwalphari	9999121998
76.	Sh.Deshraj	Ghata	9711966183
77.	SH. Om Parkash	Ghata	9891677382
78.	Sh.Satnam Singh	Ghasola	9818047888
79.	Sh. Bishan Singh	Gopalpur	-

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80.	Sh. Nihal Singh	Gopalpur	9728339036
81.	Sh.Rajender Singh	Gurugram1	9990781884
82.	Sh. Manjeet Singh	Gurugram 1	9873171780
83.	Sh.Om Parkash	Gurugram1	9971166988
84.	Sh.Bijender Singh	Gurugram1	9891146362
85.	Sh.Malkhan Singh	Gurugram2	9654657301
86.	Sh.Umed Singh	Gurugram2	9310107673
87.	Sh.Bhagwat Swaroop	Gurugram2	-
88.	Sh.Jaipal	Gurugram2	9811195816
89.	Sh.Dharamvir Singh	Gurugram2	9990801241
90	Sh.Gulshan Singh	Gurugram 2	9968128115
91	Sh. Jitender	Gurugram 2	9560012707
92	Sh.Tarif Singh	Gurugram	-
93	Sh.Mukesh	Gurugram	-
94	Sh.Pohap Singh	Gurugram	-
95	Sh.Krishan Kumar	Gurugram	-
96	Sh.Rajpal Singh	Hamirpur	839702802
97	Sh.Khushvinder Singh	Harsaru	9810740775
98	Sh.Ram Kishan	Hasanpur	-
99	Sh.Bhartu	Hayatpur	9818511952
100	Sh.Devinder Kumar	Hayatpur	9212254066
101	Sh.Bhram Singh	Hayatpur	8510050566
102	Sh. Rakesh	Islampur	9213182652
103	Sh. Beena Devi	Islampur	8800587111
104	Sh.Ramkanwar	Islampur	7338518467
105	Sh.Hawa Singh	Islampur	9718587004
106	Sh.Birender Singh	Jharsa	9210662942
107	Sh.Bed Singh	Jharsa	8800581731

108	Sh. Gajender Singh	Jharsa	9212345406
109	Sh.Om Parkash	Jharsa	9899282863
110	Sh. Karan Singh Saini	Jharsa	9811167796
111	Sh.Rambir	Kadarpur	9899736692
112	Sh.Ashok kumar	Kadarpur	9711690050
113	Sh.Nafe Singh	Kadarpur	-
114	Sh.Chiranji lal	Kadarpur	8447195809
115	Sh.Madal lal	Kadipur	9873171386
116	Sh.Vedram	Kadipur	8860186263
117	Sh.Rajaram	Kadipur	-
118	Sh.Ramniwas	Kadipur	9899816188
119	Sh. Jage Singh	Kanhai	-
120	Sh.Geeta nand	Kanhai	-
121	Sh. Rajesh Kumar	Kakrola	9810572469
122	Sh. Ravi Kumar	Kakrola	9999937470
123	Sh. Jagannat	Kakrola	9771504632
124	Sh. Manjeet Singh	Khnadsa	9899385080
125	Sh. Dharambir	Khandsa	-
126	Sh. Mahavir Singh	Khandsa	9910249087
127	Sh.Jagvir Singh	Khandsa	-
128	Sh. Devinder	Khandsa	9891245924
129	Sh. Bir Singh	Khands a	8750920538
130	Sh. Balram	Dhankot	9953473223
131	Sh.Prem Singh	Kherki Majra	8738380355
132	Sh.Randhir Singh	Dhankot	9250711209
133	Sh.Mukesh	Maidawas	9899266210
134	Sh.Rakesh	Maidawas	9810684512
135	Sh.Jeet Singh	Nakhrola	-

