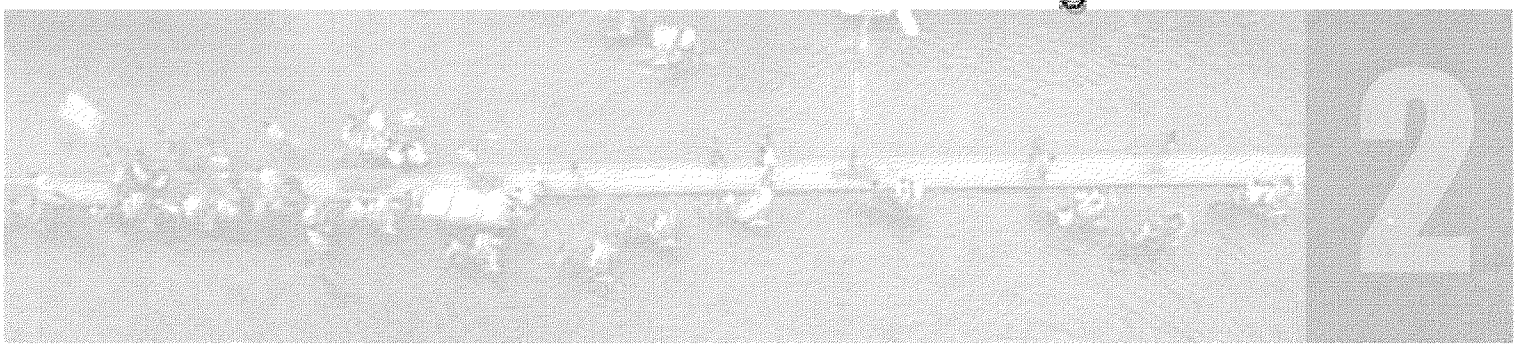
Key Elements of Flood Disaster Management

