

Floods and Flash Floods in Himachal Pradesh

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ABSTRACT

Himachal Pradesh is a multi-hazard prone state. It comes under zone III and IV according seismic hazard zone map of India. The state of Himachal Pradesh has been facing widespread and extensive damages almost every year because of natural calamities, unprecedented droughts situation, excessive rains, snow and flash flood due to cloud burst etc. which have been taking its toll of human lives, cattle heads, destruction of public utilities, roads, bridges, footpaths, culverts, landslides and washing away of drinking water supply and irrigation schemes and damage to public and private properties making a dependent into the already fragile economy of the state. This paper focuses on analyzing natural disaster floods in Himachal Pradesh and also describes the main mitigation strategies during floods natural disasters. The universe of the study was very wide and vast. Therefore due to constraints of resources and time only floods in Himachal Pradesh and Main Mitigation strategies for floods were studied. In the present paper the data was collected through primary and secondary sources.

Keywords: Natural calamities; Excessive rains; Flash flood; Landslides

INTRODUCTION

Pre-independence, droughts and famines were the biggest killers in India. The situation stands somewhat altered today, wherein it is probably a combination of factors like increased irrigation development, improved reservoir management and food security measures that have greatly reduced deaths caused by droughts and famines. Floods, cyclones, and earthquakes dominate (98%) the reported injuries, with ever increasing frequency in the last ten years. The period from 1973 to 2008 has been associated with a large number of earthquakes in Asia, that have a relatively high injury-to-death ratio. Floods, droughts, cyclones, earthquakes, landslides, tsunami and avalanches are some of the major natural disasters that repeatedly and increasingly affect India. The fast pace of growth and expansion without comprehensive understanding or preparedness has brought forth a range of issues that seek urgent attention at all levels. In the absence of such measures, the growing numbers in our population are at a risk of prospective hazards such as air accidents, rail accidents, road accidents, boat capsizing, building collapse, electric fires, festival related disasters, forest fires, mine flooding, oil spills, serial bomb blasts and fires. The safeguards within existing systems are limited and the risks involved high [1].

Vulnerability of disasters in Himachal Pradesh

Himachal Pradesh is a multi-hazard prone state. It comes under

zone III and IV according seismic hazard zone map of India. The state of Himachal Pradesh has been facing widespread and extensive damages almost every year because of natural calamities, unprecedented droughts situation, excessive rains, snow and flash flood due to cloud burst etc. which have been taking its toll of human lives, cattle heads, destruction of public utilities, roads, bridges, footpaths, culverts, landslides and washing away of drinking water supply and irrigation schemes and damage to public and private properties making a dependent into the already fragile economy of the state.

Flood

A flood is the over flow of water on to land that is normally dry. Flooding occurs when the water level rises and over flows the banks of a river of some other low-lying channel, or when high banks of a river of some other low-lying channel, or when high ocean waters wash over the coast. In many parts of the world floods happen frequently while flooding is a disaster in many cases in other cases floods are relied upon to replenish nutrients in the soil and to sustain crops. World wide, 40 percent of all deaths from natural diseases are due to floods. Floods and flash flood in particular, kill more people than any other weather phenomenon

Causes of floods

Flood may be caused due to

- River in spate.

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- Snowmelt.
- Storm surges.
- Short intense storm causing flash floods

Floods in rivers may be caused by

- Inadequate capacity within the banks of the river to contain high flows.
- River bank erosion and silting of riverbed.
- Landslide leading to obstruction of flows and changes in river course.
- Synchronization of flood in the main and tributary rivers.
- Flow retardation due to tidal and back water effects.
- Poor natural drainage.
- Cyclone and heavy rainfall.

Types of floods

Flash floods: These are usually defined as floods, which occur within six hours of beginning of heavy rainfall, and are usually associated with towering cumulus clouds, severe thunderstorms, tropical cyclones or the passage of cold-water fronts. This type of flooding requires rapid localized warning and immediate response by affected communities if damaged is to be mitigated. Flash floods are normally a result of run off from a torrential downpour, particularly if catchments slope is able to absorb and hold a significant part of the water. Other cause of flash floods includes dam failure or sudden breakup of ice jams or other river obstructions.

River floods: River floods are usually by precipitation over large catchments areas or by melting or the winter's accumulation of snow or sometimes by both. The floods take place in river systems with tributaries that may drain large geographic areas and encompass many independent river basins. In contrast to flash floods, river flood normally build up slowly, are often seasonal and may continue for days or weeks.