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136	Sh. Bishamber	Nakhrola	-
137	Sh.Rohtash	Makhrola	-
138	Sh.Laxman Singh	Makhrola	-
139	Sh. Rajender Singh	Mevka	989906072
140	Sh. Rohtash	Mohmmad Heri	9873547955
141	Sh. Bhrampal	Mohmmadpur Jharsa	9871455022
142	Sh. Mohan lal	Mohmmadpur Jharsa	9582488611
143	Sh. Chatter Singh	Mohmmadpur Jharsa	9213190895
144	Sh. Vinod Kumar	Molahera	9910585804
145	Sh.Khajan Singh	Molahera	9311159486
146	Sh. Inder Singh	Naharpur Rupa	9810370113
147	Sh. Ajay Kumar	Naharpur rupa	9350792777
148	Sh. Sitram	Narsinghpur	9350665859
149	Sh. Rajesh	Narsinghpur	-
150	Sh. Balkishan	Narsinghpur	9990791058
151	Sh. Rohtash	Nathupur	9716417060
152	Sh. Khushi Ram	Nathupur	9813854123
153	Sh. Satish	Nurpur Jharsa	9899838180
154	Sh. Chater Singh	Nurpur Jharsa	9810078756
155	Sh. Rajpal	Palda	9350360045
156	Sh. Hansraj	Palda	9811079486
157	Sh. Sunil Kumar	Palda	9555355555
158	Sh. Shyam Singh	Palda	9999454680
159	Sh. Vipin Sharma	Pawala Khusrpur	9250927836
160	Sh. Dharamvir	Pawala Khusurpur	9810454642
161	Sh. Mangtu	Pawala Khusurpur	-
162	Sh. Harkesh	S lalvadi	-
163	Sh.Rohtash	Sadhrana	9818018635

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164	Sh. Hakamdin	Sakatpur	9811253649
165	Sh. Surajbhan	Sakatpur	-
166	Sh. Surender	Samaspur	9910904650
167	Sh. Sarwan Kumar	Sarai alawardi	-
168	Sh. Pardeep	Sarhol	-
169	Sh. Rajesh Singh	Sarhol	9810211568
170	Sh. Suresh Chand	Silokhera	-
171	Sh. Jaibhagwan	Silokhera	-
172	Sh. Amar Singh	Silokhera	-
173	Sh. Sher Singh	Silokhera	9582729006
174	Sh. Raj Kumar	Silokhera	-
175	Sh. Sandeep	Sukhrali	-
176	Sh. Jagvir	Sukhrali	-
177	Sh. Hari Chand	Sukhrali	-
178	Sh. Ram Mehar	Sikanderpur	9891121142
179	Sh. Parveen	Sukhrali	-
180	Sh. Jaipal	Sukhrali	-
181	Sh. Surjan Singh	Tigra	9582375193
182	Sh. Amar Singh	Tikli	7457813360
183	Sh. Ram Niwas	Tikli	9582934611
184	Sh.Raghubir	Tikli	987366660
185	Sh. Raj Singh	Tikli	9873121830
186	Smt. Babita	Tikli	9873526177
187	Sh. Shishram	Tikri	9958208003
188	Sh. Parveen	Ullawas	9873230099
189	Sh. Suraj	Ullawas	9873512834
190	Sh. Ashok Kumar	Wazirabad	9899830671
191	Sh. Dharambir	Wazirabad	9810325585

192	Sh. Dayachand	Wazirabad	9871771311
193	Sh. Tikaram	Wazirabad	9810861440
194	Sh.Vijay	Wazirabad	9250646936
195	Sh. Vijay Singh	Wazirabad	9873949040
196	Sh. Sunil Kumar	Wazirabad	999007118
197	Sh.chater Singh	Wazirabad	9810732521
198	Sh. Ajay Kumar	Wazirabad	9811067555

Table 7.14 Nehru Yuva Kendra (NYKS) of vulnerable villages (along with telephone numbers)

Sr. No.	Name of the Agency	Telephone No.
1.	K L Parcha	0124-2321945 9810548945

Table 7.15 List of NGO's along with telephone numbers

Sr.No.	Name of the Agency	Telephone No.
1.	Rotary Club, Gurugram	0124-2328421 0124-2320099
2.	Rotary Club, DLF Enclave, Gurugram	0124-242166 0124-2350529
3.	Lions Club, Gurugram.	0124-5753045 0124-2321695
4.	Arya Kendriya Sabha, Gurugram.	09911197073
5.	Aggarwal Sabha, Gurugram.	0124-2322864
6.	Sri Sanatan Dharam Sabha, Gurugram.	0124-232220
7.	Sri Digamber Jain Sabha, Gurugram.	0124-2329629 0124-2330893
8.	Mahavir Dal, Gurugram.	0124-2320459
9.	Gurdawara Singh Sabha, Gurugram.	0124-2315828
10.	Manav Sewa Samiti, Gurugram.	0124-
11.	Vikas Samiti, Gurugram.	0124-2329196
12.	Youth Welfare & Culture Association.	0124-2325665
13.	All India Crime Prevention Society, Gurugram.	0124-2324076

