# FLOOD PLANNING, FLOOD WARNINGS AND FLOOD INTELLIGENCE: A PROGRESS REPORT

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## 1 SUMMARY

This paper argues the need for improved flood intelligence systems as vital tools in the development of high-quality flood warnings and flood response plans. It makes suggestions as to how these systems should be developed and on the importance of council input to them. A partnership between the SES as the flood combat agency and the local council as the key player in the community's general disaster planning is seen as being vital for the optimal development of flood preparedness.

These themes are illustrated by reference to the results of a survey on flood warning issues carried out by the NSW Flood Warning Consultative Committee in 1991-92.

## 2 INTRODUCTION

Until relatively recently, promoting community understanding of and preparedness for flooding was a minor consideration in the field of flood mitigation. Mitigation was, primarily, a matter of engineering works designed to eliminate or lessen flooding: hence the focus on levees, river training devices, flood retention basins and the like. When floods did occur, the State Emergency Service saw its role largely as one of **responding** at the time - by organising sandbags and other supplies or by helping people evacuate as necessary and appropriate.

In the 1990s, however, flood mitigation must be seen as constituting more than engineering works alone, and the SES should be regarded as an organisation with a wider brief than simply responding to floods when they occur. Modern flood preparedness involves being ready for floods **in advance**, and ensuring that whole communities are aware of the flood threats they may face and how they should deal with them. Engineering works are important, but they must be complemented by well developed preparations of other sorts - including effective warning systems, plans specifying how floods will be handled and communities whose members know and comprehend the flood hazard. The SES, as the state's 'combat agency' for floods, has a major role in promoting higher levels of flood preparedness by all these means.

The key to the creation of quality flood warning systems, flood plans and community awareness is the development of knowledge about flooding at the local level. In the past, unfortunately, flood intelligence systems have been lacking in many flood prone areas of the state. The consequences have been twofold. Firstly, flood warnings produced by the Bureau of Meteorology have not been effectively used locally to determine the likely impacts of flooding at the predicted gauge heights or to educate communities about flood levels and consequences. Second, response activity has not been fully informed by a proper appreciation of the scale of flooding which is anticipated. Unquestionably, flood warnings and flood response efforts have been less effective than they ought to have been because quality appreciations of the effects of the anticipated flooding have been

lacking.

## 3 FLOOD INTELLIGENCE SYSTEMS

The central element of a flood intelligence system is the systematic recording, during and immediately after a flood, of information on where the water went at different stages of the event. This information can be used predictively in later flood episodes to inform response decisions and to provide higher-quality warnings to the community than have traditionally been possible. The building up over a period of time of a dossier of information on flood behaviour constitutes a valuable resource to guide later efforts.

There is evidence that the recording of flood-related information during and after floods is haphazard and unsystematic in New South Wales. A survey of SES Local Controllers and Council engineers carried out by the NSW Flood Warning Consultative Committee in 1991-92 revealed that most SES units and councils in flood prone areas recorded flood information, but showed clearly that there was little if any co-ordination between the two sets of organisations and little structuring of the recording effort. Some recording is little more than anecdotal and observes no accepted principles of data management: thus information is written down in operations logs or incident files rather than being incorporated in defined cause-effect systems. Under these circumstances, the information tends to be scattered and to quickly lose usefulness in an intelligence-development context.

Some of the information which is apparently retained - height/time data, for example - can be of little value for the future unless it is more effectively contextualised than appears to be the norm. In particular it appears that the collection of data on the consequences of flooding is not always tied clearly to flood heights on key gauges. Yet this is central to the development of flood intelligence systems if they are to allow flood predictions to be given meaning in terms of expected impacts on an area about to experience flooding.

The percentages of the surveyed organisations (councils and SES units) claiming to record and retain particular kinds of information are tabulated below. Because several respondents noted various types of information, the percentages do not sum to 100.

| **Type of Information** | **% of Respondents Claiming to Record** |
|---|---|
| Heights and times | 32 |
| Flood hydrographs | 6 |
| Road information (including closures) | 23 |
| Impacts on public utilities | 18 |
| Impacts on housing and the public | 19 |
| Maps of flood extent | 13 |
| Photographs (land or aerial) | 6 |
| Floor heights of dwellings | 2 |

A much more systematic approach is needed if an understanding of flooding is to be directed

towards sharpening response efforts or providing improved warnings to people about what will happen at their particular location when a flood is approaching. It seems unlikely in most flood prone areas that the information which is collected at present can be used effectively in the upgrading of responses to floods or in communicating with the community as a flood is developing.

What is needed, for a particular reference gauge in a community, is information of the following kinds:

* A map showing the boundary of the area to which the gauge refers - that is, the area for which gauge heights have meaning in terms of riverine flooding independent of flooding from tributary creeks, surcharging drains or other local sources.