Coastal floods: Some flooding is associated with tropical cyclones (also called hurricanes and typhoons). Catastrophic flooding from rainwater is often aggravated by wind-induced storm surges along the coast. Salt water may flood the land by one or a combination of effects from high tides, storm surges or tsunamis.

Typical effects

Physical damage: Structures damaged or collapsed by washing waters, landslides triggered on account of water getting saturated. Boats and fishing equipments may be lost or damaged in coastal areas.

Causalities and public health: People and livestock deaths caused by drowning, very few serious injuries, outbreak of epidemics, diarrhoea, viral infections, malaria

Water supplies: Contamination of water (wells, groundwater, piped water supply). Clean water may be unavailable.

Crops and food supplies: Sudden food shortage can be caused due to loss of entire harvest, spoiling of grains when saturated in water along with loss of animal fodder. The crop storage facilities and godowns may get submerged resulting in immediate food shortage.

Floods may also affect the soil characteristics. The land may be rendered infertile due to erosion of top layer or may turn saline if sea water floods the area [2].

Floods in Himachal Pradesh

The state being in hilly terrain, the flood problem in the state is largely isolated in nature. The main problems are flash floods and bank erosion because of steep slopes of rivers and high river flows due to heavy rains are not an unusual phenomenon. As a result breaches in embankments and damage to various utilities like irrigation/flood control schemes and houses are also observed.

The rivers of importance from flood damage angle are:

- River Satluj and its tributaries like Spiti, Sangle Khad, Ali Khad, Gambhar Khad, Sirs Khad and Swan Khad.
- River Beas and its tributaries like Uru, and Sukheti Khad.
- River Ravi and its tributaries like Sivi.
- River Yamuna and its tributaries like Pabbar Khad, Giri and Bata. Flash floods in Satluj during rainy season of Year 2000

A natural calamity of gigantic magnitude struck the Satluj Valley on the intervening night of 31st July 2000. It led to an unprecedented rise in the water level of Satluj River from Tibetan plateau throughout the entire length of about 250 km up to Govindsagar Lake. The rise in the level of water according to eyewitnesses was reported up to 60 feet above the normal levels. The flash flood was termed as the one that occur once in 61000 years. It is almost impossible to design technical specifications for all kinds of infrastructures to cater to such a rare incidence. It is obvious that such a natural calamities would cause unprecedented loss of human life, livestock, public and private property and would also erase from the surface and existing of physical infrastructure. It has led to extensive damage to about 200 km of road length, washed away 20 bridges and 22 Jhulas and badly damaged 12 bridges. About 1,000 irrigation, sewerage, flood protection and water supply schemes have been considerably damaged and some of these have been completely destroyed [3].

Extensive damage has taken place in the already executed Hydel Projects as also those under execution including the prestigious Nathpa Jhakri project. These calamities have, infect, and turned the clock backwards in time by several decades in terms of availability of the infrastructure. The area has been completely cut off. The availability of essential commodities has been disrupted and reaching relief teams in the areas of worst incidence has been rendered impossible. In certain areas from knowledge about loss of human life is yet to emerge as shown in table 1 [4].

Table 1: According to preliminary estimates the damage has been estimated at about Rs 1466.26 crore. Macro details are as follows:

Item	Estimated loss (Rs crore)
Road bridges and Jhulas including National Highways	261.18
Water supply, irrigation sewerage and flood protection	17.77
Power projects and transmission lines	1083.50
Forest infrastructure	0.73

Cultivated area washed away (1887.50 bighas) in Kinnaur, Kullu and Shimla Districts	31.92
Human lives lost (number)	135
Cattle heads lost (number)	1673
Private houses damaged (number)	15.82
Standing crops and fruit crops lost over an area of 41,792 hectares	53.34
Total	1466.26

Relief measures

The administrative implications apart, the human aspect of the problem call for prompt and urgent action in meeting the impact of such natural calamities. Keeping this in view, the state government immediately rose the occasion and initiated various relief measures with a view to providing succor to the affected people.