14.	Sayukat Kalyan Parishad, Gurugram.	0124-2320961
15.	Resident Welfare Association, Sector-14, Gurugram.	0124-2321362 0124-232312\
16.	Resident Welfare Association, Sector-4, Gurugram.	0124-2342117 0124-2350355
17.	Resident Welfare Association, DLF Qutab Enclave, Phase-2, Gurugram.	0124-2387845 0124-2350772
18.	Joint Assistance Centre, DLF Qutab Enclave, Phase-1, Gurugram.	0124-2352141 0124-2353833
19.	Gurugram Industrial Association.	0124-2322426 0124-2321460
20.	Gurugram Small Industries Association	0124-2345082 0124-2341267

Table 7.16 Ministry of Home Affairs

Sh. Sanjeev Kumar Jindal	Joint Secretary (Disaster Management)	NDCC-II, 3rd Floor	23438096, 23438098(F)	jsdm@nic.in
MHA Control Roon(Disaster Management Division)		23093563, 23093564, 23093566,23093571		

Table 7.17 Contact Details of NDRF Officers

Name	Designation	Telephone no.	Email I D	Address
Sh. S.N. Pradhan (IPS)	Director General	011-23438020 011-23438119	Dg.ndrf@nic.in	Directorate General, NDRF 6th Floor, NDCC-II Building, Jai Singh Road, New Delhi-110001
Sh. Amrender Kumar Sengar (IPS)	Inspector General	011-23438021	Ig.mdrf@nic.in	Directorate General, NDRF 6th Floor, NDCC-II Building, Jai Singh Road, New Delhi-110001
Sh. P. K. Srivastava	Commandant	0120-2766013	Up08-ndrf@nic.in	8th BN NDRF, Kamla Nehru Nagar, Ghaziabad (UP), Pin-201002
Sh. Ravi Kumar Pandita	Commandant	0164-2246193	Pun0—ndrf@nic.in	7th BN NDRF, Bibiwala Road, Bhatinda (Punjab) Pin 151001

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Control Room	011-23438091, 011-23438136		Hq.ndrf@nic.in	
Sh.AK Singh	Commandant	0542-2501201	Up-11ndrf@gov.in	11th BN NDRF,HQrs, Sanskritik Sankul, Maqbool Alam Road, Varanasi, UP-221002
Sh. Shivom	Offg,Commandant	03621-242940	Bn12-ndrf@gov.in	12th BN NDRF, Itnagar, Arunachal Pardesh

Table 7.18 Details of De-watering pumps from NHAI Office of Gurugram

NHAI Control Room		Nodal Officers of NHAI	Mr. Shailesh Kumar	9671966601
Phone No.	0124-2970000		Mr. Jayvir Singh	7056600710

A. Rajiv Chowk

Sr.No.	Name	Designation	Location of Pumps	Mobile no.	Remarks
1	Ranvir Singh	Site Eng	Tai Devilal Stadium	9284706995	SHP Electrical Mud pump along with complete fittings.
2	Barun Kumar	Supervisior		9471427798	
3	Vansraj	Skilled Helper			
4	Suraj Kumar	Supervisior	Subhash Chowk	9053066982	5HP Electrical Mud pumps along with complete fittings.
5	Santosh Kumar	Pump Optr		9717459201	
6	Deenanath Mishra	Plumber	Raheja Mall (Shishpal Vihar	8059240690	Kirloskar 5.0 hp dewatering pump
7	Ram Kumar	Skilled Helper			
9	Pushpendra Yadav	Skilled Helper			
10	Dinesh Yadav	Skilled Helper	Vatika Chowk		

