HANG-UPS IN FLOOD HAZARD PLANNING (PART I)

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While it is not especially difficult to assess flood-prone areas, the hard part is marshalling resources to do it and then building wisely in areas known to be at risk from floods

When severe rains fall, flooding results. It is often accompanied by land-slips. This matters most when it affects people and land uses. For decades, legislation has enabled local territorial authorities to plan in ways that minimize damages. Yet recent community flood disasters suggest that there is a gap between legislative intent and the practical response to it. This may be due to planning decisions that are resulting in an increase in flood hazard, rather than there being a corresponding rise in the severity of flood events.' Why would this be so? This paper summarises factors that impede good flood hazard planning? After reading each factor, join the relevant dots in the diagram at the end of the paper (Figure 5). While the discussion below focuses on floods, the principles apply to other so-called "natural" hazards, like landslips, coastal erosion and inundation.

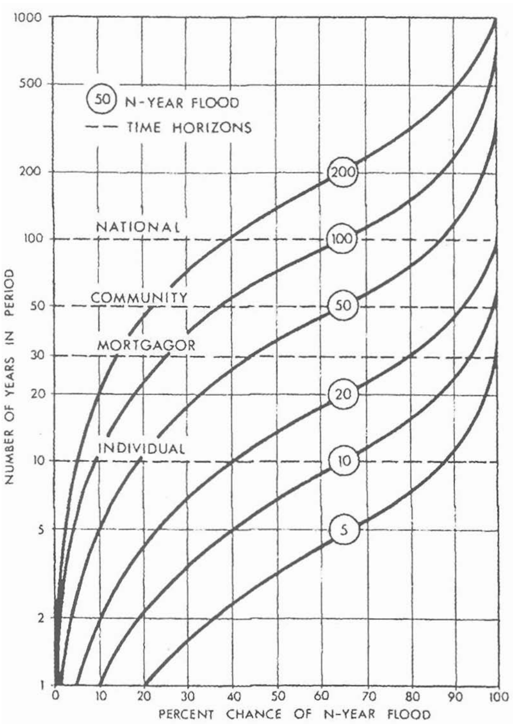
Factor 1: Understanding the Coming of Floods

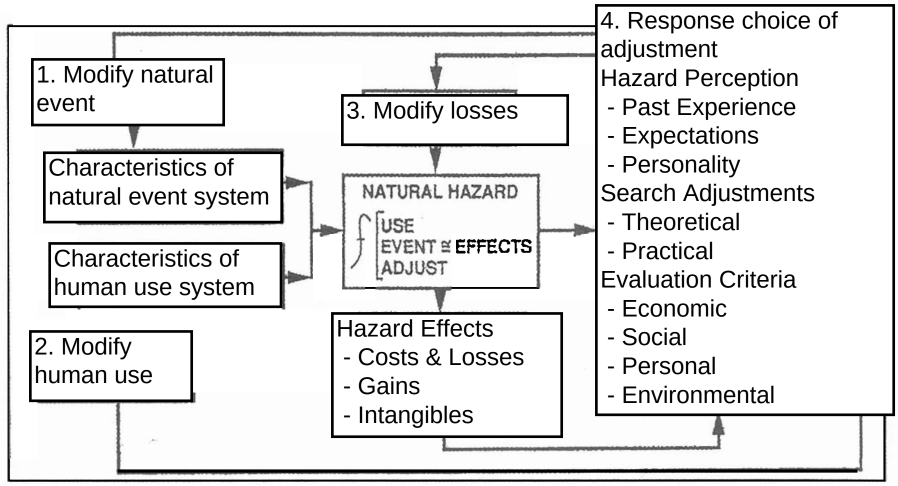
Using the history of flood flows at a given location, flood frequency analysis tries to work out the "size" of a "probable" flood which will be equalled or exceeded in a particular time-period called the "return period" (or "recurrence interval"). This analysis provides the size of flood to plan against in future and/or the "probability of occurrence" and "return period" for a flood event (of a particular size) that has just occurred. Typically, scientists and engineers use only the "return period" to explain floods to councillors and general pubic (e.g., 50, 100, or 200 year rainfall or flood).