The state government immediately planned air lifting of essential commodities from Shimla to various pockets of the cut-off areas. Arrangements were also made to rush supplies via Manali, Kunzam Pass and Kaza to the areas beyond Khab comprising of Hangrang Tehsil of Pooh Sub-Division. Similarly, the supplies to the lower areas of Kinnaur District i.e. part of Nichar Sub Division, Ani, Nirmand of Kullu district and Rampur area of Shimla district are being supplemented and maintained by rushing stocks of essential commodities from the nearby godowns of Food and Supplies Department/Civil Supplies Corporation from Shimla. 742 quintals of essential commodities have been air lifted in 46 sorties of helicopters with effect from 3rd August, 2000 to 6th August, 2000. Further, essential commodities totalling 537 quintals have also been rushed by road to Hangrang Tehsil of Pooh Sub-Division and Bhabanagar of Nichar Sub-Division till 06-08-2000.

The air lifting of supplies of essential commodities is being made by Indian Air Force (IAF) helicopters besides, the lone helicopter available with the State Government. As the cost of transportation of wheat and rice up to principal distribution centre of FCI is borne by the Central Government, the State Government would be claiming air freight charges of these helicopters from the Central Government as road link to the various public distribution centres in the district of Kinnaur has been cut off by these flash floods and the only mode of transportation at the moment is by air lifting of these commodities to the cut off areas of Kinnaur. As the power supply has also broken down by these floods and the Chakkis (watermills) are also not functioning. The State Government is rushing wheat atta instead of wheat to these areas. The State Government is well aware that air lifting is a costly exercise and must be resorted to in extreme circumstances when no other alternative of transportation is available. It has therefore been planned to carry stocks on mules/head load etc. as soon as at least the pedestrian paths are restored in the District.

In normal circumstances, LPG cylinders are made available on for basis up to the location of LPG Agency by the concerned Oil Company, now, due to disruption of roads, these refills have to be carried by mules or on head load up to the LPG Agencies of Pooh and Peo. The Government of India, is, therefore, requested to ask the Oil Companies to reimburse the additional carriage charges on carriage rates duly approved by the District Administration.

Till date, Rs 19.90 crore has been spent by the State Government for various relief measures [5]. FEAR OF FLASH FLOOD IN HIMACHAL PRADESH 2004

Blockage of River Parchu by landslide in Tibet-creation of artificial dam-possibility of flash floods in Himachal Pradesh.

On the 29th July, the Army Headquarters reported that there was a drastic reduction in the flow of River Parchu which had probably been caused because of a land slide in the Chinese territory blocking the water way. It was noted that if the dam so created bursts there was a likelihood of a flash flood leading to large scale destruction of life and property. The river Parchu originates from the Prangla Pass on the boundary between Himachal Pradesh and Jammu & Kashmir. It enters in to the Chinese territory across the LOC near Chumar and then again re-enters in to Indian territory across LOC near Kaurik. It merges with Spiti river at Sumdo which finally merges with Sutlej river at Khab. The landslide blocking the waterway is 28 km on the other side of the LOC. The MEA were requested to take up the matter with the Chinese side to confirm this information and if this was correct to make a request that the Chinese side should resort to control removal of the blockage so that the release was gradual. The MEA was also requested to request the Chinese side to intimate us as soon as the dam showed signs of bursting so that the people in the valley of Parchu and of Spiti downstream of Sutlej are evacuated. The State Government was also informed about the blockage on the river and possibility of the bursting of the dam leading to serious flash floods.

The Chinese side informed the MEA that as on the 27th of July, the artificial dam was 35 meters high, and the lake created by the dam was 800 meters wide 3500 meters long and 15 meters deep. The water volume in the lake was 21 million cubic meters. The water level was rising by 0.79 meters per day. The dam was leaking by 10 cubic meters per second. The Chinese indicated that there was possibility of dam bursting. The Chinese side communicated that because the site of landslide was very remote and there was no motorable road, it was very difficult to foresee the time of the dam bursting or take steps for controlled removal of the blockage.

In consultation with the Chief Secretary of Himachal Pradesh, the Financial Commissioner (Revenue), Himachal Pradesh was designated as the contact person on the Indian side and the contact was to be maintained through hot line between the Army formations on both sides at Spanggur. The Chinese side was intimated through the hot line that they should inform whenever there was possibility of the dam bursting. The state Government was requested to warn all the villages lying in the valley of Parchu, Spiti downstream of Sumdo and Sutlej downstream of Khab and was also advised to set up a post at the point where the river Parchu enters the Indian Territory so that warning about flash floods could also be given from our side. The ITBP was also advised to set up a post at the point where river Parchu enters the Indian Territory to constantly monitor the situation. ITBP have set up the lookout post. Regular meetings are being convened with MEA, Ministry of Defence, Army Headquarters, Ministry of Water Resources/CWC, Ministry of Power, NASA, ITBP and a representative of the State Government to monitor the situation.