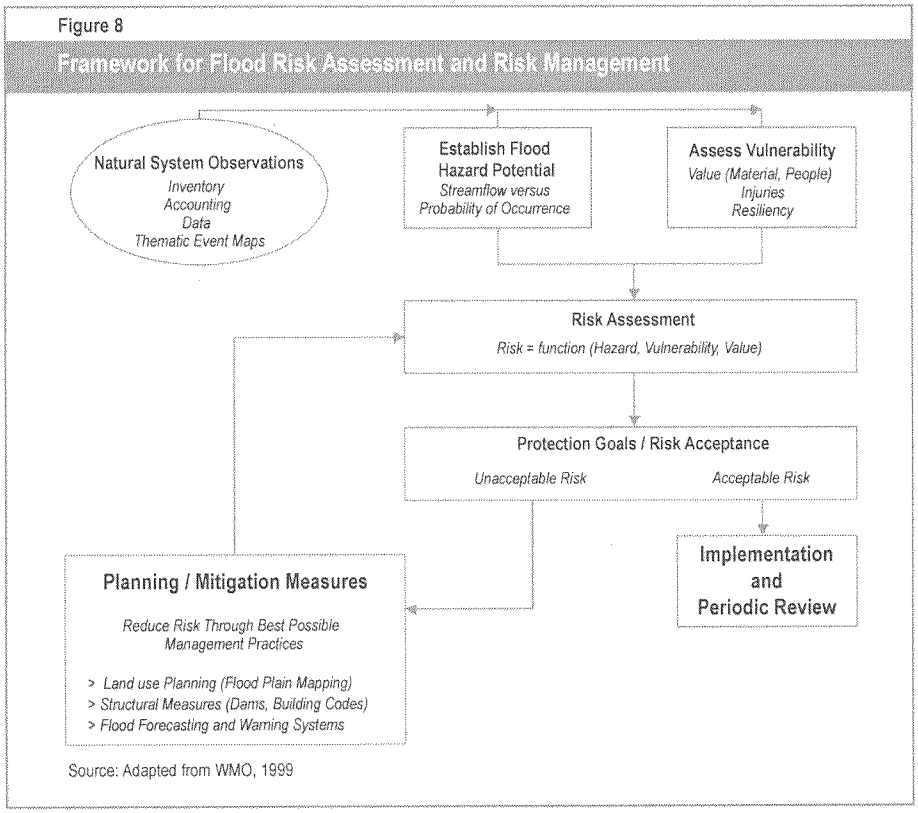


2.1 Risk Management and Flood Plain Delineation

A change to proactive management of natural disasters requires an identification of the risk, the development of strategies to reduce that risk, and the creation of policies and programmes to put these strategies into effect. Risk management is a fundamental activity geared to the evaluation of schemes for reducing but not necessarily eliminating the overall risk, as in may cases risk cannot be entirely eliminated Figure 8 provides a schematic of the steps associated with risk assessment and management. It includes assessing the potential for a hazard to occur and a vulnerability analysis to provide an understanding of the consequences should an event of a certain magnitude and frequency occur. Based on this initial work, various mitigation measures can be evaluated to assess their ability for reducing risk exposure. Based on a thorough risk assessment, disaster management plans and specific mitigation measures can be identified. Efforts would then be undertaken to implement the selected mitigation measures.

For flooding events, there is a need to calculate the probability or likelihood that an extreme event will occur and to establish and estimate the social, economic and environmental implications should the event occur under existing conditions Maps of the flood-prone areas should be prepared and detailed impacts outlined. A participatory process should be invoked, leading to the development of an acceptable level of risk. Measures can be evaluated and implemented to meet this level. This overall process assists the community in better understanding the various actions that can increase or decrease risk exposure, and can lead to greater community participation in the developed solutions to the flooding problem

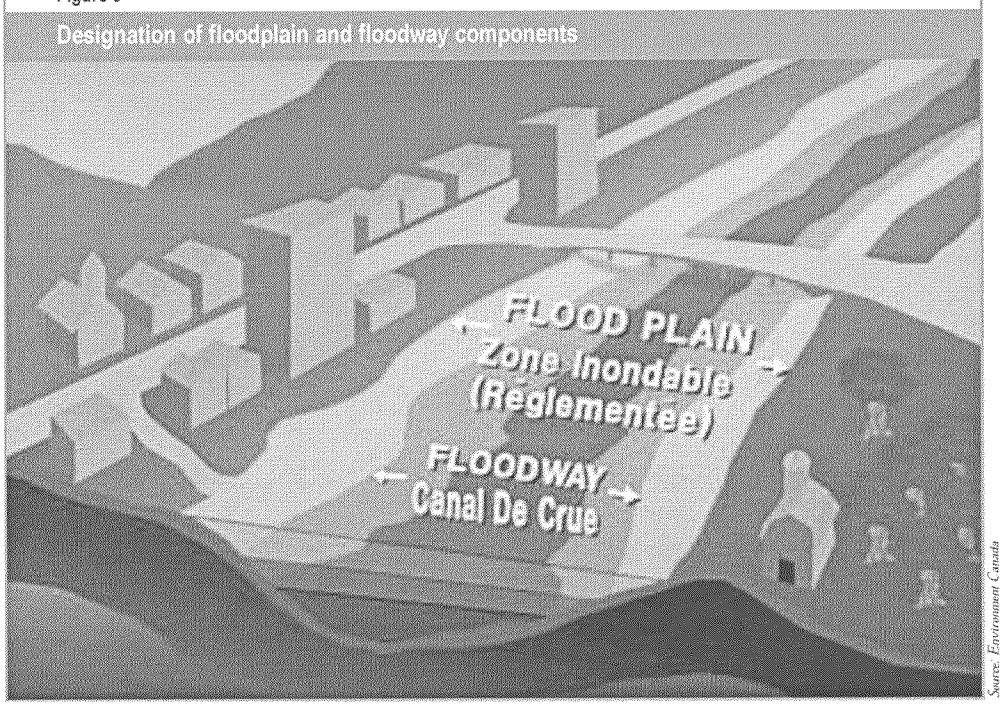
Figure 8



Source: Adapted from WMO, 1999

Figure 9

Designation of floodplain and floodway components



Source: Environment Canada

There may be a necessity to define several zones within the flood-prone area, dependent on the velocity of the river and other physical factors. As an example, the flood-prone area may be broken down into floodway and flood plain components. Figure 9 shows a schematic of the designated floodway and flood plain for a hypothetical community.