Research shows that the "return period" misleads ordinary people about the coming of floods. For example, 93 percent of 65 people sampled in one flood-prone community had an erroneous view of the return period. In another community a councillor, on being told that a 50-year flood had damaged his town, said that at least it would not happen for another 50 years. Elsewhere, a planner, when commenting on flood risk asked: Do approvals or permits lapse after, say, 80 years for a 100-year hazard zone? Not so, the same sized flood can happen at a place any year and the probability of it happening for the 100 year event is 1 percent. In any 10 year period the 100 year flood has an almost 10 percent chance of being equalled or exceeded. The graph in Figure 1 is illuminating in this regard because it not only relates an echelon of return periods to probabilities, but also to differing planning time-horizons for individuals (say, 10 years), communities (e.g., 50 years), and the nation (e.g., 100 years).

Research in over three dozen countries, including New Zealand, long ago showed that the "probability" or "chance" of a large damaging event happening in a given period is much more meaningful to ordinary people and community decision-makers than the "return period" (White, 1974; Ericksen, 1974; 1986a). Thus, it would be much more effective for the public, developers, planners, councillors and journalists alike if potential and actual rainfall and/or flood events were referred to as ones that had, say, a 1 in 10 chance of being equalled or exceeded in a 10 year period (as per the much-reported 100 year flood event).[3]

The lesson from this factor is that the "probability statement" (i.e., % chance of an event happening within an individual's planning horizon) is much more meaningful and useful than the misleading "return period" (e.g., 100 year event). Thus, physical scientists and engineers would better serve planners, councillors and the general public (through the media) if they used only the "probability of occurrence" statement about an event, and completely ignored its reciprocal "return period." (Link dots 1 in Figure 5 at the end of this paper.)





LEFT:: Figure 1: Percent probability of the N-year floodoccurring in a given period [Source: Ericksen, 1986, p29)
ABOVE:: Figure 2: Understanding the dynamic, functional, feedback relationship of natural hazards lies at the heart of effective flood hazard planning and management (Source: Ericksen, 1986a; 7990).

Factor 2: Worsening Floods in a Warming World

The Prime Minister recently stated that her scientists advise that worsening flooding is due to global warming and climate change. By worsening one assumes it means more frequent and intensive rainfalls leading to worse flooding. But is flooding really worsening and if so is it due to global warming? It is intuitively appealing to think so (Campbell and Ericksen, 1990). However, a recent frequency analysis of rainfall data from for the past 50 years from selected rainfall gauges in the Bay of Plenty, where three flood disasters have occurred in the last six years, shows the trend of extreme events either has not changed or is actually decreasing over that time-period, while the severity of the extreme events has not changed (Kouwenhoven, 2005).

When graphing damaging floods since 1920, Ericksen (1986a, pp 21-23) showed they occurred several times in every decade in all regions of New Zealand. In 30 years to 1985, there were 117 floods affecting all regions, 20 of them in the 5 years to 1985, of which 10 occurred in just three regions – Westland, Otago and Southland. An initial search of floods by Kelman (2004) showed that 30 had occurred since 1985 affecting most regions at least once and affecting over 10,000 people, including 18 deaths.[4]

Perhaps less is known about the intensity of storms and rainfalls in relation to climate change (McKercher and Henderson, 2003). Even so, while impressive amounts of rain fell over parts of Bay of Plenty causing floods in 1998, 2004, and 2005, similar falls have occurred in recent decades. For example, in Eastern Bay of Plenty, a gauge recorded 670mm in 40 hours in a catchment affecting Opotiki in 1964. In the Coromandel, 800mm of rain fell in 36 hours dramatically flooding Paeroa and other communities in the region in 1981.

Obviously, for a specific locality, flooding can be expected much less frequently than for the region as a whole. Whether flooding occurs at the locality depeds on the relationship between severe rainfall events and the catchments that channel flood flows. Repeated coincidences over a few years would certainly make it seem as though flooding is worsening. But it seems more likely that for specific localities it is the flood hazard that is worsening, for reasons dealt with under other factors below.

Appealing to climate change as the harbinger of flood problems is hazing the issue and avoiding responsibility for current disasters, which likely has more to do with poorly developed and/or implemented policies and plans, than with global warming. This is not to say councils ought not to adopt an anticipatory approach to global warming (recently required by changes to the RMA). If climate change issues help councils to better focus current planning, the longer term prospects of reducing flood damages may be better assured. (Link dots 2 in Figure 5 at the end of the paper.)