The NASA are making regular Satellite pictures available. The CWC were requested to communicate the likely dimensions of the flash flood which would result if the dam bursts. The CWC communicated that in case of the dam burst, the likely height of the tidal wave which will reach Sumdo will be in excess of a

height of 19 meters. On the 8th of August, at around 3.00 PM, the Chinese informed that the dam was overflowing and was likely to burst in next 24 hours [6].

The following steps have been taken;

- A chain of wireless sets have been set up along all the major villages on the banks of Parchu, Spiti downstream of Sumdo and Sutlej downstream of Khab for communication and warning.
- All the villages had been sensitized in advance and they had been advised to select places to which they will evacuate in case of the flash flood.
- 56 villages which fall within the danger zone have been evacuated.
- Essential commodities have been located at convenient places.
- Four columns of Army have been placed on standby.
- Four helicopters of IAF are also on standby. In addition, two Army Aviation Helicopters are available at Pooh.
- Six medical teams are on standby.
- All the river valley projects on these rivers had been warned in advance and they were prepared.
- As indicated in the earlier reports, an ITBP post has been set up at the point where the river Parchu enters Indian territory.
- The State Government has also set up a look out post on the same point.
- A system for communicating the warning was put in place and tested through a mock drill on the 8th of August.

FLASH FLOOD IN SATLUJ DURING RAINY SEASON OF THE YEAR 2005

A natural calamity of gigantic magnitude, due to sudden rise/breach of Parechu River in the Chinese territory struck the Satluj valley on 26-06-2005. It led to an unprecedented rise of water level of Satluj river from Tibetan Plateau throughout the entire stretch of National Highway 22. The rise in water level was reported up to 15 meters above the normal level at some places. It led to extensive damage to about 350 hundred kilometers of road length from Samdo to Govindsagar/Bhakra Dam. Detail of damage is as under:

- 10 bridges, 11 ropeways washed away.
- 15 motorable bridges and 8 jeepable and foot bridges damaged/affected.
- 10 kms road between Wangtoo and Samdo washed away.
- 15 kilometer length of various patches in road between Wangtoo and Samdo has been damaged/affected.
- Various link roads originating from National Highways including certain NH/PWD roads between Sainj and Wangtoo have been damaged.
- Electrical lines including poles and towers, OFC Network, water supply schemes, sewerage system have also suffered serious damages.
- Generation in power projects has also been affected. The details of the washed away/damaged bridges is as under:

Shilkar, Leo, Khab, Akpa, Khari, Karcham, Jagatkhana, Bazir Bauri, Nathpa and Bhabanagar.

Apart from the above, the foundation and abutments and approaches of number of other bridges have been damaged, extensive damage has also been caused to National Highway-22 which have been damaged at the following places:

Kali Mitti, Nogli, Cholling and Ralli, Poari, Pooh, Khari, Khab, Shilkar and Sambho. State Highway at Saij and Luhari has also been damaged and at several places foundation/base of National/State Highway has also been damaged. The major part of district Kinnaur i.e. from Wangtoo to Samdho is completely cut off from rest of the world and intra district communication is also affected due to breach of roads and bridges at various points in this stretch. Similarly, Spiti valley of Lahaul and Spiti District, which is also mainly dependent on this road, has also suffered connectivity problem. Flood has not only caused extensive damages along the rivers Parechu, Satluj and Spiti but has also affected the population living in the entire area of Kinnaur District between Wangtoo to Samdho and Spiti Sub-Division of Lahaul Spiti District as they have no access to transportation and not in a position to sell their cash crops/export surplus farm produce in the market services like health, education, electricity and supplies of essential commodities have also been affected. This has also adversely affected movement of local people, employees and security forces especially students/patients. In the year 2005, the total damages to crops, houses and public utilities have been estimated Rs 68604.48 lacs say 686 crore.