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Table 7.19 Team-2(Vatika Chowk To BSF CAMP)

Sr. No.	Name	Designation	Location of Pumps	Mobile no.	Remarks
1	Rakesh Negi	Site Eng	Badshahpur Junction	7620405124	Kirloskar 5.0 hp dewatering pump
2	Brajesh Bijoliya	Supervisior		9899540217	
3	Omprakash	Skilled Helper			
4	Vikash Singh	Supervisior	Tokri More	9838256272	Kirloskar 5.0 hp dewatering pump
5	Akhtar ali	Skilled Helper			
6	Rakesh Ahirwar	Pump Optr		9306396284	Kirloskar 10 hp dewatering pump
7	Sohan Lal	Skilled Helper	Badshahpur Market		
8	Jari Lal	Skilled Helper			
9	Akhtar Ali	Skilled Helper			PTO Driven High pressure pump with tanker
10	Sunil	Skilled Helper	Airia Mall		
11	Ashish Sahni	Skilled Helper	BSF Camp		

8 Flood Budget Allocation for the year 2020-21

8.1 Financial Arrangements for Floods

The Governor of Haryana is pleased to accord sanction for allocation of funds and to incur an expenditure of Rs. 99,00,000/- (Rupees ninety nine lacs only) with letter no. 606-ER-1-2020/3107 Chandigarh dated 19-05-2020 for keeping as reserve to be used for areas of the state affected by Floods if any, during the year 2020-21 as per details given blow:-

Table8.1 Budget details of State for flood

Sr. No.	Department/D.C.	Purpose	Amount (Rs.in lacs)	Minor Head under 2245-Relief on account of Natural Calamities-02-floods/cyclone to which the expenditure is debatable for the year for the year 2016-17
1	All the D.C.s (Rs.25,000) each	Supply of food & clothing	5.50	101-Gratuitous Relief-food & clothing
2	All the D.C.s (Rs.25,000) each	Supply of sirkies & Tents	5.50	80-General-800-Other expenditure-purchase of sirkies & Tents
3	All the D.C.s (Rs.25,000) each	Supply of fodder	5.50	101-Gratuitous Relief-Supply of fodder
4	All the D.C.s (Rs.25,000) each	Misc. expenditure like POL transportation of material etc.	5.50	800-Other Expenditure
5	All the D.C.s (Rs.50,000) each	House repair	11.00	113-Assistance for the repair/constructions of house
6	All the D.C.s (Rs.50,000) each	Cattle death	11.00	117-Assistance to farmers for purchase of livestock
7	All the D.C.s (Rs.2.50 lacs) each	Dewatering in rural areas	55.00	282-Dewatering
		Total	**99.00**	

The expenditure will be debited to the Budget head "2245-Relief on account of Natural Clamities-02-floods/cyclones etc." (N.P.) for the year 2020-21. The said amount will be released from state budget.

The sanction is further subject to the condition that the monthly expenditure statement in from 26 & 29 is sent to this department (in Accounts Branch) by the 0th every month. The payment is to be made in the Bank account of beneficiary directly through DBT.

Free and subsidized fodder as well as free and subsidized food and clothing is to be provided strictly in accordance with the existing instruction as condition in Haryana Flood Manual.

All Deputy Comissioner in the state are requested to exercise strict control over the expenditure and ensure that the funds are utilized for purpose for which the same have been sanctioned and in no case it should be allowed exceed the sanctioned allotment without the prior approval of the Government. I case the amount has not drawn from the Treasury the same may be surrendered before 25-03-2021.