Factor 3: Understanding the Flood Hazard

Before planning can be effective, people must understand the nature of the "hazard" for which they plan. Unfortunately, not all disciplines use "hazard" in the same way. For example, scientists and engineers, who are more concerned with the physical aspects of flooding, tend to equate flood "hazard" with flood "event". This implies a basic impact model leading from, say, human uses to flood event to adverse impacts to responses (Ericksen, 1990; Ericksen, et al., 2000). Section 2 of the RMA also defines natural "hazard" as natural "events", although when this is considered in relation to s. 5, hazards can be interpreted more broadly than that which is implied in a

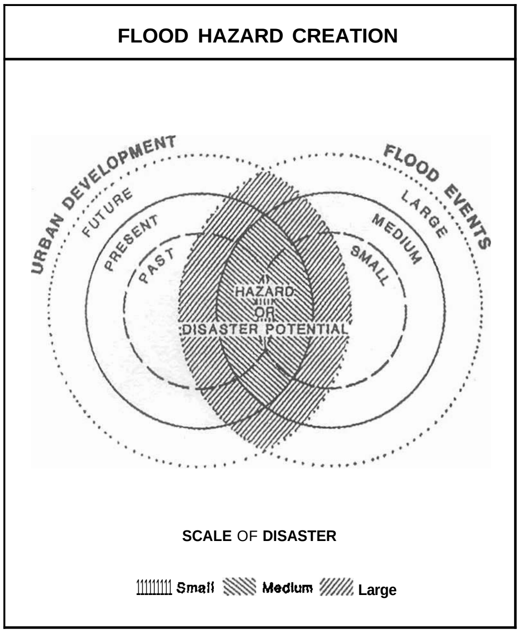


Figure 3: Flood hazard creation conceptualised

basic impact model. Further, a Court of Appeal decision makes it clear that natural hazards do not in themselves have effects; they are the effects. Thus, if land uses are controlled (by regional or territorial authorities or both jointly), then so too the effects of the uses (Court of Appeal, 1995; Ericksen, et al., 2000, p. 129). This court decision moves the definition closer to that of social scientists.

Social scientists who adopt a human ecological approach tend to use an interactive model of natural hazards (Ericksen, 1986a; Kates, 1971; Kates, 1985). For them, the "natural event" (e.g., flood, landslip, coastal erosion) is not in-itself the "hazard" (Ericksen, 1986b). Rather, the ***hazard is a function of the potential for natural events, human occupance in at-risk areas, and, most importantly, measures for reducing losses*** (Figure 2).

The "hazard" is, therefore, seen as a dynamic, functional and interacting system of natural and human factors (Ericksen, 1986a; 1986c; 1990; 1998; Ericksen, Dixon and Berke, 2000; Montz and Tobin, 1997). Thus, increase the size of a flood event for a community of given size and density of development, and the hazard will increase. Conversely, if the size and/or density of a community are increased, the hazard will increase for a flood of given size. This functional and dynamic relationship is easily seen if a community's floodplain development in, say, 10 year intervals is overlain onto a flood area map, as shown in Ericksen (1986a, Figure 4.23). It is conceptually represented in Figure 3 below. Under this model the hazard is the potential for *disaster*. The disaster happens when extreme flood events occur and adversely affects human occupancy on the floodplain.

Thus, as the interaction model of natural hazards indicates in Figure 2, it is important to consider how measures taken to deal with flood problems feed back on the hazard itself (Ericksen, 1971). Some measures, like avoiding flood-prone areas, dramatically reduce the hazard and thereby losses when flood events occur. Others; such as flood embankments (which aim at modifying flood events and their effects), actually increase the hazard because they encourage intensification of human occupance within the "protected" at-risk areas. This is because people feel that the stopbanks (embankments) make them feel secure from floods or new entrants to the area are left unaware of past flooding and the function of the stopbanks. Since sooner or later stopbanks may be breached or overtopped and the area flooded. Thus, the floodplain occupants in effect develop a false sense of security from the "protection". Recent flooding in the Awatapu suburb of Whakatane illustrates well this point, and so too in the longer term would flooding in Matata if "protecting" future development was adopted through stream channelisation and embankments. (On this issue, see also Figures 6.2 and 7.8 in Ericksen, 1986a.) However, as Factor 9 will show, in-situ changes to land uses and buildings can be used to help reduce potential losses (Ericksen, 197.6).

