

value and they may enter legal objections to the map or make claims for compensation. The map must be prepared carefully to ensure that it can withstand these objections. The map may also be used to decide flood insurance premiums, or to refuse insurance because of the danger of flooding. These examples serve to show that the map has considerable economic and legal importance and must be prepared bearing this importance in mind.

As well as delineating the 100-year flood, the flood plain map may show areas flooded more frequently, perhaps the 50-year or 10-year flood. A floodway is often designated; this would be the permanent river channel and the immediately adjacent flood plain that would carry most of the flood flow. Outside the floodway the water velocities would be low, contributing little to the discharge. The floodway needs to be kept clear of all development to prevent excessive backwater effects, leading to increased levels of inundation upstream, and to ensure rapid evacuation of flood water after the peak has passed.

## Flood insurance

The primary purpose of flood insurance is, of course, to pay for the damage caused by flooding, but it is also often recommended as a means of promoting good use of the flood plain. Insurance premiums that correctly reflect the risk of flooding, by being based on long-term annual average damages, should provide an indication of the risk of developing in the flood plain and would deter unsuitable developments there. In practice, this rarely happens. Flood insurance premiums are usually very high as only those likely to make frequent claims consider insuring themselves against floods. This leads to one of two possibilities: the customer decides that the insurance is too expensive and does not insure his or her property or, the insurance companies decide that there will be no profit in underwriting flood damage at a premium that customers are willing to pay and decline to offer the business.

When flood insurance is not available commercially, governments may intervene to ensure that people can insure themselves against flood losses. The United States National Flood Insurance Programme was set up, in part, because of the difficulty of obtaining flood insurance. In other countries, flood insurance is provided as part of compulsory, government-provided natural disaster insurance funded by a levy on fire and buildings insurance premiums. Spain, New Zealand and France operate systems of this type.

The rest of this chapter will describe two flood plain management systems: the United States National Flood Insurance Programme, and the Canadian Flood Damage Reduction Programme.

## The United States National Flood Insurance Programme

The National Flood Insurance Programme (NFIP) uses flood insurance to promote well-managed flood plains. The basic principle of the NFIP is that flood insurance should only be available in areas where certain minimum flood plain management policies have been adopted. Thus it is, in effect, a land-use programme with the carrot of insurance to encourage the adoption of the specified policies.





Floods in Lisbon, November 1983.

The NFIP was established in 1968, following large floods in previous years, which had served to sensitize the public and politicians to the flood loss problem. Three factors are credited with influencing the adoption of the NFIP. Insurance companies were becoming increasingly reluctant to sell flood insurance cover, largely because of their exposure to potentially catastrophic loss; flood losses were increasing mostly because of increasing development in flood plains leading to rising federal flood-related expenditures (in part because of a more liberal disaster relief policy); and there was an increasing interest at the time in non-structural solutions to flood problems.

FEMA, which manages the NFIP, identifies communities at risk from floods and they must join the programme or lose access to certain federal funds, including flood disaster relief. Also, individuals in the flood-prone areas cannot borrow for purchasing or constructing (including reconstructing after loss) from a federal agency or federally-regulated company without buying flood insurance. These agencies and companies provide some 80 per cent of home loan funds in the United States.

A community entering the NFIP starts in the "Emergency Programme" because only approximate information will be available on flood extent. This involves adopting a minimum set of land-use regulations (see table 3) and, in return, subsidized flood insurance is available. Detailed flood plain maps are then prepared showing the extent of the 100-year flood. Once these are prepared, the



community enters the "Regular Programme", with stronger regulation required. The maps show the floodway where all development is prohibited and zones with different risks of flooding. The flood plain maps are freely available to the public (including on the Internet) thus ensuring that the risks of flood plain development are well publicised. New properties in these zones must buy flood insurance at actuarial rates (based on annual average damage) which vary with the risk zone and building elevation. The flood plain regulations under the NFIP (table 3) are minimum regulations and communities are encouraged to adopt a tighter control of flood plain development.

### EMERGENCY PROGRAMME

- Permits required for all new developments in the identified flood hazard zone.
- If flood elevation data are available, new residential structure must be elevated, and non-residential structures flood-proofed, to or above the 100-year flood level.
- Water supply and sewerage systems must be safe from flooding and designed to prevent contamination of flood waters.
- Mobile homes must be anchored and evacuation plans prepared for mobile home sites.

### REGULAR PROGRAMME

- The above regulations apply to the designated 100-year flood plain.
- All new residential structures must be elevated to or above the 100-year flood level. Watertight basements are allowed.
- New non-residential structures must be flood-proofed to the 100-year level.
- Drainage must be provided for subdivisions in areas of shallow flooding.
- No development is allowed in the designated floodway.