ANNEXURE F

Stakeholder involved in Integrated Flood Management

Table 2: Stakeholders involved in Integrated Flood Management; (*Source:* WMO, 2006)

Government ministries and agencies	Areas of interest and responsibilities
Agriculture and fisheries	• Planning for seasonal crops, decisions relating to frequency of flooding the fields for replenishment of nutrients, controlling the usage of pesticides and fertilizers, vaccination of livestock, management of rice and seed banks Planning for fish spawning, enforcement of rules on restricted fishing in certain parts of the basin
Water resources management	• Monitoring water quality and quantity, construction and maintenance of flood mitigation structures, ensuring the proper utilization of water resources
Public works	• Building and maintenance of urban infrastructures, flood damage assessment, repair of flood-damaged structures
Transport	• Improved river navigation systems, construction and maintenance of bridges, roads, railways and waterways, flood protection of such structures and subsequent repairs
Communication and broadcasting	• News releases on latest flood situation, providing weather and flood forecasts on radio and TV, education and public awareness of flood issues
Environment and natural resources	• Conservation of natural resources, identification of renewable energy, rapid environmental assessment after a flood event, enhancing public awareness of environmental preservation
Home affairs and foreign affairs	• Liaison with countries sharing transboundary basins, international non-governmental organisations, and external donors and funding agencies
Health departments	• Provision of health services, overseeing medical relief efforts such as the distribution of medicine during

	floods, treatment of injuries and illness, prevention of epidemics, raising public awareness of waterborne diseases and of the importance of clean water and personal hygiene
Rural development	• Construction, maintenance and repair of rural infrastructures
Land management and urban planning	• Enforcement of proper land use planning, development planning in urban areas of the river basin
Military and police force	• Flood fighting, search and rescue, relief distribution
Economics and finance	• Budget allocations for flood mitigation at various levels and river basin development
Planning	• National state or district development plans in which flood management should be incorporated
Women, children and veteran affairs	• Development of special flood protection programmes for vulnerable groups, welfare of these groups, public awareness campaigns targeting these special groups
Culture and religion	• Maintenance and protection of important religious and cultural sites, public awareness raising religious centres offering safe haven for flood victims, organising voluntary groups.
Education	• Schools as centres for dissemination of information on water resources management and flood preparedness to the public, safe shelters, and as a place for public awareness activities targeting children and teachers, incorporation of flood risk management concepts into school curriculum
Government disaster management institutions	**Areas of interest and responsibilities**
Disaster management offices at national, state and district levels	• Development and implementation of disaster management plans at various levels, public awareness campaigns, capacity-building for disaster management practitioners and the communities, issuance of warnings, construction and maintenance of safe shelters and areas, preparing for flood emergency

	management and coordination with external aid agencies
Flood-prone communities	**Areas of interest and responsibilities**
Landowners or farmers	• Understanding the local hazards in order to protect crops, land and other property from flood damage, complying with land use management laws, understanding the consequences of malpractice of land use issues, knowing how to voice their concerns
Rural and urban residents	• Understanding existing risks; knowing how to protect lives and properties; recognizing the signs of impending hazards (indigenous knowledge); responding to flood situations; being aware of escape routes and location of shelters; understanding the links between water, land use management and floods, temporary shelters and information sources; participating in emergency drills
Fishermen	• Being aware of flood situation and knowing what to do to save their livelihoods, understanding key environmental concerns, knowing how to voice their concerns
Other basin communities	**Areas of interest and responsibilities**
Water user associations	• Having a good understanding of land use regulations, having knowledge of drainage conditions, understanding functions of flood moderation requirements of multi-purpose reservoirs, knowing how to voice their concerns
Watershed and forest management committees	• Knowing potential hazards of inadequate watershed and forest management policies and practices relating to landslides and mudflow risks in the areas, knowing where to find hazard information and how to react, helping provide assistance to victims in such situations
River basin organisations	• Development and implementation of basin development plans, improvement of facilities for preserving water retention, working closely with governments of riparian

	countries and relevant line agencies, providing a common platform for the basin communities such as government agencies, communities and NGOs, in order to meet and share ideas, information and lessons learned
Scientific institutes or organisations	• **Areas of interest and responsibilities**
Meteorology and hydrology	• Monitoring weather conditions, water levels in rivers and tributaries, generating and issuing flood forecasts
Water resources management research centres and institutes	• Monitoring of water quality to find means to preserve the water ecosystem, monitoring of resources in the river basins (consumption rates, how much reserves left, how to preserve, recycle), sharing findings with relevant government and non-governmental agencies and other users, ensuring that data disseminated are user friendly
Environmental research institutes	• Environmental impact assessments, impact monitoring, environmental preservation and pollution control research, raising public awareness of environmental preservation, sharing findings with relevant governments, non-governmental agencies and other users
Irrigation and agricultural research centres	• Finding ways to improve crop yield with minimum usage of fertilizers and pesticides, improvement of crop varieties in the region to withstand flood inundation, provision of training to farmers and other users in farming techniques in flood-prone areas
Climate change and hazard related research institutes	• Research on climate change and its impacts on increased frequency and severity of floods, public awareness raising of hazards and their impacts, capacity-building programmes