The main message here is that equating the natural "event" to natural "hazard" (as scientists and engineers are prone to do), reduces the, ability for councils to plan effectively. The "flood hazard" is a function of land use, flood event, and measures taken to reduce losses. Given the heavy involvement of people with science and engineering training in planning for natural hazards in research institutions and councils, it is no surprise that most regional and district plans also equate "natural hazards" with "natural events"– a problem that ought to be rectified in the second generation of plans. (Link dots 3 in Figure 5.)

Factor 4: Selling the Mandate Short

Matters of national importance are identified in Part II of the RMA. While the topic of natural hazards is not listed there, it is the only topic identified elsewhere in Act. The RMA, like the new Local Government Act (LGA), is characterized as a ***devolved and cooperative mandate*** (May, Burby, Ericksen, et al., 1996). Key assumptions of a devolved and cooperative mandate are that local government will be willing to comply with the national mandate, but may not have the capacity to do so; and Government will ensure its agencies have the resources to build capacity in local government through technical and/or financial assistance (Ericksen, Crawford, Berke and Dixon, 2003, Ch. 1).

The foundation for this cooperative approach to flood problems was laid prior to the RMA. In 1987, the Water and Soil Directorate (WSD) of the Ministry of Works and Development started preparing a unified or integrated policy guide for managing flood hazards at local level-- including taking stock of issues noted in factors 1 and 2 above (Bewick, 1988; NWASCA, 1987).[5] When disestablished by reform of the bureaucracy in 1988, some functions of WSD, and some of its staff, were transferred to the Ministry for the Environment (MFE), including staff that had been responsible for developing the new integrated approach to flood hazards. The Resource Management Law Review of Natural Hazards (Campbell, et al., 1988), encapsulated this need for an integrated approach to natural hazard planning-- a topic highlighted in the RMA.

However, the Government had already clearly signalled that the role of central government in flood hazards (and other resource issues) was to diminish (e.g., Parliamentary Planning and Development Committee, 1989). Although national policy development was enabled by the RMA, MFE did not pursue the implementation of the WSD integrated flood hazard policy. Instead, local government was informed that subsidies for flood control works would be phased out, and local government would be responsible for them and other aspects of flood hazard management. MFE did, however, provide funds to regional councils for developing relevant hazard plans, but this was not extended to district councils where the need was greatest (MFE, 1992; May, Burby, Ericksen, et al., 1996; Ericksen, et al., 2003).

Whether for flood hazard or other resource management topics, history has shown that the Government failed miserably to live up to its much-vaunted devolved and cooperative mandate. By its actions it did not acknowledge its responsibility for ensuring that capacity would be built in its own agencies (e.g., MFE) and thence to local government. Research clearly shows the consequence of this failure (Ericksen Crawford, Berke and Dixon, 2001; and Ericksen, Crawford, Berke, and Dixon, 2003). MFE was unable to provide guidance to local government on policies and methods for dealing with flood (and other) hazards or for matters of national importance under Part II of the Act.[6]

The lesson from history is this: there was a huge waste of human and financial resources as 86 councils around the country spent years trying to work out how to develop plans under the RMA, when careful guidance on policies and methods from the centre would have facilitated policy learning. The outcome is 15 years of lost opportunities for ***universally*** implementing an integrated approach to flood hazard planning and management. (Link dots 4 in Figure 5.)

Factor 5: Cooperation in Local Government

In reaction to serious regional flooding in 2004, a Governance Group representing both local and central government, and professional interests, was brought together to prepare a new Flood Risk Management Protocol for New Zealand. The purpose of its first report is to "state the case for, and the likely elements of, an improved approach to flood risk management in New Zealand." The hope is that the protocol will lead to a more consistent and strategic approach to flood risk management across the country and between the two levels of government (Centre for Advanced Engineering, 2005).

This initiative can only be welcomed, but why was it not put forward 15 years ago when local government was first reformed? Doing so would have provided a useful foundation for helping to guide both regional and territorial authorities when implementing an integrated approach to flood hazard planning (flood-risk management). In other words, it would have helped to highlight the capacity-building role of regional councils vis-a-vis territorial authorities within their areas as sought by the local government reforms (1988-89) and by implication the RMA (1991).