Delineation of the flood-prone area

In order to map and delineate an area affected by floodwaters, there is the need to select a "design" event. Various approaches for estimating the design event exist, based in essence on "acceptable" risk, although at the time of their adoption, the concept of acceptable risk was not explicitly recognized. These approaches include using a historical worst-case scenario that happened in the basin or could plausibly have happened, which is referred to as storm transposition. Another approach is to theoretically maximize the meteorological factors that could happen in an area leading to the worst possible storm producing the worst possible flood. These are termed the Probable Maximum Storm and Probable Maximum Flood, respectively. The third approach is to use a probability-based analysis wherein systematic records and historical information on past flooding are used to develop a relation of probability of occurrence versus magnitude. It is becoming popular to adopt the concept of acceptable risk rather than adopting preset levels of protection associated with a specific probability of occurrence (e.g., the 100-year flood). A community and its government may wish to move to more extreme design levels when faced with the reality of future loss-of-life and extreme economic hardships when the future event occurs.

The frequency based approach is the predominate method used in most flood plain delineation studies when the potential for loss of life is considered negligible in terms of historical floods. The peak flood discharge and corresponding water level are established for various frequencies of occurrence or return periods of events such as once in 25 years (1:25), 1:50, and 1:100. Associated estimated damages are

established for each probability Many jurisdictions have set their design level to the "100 year flood". Statistically it is quite possible to have more than one "100 year flood" within a 100-year period, and a more extreme event can also occur at any time A reasonable length of streamflow record is required to ascertain with some accuracy the probability of an event occurring.

When using a known historical flood to define the flood-prone area, various efforts are required to delineate the flood plain. This approach can at times rely on survey information collected during or immediately after the historical flood event. These data can be used to verify hydraulic model information to ensure accurate delineation of the flood plain. In cases using historical floods, care should be taken to adjust streamflow and water levels to reflect the present levels and possibly projected levels of development in the basin or other physical changes in the waterway. When a historical storm is transposed, hydrological models are used to transform rainfall to streamflow, and hydraulic models are, in turn, used to delineate the flood plain.

A shortcoming of using a known extreme flood event is the difficulty of assigning a frequency of return for evaluation of risk. However in data-short areas or when the event can cause catastrophic results, it is probably the preferred approach. It is also useful in establishing acceptable levels of protection.

These approaches tend to assume that events in the future are predictable based on the experience of the past. If changes in land use are occurring, this may not be true, and the changes should be reflected in the analyses. Similarly, the impacts of climate change or variability are not typically being incorporated in the analysis. If possible, such factors should also be taken into account in the delineation of flood-prone areas.

Floodway and flood plain

The floodway is that portion of the flood-prone area that is required to pass the design flood event without a significant rise in water levels compared to undeveloped conditions. "Significant" is normally defined as a rise in the range of 25 to 40 cm The floodway is delineated using the flood frequency or extreme event information combined with a hydraulic analysis. Normally the floodway can be characterized as that part of the flood-prone area having high velocities, high potential for erosion, and high exposure to significant flow of debris. Often the floodway encompasses the normal river channel and some expanded high water area. No structures, other than critical infrastructure such as bridges, should be allowed in the floodway. In simple terms, the floodway is reserved for the river, not for humans.

The flood plain is the residual area outside of the floodway where the water velocities are less and flood protection and flood-proofing measures can be considered. When both the floodway and flood plain are identified, this it termed a two-zone approach. A simplified or one-zone approach is, at times, used when there is no existing incompatible development in the floodway and no new incompatible development will be allowed in the future. In such cases, only one designation of zone is used, and the entire area is treated as a flood plain Under such circumstances, care would be taken to ensure that no new incompatible development occurs in the zone.

Figure 10 shows a section of a map for a one-zone application where the flood plain is designated in its entirety. The map shows homes, businesses, and institutions at risk at a 1:2,000 scale. Land contour information at 1-metre resolution is provided. Implications on existing and future land use (e.g., residential, parkland, industrial) would be set through policy and would be reflected in local zoning.