Registered nongovernmental organisations	Areas of interest and responsibilities
Flood and emergency management centres or groups, human and environmental interest groups	• Understanding and advocating IFM in national, state and district development plans, assisting national, state and district authorities to develop and implement suitable flood management programmes, facilitating participation of communities in such decision-making processes, raising public awareness, performing community need assessments, assisting them in conveying their needs to decision makers, planning flood emergency preparedness and response, providing capacity-building for all stakeholders, working closely with the community to develop and implement community-based flood preparedness programmes, coordinating with other NGOs
Technical and professional societies or associations	• Providing capacity-building at various levels, technical know-how to local government in monitoring and evaluation of flood management plans and technical support to flood and emergency management groups
Humanitarian relief organisations	• Distributing relief supplies to flood victims
Development agencies (international, regional, national, local)	• Advocating adoption of IFM at the basin or national level, greater public participation in IFM planning, linking macro-scale international capabilities and experience to the individual needs of a particular country or a community
National Red Cross Societies	• Establishing and maintaining Red Cross volunteer networks; providing community-based emergency preparedness, first-aid training and flood fighting and emergency response; making quick damage and loss assessments after a flood event, providing capacity-building for the community and volunteers

Mass organisations (Women's Union, Youth Union, Farmers' Union)	• Ensuring the welfare of special focus groups, protecting them and providing assistance in maintaining their livelihoods, raising public awareness of the focused groups, undertaking specific tasks, for instance women's groups managing emergency kindergarten, youth groups forming search and rescue groups, Farmers' Union establishing grain banks in villages
Voluntary organisations	**Areas of interest and responsibilities**
Red Cross volunteers	• Coordinating with various voluntary organisations, faciliting community-based emergency preparedness, search and rescue, carrying out flood fighting and emergency response, performing rapid damage and loss assessment after a flood event, providing capacity building for the community and volunteers, educating the public on basic flood response and preparedness
Other voluntary organisations	• Distributing relief supplies to flood victims, faciliting community-based emergency preparedness, flood fighting and emergency response, implementing focused activities related to flooding, for example, rapid environmental assessment by a team of volunteers from a local university, retrofitting of individual houses by volunteer groups of engineers
Private sector	**Areas of interest and responsibilities**
Transportation and shipping companies	• Facilitating transport of commuters and goods, ensuring maintenance of vehicles, vessels and roads in accordance with the law, assisting in relief and emergency response operations as needed
Construction companies, private developers and real estate agencies	• Proper land use management, such as ensuring conformity to existing rules, protection and flood-proofing of buildings, coordination with flood insurance companies, understanding the risks of unplanned development, costs and benefits of flood protection

Waste management and utilities	• Providing standardized waste disposal systems, preventing interruption of utility services, providing adequate safeguarding measures, carrying out post-flood recovery operations
Industrial sector and industrial organisations	• Installing appropriate waste disposal schemes, providing alternative jobs for the community, proper land use management, building awareness of risk caused by diffusion of stored toxic chemicals
Logging companies	• Having sufficient understanding of deforestation and environmental impacts and being able to rectify the problems, for example, replanting trees in upstream areas, avoiding logjams through proper management
Agriculture and aquaculture production farms	• Understanding the impacts on the environment and preserving it through installation of appropriate waste disposal methods
Small local businesses	• Understanding the risks in the area and employing schemes such as flood-proofing and flood insurance to protect them against risks
Hydropower	• Operating reservoirs to keep flood risks in view and maintaining environmental flows

ANNEXURE G

Flood Forecasting Stations across India

Table 3: State wise flood – forecasting stations across India,
(*Source:* Central Water Commission, 2019)