There are many reasons why this initiative was not taken years ago, some already touched upon in the previous factor. But key others include: regional councils having to fight for political survival in the early 1990s; limited capacity in some regional councils; a paternalistic view taken by too many in regional councils towards the local government partnership; and antagonistic attitudes of too many staff and councillors in territorial authorities towards regional councils and central government (May et al., 1996; Ericksen, et al., 2001; 2003).

With respect to natural hazards, the RMA caused confusion and tensions in local government by overlapping regional and district functions and responsibilities (s. 30 and s.31) (Ericksen, et al., 2000). When trying to overcome the problem, the RMA was amended in 1993 (s62h(a)) so that regional councils could, through the regional policy statement, devolve the land use planning aspects of natural hazards to district councils. By 1994, most regional councils had done so with respect to localised hazards, like floods, erosion, landslip and subsidence (Hinton and Hutchings, 1994). However, the principle of devolution requires regional councils to support district councils through technical support and other capacity-building means. Little such support seems to have occurred. Thus, not surprisingly, Ericksen, et al. (2001) found only about one-third of district councils reported in 1997 that regional councils were useful in consultations over preparing district plans. While some good examples of cooperation can be found, it is not always sustained (as Factor 6 will demonstrate). Indeed, more than 10 years after the RMA was amended to overcome the problem of overlapping responsibilities? the lead policy planner in a regional council did not know if responsibility for flood hazard had been retained by the region or devolved to the districts, even though serious flooding had occurred in the region twice in four years.

While crises caused by serious regional flooding can lead to good outcomes (like the proposed protocol noted above), they can also raise tensions between the main actors in regional and district councils and affected communities. A senior manager of one district council recently exclaimed to the author: "I'm not talking about regional council upgrading the level of protection. I just want the existing stopbanks to function according to their design standard." Aggravating this sort of problem is having too few professional staff dealing with flood analyses in regional councils, when compared to the previous planning regime.

Examining this factor suggests that cooperation in local government is not as good as it should be for reducing flood hazard in at-risk communities. While 15 years late, it is nevertheless better to have now a new protocol for achieving intergovernmental cooperation and a more consistent and strategic approach to flood-risk management across the country than none at all. But implementing it will require additional resources for capacity-building and a commitment to cooperation from councillors in all councils. (Link dots 5 in Figure 5.) ::

Part II will appear in Planning Quarterly December.

FOOTNOTES

1. Some might posit that it is due to a lag effect between developing a sound flood hazard plan and its effective implementation. Evidence in Factor 7 does not give very much support for this view.
2. There are some very good council reports that propose taking an integrated approach to flood problems, but this is by no means universal. (Two very useful reports come from Canterbury Regional Council and Christchurch City Council (1997) and Waikato Regional Council and Thames Coromandel District Council (1993/94).) However, good intentions in reports do not necessarily follow through in good practice as Factor 6 will illustrate.
3. It is recognised that people (including councillors and journalists) may be inclined to restate the '1 in 10 change of happening' statement and use the '9 in 10 chance of it not happening' to justify inaction. Even so, that is preferable to the misconception surrounding the return period (e.g., 100 year flood).
4. The large difference in number of floods between the periods 1955-85 and 1986-2005 may be due to, for example: the latter involving an initial search; flood control works from the earlier period reducing the number of floods experienced in the second period; and the interdecal climate variations.
5. The policy guides drew on a suite of recommendations from research in many flood-prone communities commissioned by WSD and published in the book Creating Flood Disasters? New Zealand's Need for New Approach to Urban Flood Hazard (Ericksen, 1986). The WSD call for research had in part been stimulated by a paper in its journal (Soil and Water) titled: Is a comprehensive floodplain strategy needed in New Zealand? (Ericksen, 1975).
6. This is not to deny the extraordinary number of valuable notes and guides that MfE did provide to councils and other stakeholders on a range of issues.
7. Adding s.62h(a) to the RMA in 1993 aimed at resolving confusion over functions of regional and district councils by requiring each regional policy statement to state for the region or part thereof which territorial authorities would have responsibility through their district plans for the control of the use of land for avoiding or mitigating natural hazards.