Action taken

The action taken by the State Govt. is as under:

- Control rooms warning system and contingency plans were already in place and hence were operationalised effectively. 922 families comprising of about 4650 members in 5 districts i.e. Kinnaur, Shimla, Kullu, Mandi and Bilaspur living in the danger zone were evacuated to already identified safe places and essential food and shelter was provided. After receding of the water level, most of them have returned to their homes except in three locations where relief camps are still operational.
- The services of Indian Air Force helicopters and State helicopter were pressed to evacuate the stranded tourists and local medical emergencies. 562 persons including 69 foreigners have been evacuated till 1st July, 2005.
- Distribution and sale of essential items through public distribution system and local markets have been regulated to avoid panic buying and to ensure equitable access to essential items.
- Restoration of power supply was taken up immediately and power supply in more than 60% area, including district headquarters, have been restored [7].
- For providing emergent connectivity, ropeways along the river at various points with priority to location where bridges have been washed away, are being installed, for which steel ropes, trolleys and other accessories have been sent through helicopters, and head load to sites. Two ropeways have been installed.
- Old Hindustan Tibet Road, which passes along higher elevation and is safe from flood, but abandoned, is being restored and this road between Tapri and Akpa with a length of about 70 kms. By passing the most critically damaged NH between those two points in a length of about 55 kms. Will provide alternative jeepable connectivity not only to the population between these two points but also beyond to rest of Kinnaur and Spiti valley till the time NH between Tapri and Akpa is restored.

- The NH with the state PWD, which was damaged at many points, particularly near Rampur has been restored upto Wangtoo for motorable traffic.
- Relief material, including gratuitous relief, to the affected persons has been distributed. Relief team along with 28 mule load material to Leo village, where more than 22 houses were completely washed away and was totally cut off due to bridges getting washed away, reached Leo on 30-06-2005 through a long trek route.
- Pedestrian/mule paths are being constructed to by-pass the block points by PWD to facilitate movements of people and goods.
- Material for restoration of power supply and pesticides and fungicides are being sent through IAF helicopters.
- There are sufficient essential commodities available under PDS in the affected areas. However, there is acute scarcity of LPG, kerosene oil and POL.
- The Chief Minister, Himachal Pradesh along with some of his cabinet colleagues visited the affected areas thrice to review relief and restoration operations.
- Smt. Sonia Gandhi, Chairman, United Progressive Alliance, Hon'ble Home Minister, Union Govt., Home Secretary, GOI and Director General ITBP also visited the affected area on 30.06.2005 [8].

MAIN MITIGATION STRATEGIES (FLOOD)

Mapping of the flood prone areas

Is a primary step involved in reducing the risk of the region. Historical records give the indication of the flood inundation areas and the period of occurrence and the extent of the coverage. The basic map is combined with other maps and data to form a complete image of the flood plain. Warning can be issued looking into the earlier marked heights of the water levels in case of potential threat. In the coastal areas the tide levels and the land characteristics will determine the submergence areas. Flood hazard mapping will give the proper indication of water flow during floods.

Land use control

Will reduce danger of life and property when waters inundate the flood plains and the coastal areas. The number of casualties is related to the population in the area of risk. It's better to reduce the densities in areas where neighbourhoods are to be developed. In areas where people already have built their settlements, measures should be taken to relocate to better sites so as to reduce vulnerability. No major development should be permitted in the areas which are subjected to high flooding. Important facilities should be built in safe areas. In urban areas, water holding areas can be created in ponds lakes or low lying areas.

Construction of engineered structures

In the flood plains and strengthening of structures to withstand flood forces and seepage. The building should be constructed on elevated areas. If necessary build on stilts or platform.

Flood Control aims to reduce flood damage. This can be done by Flood Reduction by decreasing the amount of runoff by treatment like reforestation (to increase absorption could be a mitigation strategy in certain areas), protection of vegetation, clearing of debris

from streams and other water holding areas, conservation of ponds and lake etc. Flood Diversion includes levees, embankments, dams and channel improvement. Dams can store water and can release water at a manageable rate. But failure of dams in earthquakes and operation of releasing the water can cause floods in the lower areas. Flood proofing reduces the risk of damage. Measures include use of sand bags to keep flood water away, blocking of sealing of doors and windows of houses etc. Houses may be elevated by building on raised land. Buildings should be constructed away from water bodies.

Flood management

In India, systematic planning for flood management commenced with the Five Year Plans, particularly with the launching of National Programme of Flood Management in 1954. During the last 48 years, different methods of flood protection structural as well as non-structural have been adopted in different states depending upon the nature of the problem and local conditions. Structural measures include storage reservoirs, flood embankments, drainage channels; anti-erosion works, channel improvement works, detention basins etc. and non-structural measures include flood forecasting, flood plain zoning, flood proofing, disaster preparedness etc. The flood management measures undertaken so far have provided reasonable degree of protection to an area of 15.81 million hectares throughout the country [9].