Sl. No.	Name of State/UT	Number of flood forecasting Stations		
		Level	Inflow	Total
1	Andhra Pradesh	10	9	19
2	Arunachal Pradesh	3	0	3
3	Assam	30	0	30
4	Bihar	40	3	43
5	Chhattisgarh	1	2	3
6	Gujarat	6	7	13
7	Haryana	1	1	2
8	Himachal Pradesh	1	0	1
9	Jharkhand	2	15	17
10	Karnataka	1	14	15
11	Kerala	3	2	5
12	Madhya Pradesh	2	10	12
13	Maharashtra	8	13	21
14	Odisha	12	7	19
15	Rajasthan	2	11	13
16	Sikkim	3	5	8
17	Tamil Nadu	4	11	15
18	Telangana	5	7	12
19	Tripura	2	0	2
20	Uttar Pradesh	39	5	44
21	Uttarakhand	4	2	6
22	West Bengal	12	4	16
23	Daman & Diu	1	0	1
24	NCT of Delhi	2	0	2
25	Jammu & Kashmir	3	0	3
	Total	**197**	**128**	**325**

Table 4: Basin - wise flood - forecasting stations in India,
(*Source:* Central Water Commission, 2020)

Sl. No.	Name of State/UT	Number of flood forecasting Stations		
		Level	Inflow	Total
1	Indus and its tributaries	3	0	3
2	Ganga and its tributaries	94	39	133
3	Brahmaputra and its tributaries	39	5	44
4	Barak System	6	0	6
5	Subarnarekha (including Burhabalang)	4	3	7
6	Brahmani and Baitarni	3	2	5
7	East Flowing Rivers (Mahandai to Pennar)	4	4	8
8	East Flowing Rivers (Pennar to Kanyakumari)	1	6	7
9	Narmada	4	6	10
10	Tapi	1	2	3
11	Mahi	1	4	5
12	Sabarmati	1	1	2
13	Mahanadi	3	3	6
14	Godavari	18	22	40
15	Krishna	5	17	22
16	West Flowing Rivers (Kutch & Saurashtra)	1	1	2
17	West Flowing Rivers (Tapi to Tadri)	2	1	3
18	West Flowing Rivers (Tadri to Kanyakumari)	3	2	5
19	Cauvery and its tributaries	3	9	12
20	Pennar	1	1	2
	Total	**197**	**128**	**325**

About the Authors

Prof. Surya Parkash, Head, GMRD, NIDM
Dr. Harjeet Kaur, JC, NIDM
Mr. Pranav Dhavan, Consultant FMC, NIDM
Major General Manoj Kumar Bindal, VSM, ED, NIDM

About the Institute

National Institute of Disaster Management (NIDM) was constituted under an Act of Parliament with a vision to play the role of a premier institute for capacity development in India and the region. The efforts in this direction that began with the formation of the National Centre for Disaster Management (NCDM) in 1995 gained impetus with its redesignation as the National Institute of Disaster Management (NIDM) for training and capacity development. Under the Disaster Management Act 2005, NIDM has been assigned nodal responsibilities for human resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management.

NIDM is proud to have a multi-disciplinary core team of professionals working in various aspects of disaster management. In its endeavour to facilitate training and capacity development, the Institute has state-of-the-art facilities like class rooms, seminar hall and video-conferencing facilities etc. The Institute has a well-stocked library exclusively on the theme of disaster management and mitigation. The Institute provides training in face-to-face, on-line and self-learning mode as well as satellite based training. In-house and off-campus face-to-face training to the officials of the state governments is provided free of charge including modest boarding and lodging facilities.

NIDM provides Capacity Building support to various National and State level agencies in the field of Disaster Management & Disaster Risk Reduction. The Institute's vision is to create a Disaster Resilient India by building the capacity at all levels for disaster prevention and preparedness.



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National Institute of Disaster Management
(Ministry of Home Affairs, Government of India)
Plot No.15, Pocket 3, Block-B, Sector-29, Rohini, Delhi-110042
Email: ed.nidm@nic.in | Website: https://nidm.gov.in

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