* Gauge heights at which flood waters begin to encroach, within this area, on:

  Farmlands and other rural properties
  Low points on roads and railway lines
  Caravan parks
  Houses
  Business and industrial premises, and
  Utility systems (water, power, gas, electricity, telephone and sewerage facilities).

* The depth of water at specified locations (for example, low points on roads) when particular gauge heights are reached.

* Descriptions of the severity of community impact at particular gauge heights so that 'critical levels' can be determined at which responses of particular types and intensities will become necessary. This would include information on particular institutions (schools, hospitals, homes for the aged, and the like) and on the number of people who could need to be evacuated.

* Information on the features of particular floods (including peak height, rate of rise, flood gradient, speed of flow, the contributions of individual upstream tributaries, weather conditions, tidal states and correlations with upstream gauge heights). Peak height information can be of particular value when used in warnings to remind people of floods which they have already experienced and which are similar to the flood which is now anticipated.

Over time, as intelligence systems are built up, such data will allow responders to develop pictures of the range of flood behaviours and impacts which can occur and of the ways in which individual flood episodes may vary from one another and from any general norm.

In 1992 the New South Wales State Emergency Service created the position of 'Intelligence Officer' within its state headquarters. It is the responsibility of this officer to help SES units to develop their flood intelligence systems. Initially, these systems are being developed on cards, one card per gauge. On each card a series of heights is shown along with details on the consequences of flooding (on houses, roads, etc) at each of the heights.

While the SES is taking the running in the development of these systems, there remains a substantial role in the process for councils. Not all SES units have professional expertise in hydrology and

survey methods, and all have difficulty during flood times in finding sufficient personnel to carry out the necessary data-collection tasks. Council engineering departments can be of considerable assistance in providing survey data, post-event mapping of areas affected by flooding and other kinds of information on flooding. The SES will welcome a larger council role in this regard, and Local Controllers are being encouraged to seek closer links with Council engineering staff on matters relating to the development of flood intelligence systems.

What is suggested here is a more formalised local government role in flood management and a greater co-ordination of activity between councils and SES units than has been the rule in the past. The Flood Warning Consultative Committee's survey mentioned earlier found evidence that SES controllers and council engineers believe there is a significant difference between what local government actually **does** by way of flood management tasks and what it should ideally do. In general, the survey results indicated that respondents believed that the council role was less than it ought to be. The following table, which summarises the responses on this issue, again points to the need for closer council-SES relations and for collaboration between them in determining which organisation performs which functions.

| **Role of Local Government** | **% of Survey Respondents Claiming that this Role is Carried Out Now** | **% Believing that Local Government Should Play this Role** |
|---|---|---|
| None | 29 | 9 |
| Data collection | 25 | 30 |
| Height prediction | 13 | 13 |
| Assessment of effects | 9 | 8 |
| Dissemination of information | 20 | 25 |
| Assisting the SES during floods | 16 | 21 |
| Assisting the SES at other times | 6 | 16 |
| Liaison with other organisations | 8 | 10 |
| Road closure | 12 | 10 |
| Providing/maintaining flood forecasting hardware | 9 | 19 |

## 4 FLOOD PLANNING

One of the key reasons for developing flood intelligence systems is to inform flood plans which in turn can help sharpen future responses to flooding. Over the past three years the SES organisation at state, divisional and local levels has become increasingly oriented towards flood planning work. The principal state headquarters involvement to date has been in assisting divisional personnel in the creation of seventeen division plans covering flood prone areas across the state. These plans are now virtually completed, creating opportunities for state headquarters staff to be redeployed for work on local plans during the remainder of 1993 and into next year.

By mid-1994, it is expected that all local government areas with flood problems - and there are few councils in this state which have none - will have flood plans to guide their flood warning, flood response and flood recovery activities. To date, the SES state headquarters has been involved in

local-level planning in three ways:

(a) Conducting training clinics to assist SES volunteers to come to grips with the planning task and to provide them with the skills needed to produce their own plans.

(b) Reviewing and providing comments on drafts of local plans as they are produced.

(c) At the request of local SES organisations and where flood planning problems are particularly difficult to resolve, providing direct assistance in defining the issues and preparing the plans.

Over the past two years, dozens of local flood plans have been produced in draft form in New South Wales. These plans have been written to guide responses to floods of all levels of severity from minor freshes in rivers (which may require only the dissemination of local pump warnings) to floods more severe than those experienced in European history. Where necessary, the plans include arrangements for dealing with the superfloods that would occur if major water-storage dams should fail. There are in New South Wales several dams which are known to be deficient in terms of their ability to withstand genuinely severe flood events. Failure of these storages would create flooding much more catastrophic than has ever been seen in the valleys below them and in some cases whole towns would be overwhelmed. Very severe 'natural' floods much worse than previously seen could also occur: the Nyngan flood of 1990, for example, was nearly five times as large in total flood volume as the worst flood previously experienced in the town's 100-plus years of existence. In this context, it is reckoned by hydrologists that 'probable maximum floods' on the New South Wales coast would probably have total flood discharges two to three times as large as those of the designated 100-year events. Inevitably such floods would reach greater heights than were achieved by floods in recorded history.