Community based mitigation

Sedimentation clearance, reforestation programme, dike and flood wall construction can be taken as part of the community based mitigation programme. The community can participate in flood fighting by organizing work parties to repair embankments, pile sandbags and stockpile needed materials. Farming practices have to be flood compatible, special varieties of seeds are available which can be harvested during the flood season. Houses constructed need to be flood resistant and multipurpose shelter should be constructed by the community. Banks of the earth can be raised and it can give shelter to the community as well as the live stock during the time of floods [10].

RELIEF MEASURES INITIATED BY THE STATE GOVERNMENT YEAR 2000

Apart from the immediate need to provide gratuitous relief to the bereaved families and next of kin of those who have lost lives, certain gratuitous relief shall also need to be provided for the loss of cattle, farm lands and houses etc. Interm of the provisions of Himachal Pradesh Relief Manual. This entails an immediate expenditure of about Rs. 12.86 crore comprising of Rs. 1.35 crore for human lives lost, Rs. 0.74 crore for the loss of cattle and Rs. 10.77 crore for loss and damage to house and property. This however does not include any relief for loss of farm lands and loss of crops. Agricultural/horticulture land measuring 1887-50 big has has been completely washed away in Kinnaur and Shimla district. The value of land washed away is estimated at Rs. 31.92 crore. As regards the loss of infrastructure and restoration of damages to infrastructure the state government requests the government of India for fully meeting the need for resources for restoration of infrastructure. This implies an assistance of Rs. 261.18 crore to roads and allied infrastructure, Rs. 17.77 crore for water supply and irrigation infrastructure, Rs. 0.73 crore for forestry infrastructure and Rs. 247.00 crore for power infrastructure. In it also important

to mention that the state government will incur a further loss of Rs. 836.50 crore on account of generation losses for Jhakri and all other projects. Since the natural calamity has led to irreparable loss to infrastructure, therefore, the assistance from the government of India is requested by way of special grants under the national calamity contingency funds recommended by the eleventh finance commission. Since NCCF facility could take some time in view of legislative requirements. It is requested that in view of legislative requirements. It is requested that either a special non plan grant or an on account grant under the NCCF may providing keeping in view the serious fiscal stress the state government has been facing for some time now [11].

RELIEF MEASURES UNDERTAKEN 2005 FLASH FLOOD IN HIMACHAL PRADESH

The Hon'ble Chief Minister Sh. Virbhadr Singh, accompanied by chief secretary S.S. Parmer and other senior officers, under took an aerial survey upto khab to have first-hand assessment of the damage. Later, he announced a sum of one crore rupees for undertaking immediate relief measures on war footing. The Himachal Government pegged its loss of property and infrastructure at a whopping Rs. 800 crore. An amount of Rs. 100.69 crore was available in the state calamity relief fund during the current year. Against the allocation, the govt. of Himachal Pradesh, have already spent Rs. 50.34 crore on account of drought and excessive rains snow/flash flood. Though Rs. 50.35 crore is left in balance in the calamity relief fund; but total demands to the tune of Rs. 40 crore from deputy commissioners/department have been received for repair and restoration works. Further, rainy season is in primary stage and snow season is get to come. Under the circumstances, the state will be left with no balance of calamity relief fund and will not be in a position to sustain the huge loss to the public/private property due to flash flood, which is to tune of Rs. 610 crore.

CONCLUSION

Natural disasters have very often exacted a heavy toll of death, destruction and human suffering. Among the types of natural disasters, floods occupy a prominent position. While floods and flooding have always been experienced from the earliest days, the damage and economic disruption due to flooding have been on an upswing which trend is alarming. We seem to be paying too

high a price for our unwise and indiscriminate use of land in the flood plains. This is even more regrettable when we relies that it is possible to reduce the loss significantly by means of wise regulation and recourse the some mitigate measures such as flood plain zoning. Himachal Pradesh is one of the most flood prone state of India. Himachal Pradesh, s own past experience has shown that our flood losses could be minimized by a set of desirable disaster mitigation steps. Himachal Pradesh has been a pioneer in flood forecasting there are sound policy initiatives evolved through much experience and experimentation. However, the progress in executing such desirable measures needs to accelerate.

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