#### Additional requirements for coastal hazard zones.

- All new developments must be raised above the 100-year level.
- The space below the structure must be free of obstructions. Fill is prohibited.
- No new mobile homes outside of existing developments are allowed.
- Alteration of protective sand dunes and mangrove swamps is prohibited.

Table 3 Minimum flood plain regulations under the United States National Flood Insurance Programme.

It will be seen that the NFIP is really a land-use management programme and has often been criticized for this. The balance between the insurance and the land-use planning aspects has varied with amendments to the programme under different federal administrations since its inception in 1968. The programme has had considerable success in promoting flood plain management. Over 18,000 out of a total of 21,000 flood-prone communities have enrolled in the NFIP and about 2.6 million insurance policies are in force, covering about 30 per cent of flood plain properties. It is extremely doubtful whether so many communities would have adopted flood plain management without the incentive of the insurance. However, the NFIP has its problems: the regulations are of little benefit to pre-existing properties and encroachment on flood plains is continuing. Moving from the emergency programme to the regular programme incurs the loss of a subsidy for insurance premiums and this move is often resisted, with the result that the subsidized insurance premiums may make it more attractive to build on the flood plain. Finally, there is some evidence that in coastal flood zones the NFIP may have encouraged unwise development.





Floods in Colombia, September 1984.  
*Colprensa F. Trujillo Diaz*



The example of the NFIP shows how an insurance system can provide an incentive to improved flood plain management with a potential for reducing losses as well as compensating those affected by floods exceeding the design limits of flood protection schemes. The detailed operation of the NFIP depends greatly on the form of local, State and federal government in the United States and is unlikely to be transferable to other countries. However, the land-use regulations of the NFIP, summarized in table 3, may be more transferable. The NFIP remains an example of the successful use of insurance as a part of the flood plain management strategy and as such should be studied by other countries planning to introduce flood insurance schemes or wider flood loss prevention schemes.

### The Canadian Flood Damage Reduction Programme

As in the United States and in other countries, early flood alleviation efforts in Canada concentrated on structural solutions. Indeed, the Canada Water Conservation Act of 1953 offered federal subsidies for flood alleviation structures, while non-structural measures attracted no federal funds. By 1970 attitudes had changed and the Canada Water Act of that year adopted a more comprehensive approach to water resources planning with non-structural flood alleviation solutions being favoured. The act established a mechanism for federal/provincial cooperation in all water resources matters, including flooding. It was felt that the problem of flooding called for a new approach, beyond the traditional one of employing structural works and paying disaster assistance. There was dissatisfaction with several aspects of the old policy: income transfers from the general public to the minority of flood plain dwellers; changing social values, urbanization and economic values; and the apparently endless escalation in flood damage costs, even after building costly flood-control structures. An Environment Canada publication *Flooding of 1993* characterized the old policy as "a classic case of public spending causing further public spending as well as human hardship".

The Flood Damage Reduction Programme was established in 1975 under the Canada Water Act. It post-dates the United States NFIP and draws on the United States experience. Its operation is governed by agreements between each province and the Federal Government, thus the details of the programme vary from province to province, but there are many common features. There is joint Federal/Provincial cooperation in identifying flood-prone areas, mapping those with the highest development and thus damage potential and making this information available to the public. The Governments jointly





designate these areas as flood risk areas and stop supporting flood-vulnerable development there. The minimum criterion for defining the flood risk area is the 100-year flood, but higher values may be used at the request of the province. Flood risk areas are divided into two zones: the floodway and the flood fringe. Future development is discouraged in the floodway because of the danger to life and property there and because obstructing the floodway could increase flood levels upstream. Development is permitted in the flood fringe area, as long as it is adequately flood-proofed. Flood plain mapping is seen as the primary aspect of the Flood Damage Reduction Programme, though it has also supported the establishment of flood forecasting systems and in a few cases structural measures. However, these activities complement the flood plain mapping programme and are not the primary approach to reducing flood damage. The mapping is of course not adequate on its own, but is an essential basis for the land-use planning and development control to avoid flood damage. It is often claimed that property values decrease once a flood risk area is designated. However, in its publication, *Flooding*, Environment Canada quotes a number of United States and Canadian studies showing that this is not the case and states that the opposite effect has been found in some cases.

Both the United States National Flood Insurance Programme and the Canadian Flood Damage Reduction Programme use flood plain mapping as a central feature. Well prepared flood plain maps are an objective indicator of flood risk and provide a reliable basis for land-use planning for reducing flood losses. Any country planning a system for flood plain management would be well advised to base it on flood plain mapping as the United States and Canada have done.