While the SES as combat agency for floods must take the lead in the development of local flood plans, it is important to recognise that the planning process cannot be owned by the Service or the plans themselves written in isolation from other organisations and the community. Again, this means that councils must be closely involved, the council engineer and the Local Emergency Management Officer (who may be one and the same person) in particular. The senior policemen in the council area - the Local Emergency Operations Controller - must also be involved. These individuals must be satisfied that the plan is capable of meeting its purpose and fits within the Local Disaster Plan (DISPLAN) arrangements before it goes to the Local Emergency Management Committee for endorsement.

What this implies is that the planning process must be a genuinely consultative one which is neither controlled nor owned by any single organisation. Council personnel, whether elected or employed, are vital in the process as are the police and the members of other emergency services and supporting functional areas. The consultative process must, in fact, extend to the broader community - for example to farmers' groups, flood mitigation authorities and other flood-oriented organisations.

Past flood planning efforts were sometimes deficient in this regard. Frequently, the plans were written by and for the combat agency's personnel, used little external expertise or input and were largely closed to the wider community. Modern emergency management takes a different approach and attempts to broaden the whole process in an attempt to tap all the available expertise. At the same time it provides a means of educating the populace about the hazard which is being planned

for.

Emergency planning must now be seen as an open, outward-looking process. Doing it openly tends to slow the process down somewhat, but much more importantly it creates genuine local understanding of efforts made on the community's behalf to protect people when floods occur. Moreover it improves the quality of the planning itself by maximising the opportunity for comments and suggestions on the draft plans.

## 5 PUBLIC AWARENESS OF FLOODING

There can be little doubt that a community which is keenly aware of the flood hazard it lives with and understands how the threat can be mitigated will be hurt less by flooding than one which is ignorant of the hazard. Equally, it is beyond doubt that local communities in New South Wales are less aware of the flood threats they face than is desirable. The Flood Warning Consultative Committee's survey on flood warning issues sought information on community awareness of flooding by questioning council engineers and SES controllers on local flood awareness levels. While there are no objective standards against which the results of that survey can be judged, and recognising that the values come from the perceptions of a relatively small number of individuals, the table below (which relates to council areas which contain gauges for which the Bureau of Meteorology provides flood predictions) does appear to suggest that ignorance about flooding is common. In particular, the existence of flood warning systems appears to be little known, and instances of communities being 'highly aware' of what actions to take to reduce flood damage seem to be few in number.

| | **% of Survey Respondents Judging their Communities to be** | | |
|---|---|---|---|
| | **Largely Unaware** | **Fairly Aware** | **Highly Aware** |
| Of flood effects at different levels (minor, moderate, major) | 20 | 58 | 21 |
| Of which land is flood liable | 17 | 62 | 26 |
| Of the existence of flood warning systems | 36 | 42 | 23 |
| Of actions to reduce flood damage | 36 | 54 | 9 |

Clearly, there is a need to raise community consciousness about flood hazards in New South Wales. High-quality flood plans will be vital in the achievement of this goal because they will work as tools in the process of educating the public about flooding and about how its effects can be mitigated. The creation of higher levels of public awareness will probably involve a wide range of initiatives - including briefings of councillors and particular flood-interested groups, public meetings, newspaper articles, radio talk-back shows and the like. Whatever communication media are used, the flood plan is likely to be central to the educative process. It should be widely available to the general public through schools, libraries, council offices and the SES. The SES's Flood Action Guide (a card providing advice on how to prepare for flooding and what to do when floods are imminent or actually occurring) should be available from the same sources. Again, SES Local Controllers will need to take the lead in the publicising of their communities' flood plans and of other flood-related awareness material.

A major public awareness programme is about to begin in the Hawkesbury-Nepean area on Sydney's far western outskirts. This programme, it is expected, will produce numerous insights on ways of increasing public understanding of flood planning and flood management issues and will be useful in guiding public education initiatives in other river valleys in the future.

## 6 CONCLUSION

Three years ago, little flood planning was being done in New South Wales and what plans existed were quite different in scope and purpose from those that have been developed since. Little existed in the way of systematically processed flood intelligence, either, and the flood planning was severely restricted as a result. Nowadays, flood intelligence records and flood plans are developing apace, and the delivery of flood warnings is being improved as local SES units learn more about the floods which affect their communities and as they develop their warning procedures and incorporate them within their plans.

But while gains are undoubtedly being made, the process can be further improved if councils and other organisations are effectively tied in to the development of flood intelligence records and flood plans. The SES will willingly provide leadership here, but as a volunteer community-based organisation its efforts will benefit greatly if professional assistance can be provided by councils and especially by their engineering staffs who hold so much flood-relevant information and expertise. There is scope, in preparing our many flood prone communities for the serious flood hazards they face, for genuine partnerships between local government and the flood combat agency.