The Australian Journal of Emergency Management

Produced by Emergency Management Australia Vol 17 No 1 Autumn 2002

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cover: Heavy rain can lead to severe flooding in the Hawkesbury-Nepean valley. small images: the morning after the 1998 flood in Wollongong, NSW.

The Australian Journal of Emergency Management

The Australian Journal of Emergency Management is funded by the Emergency Management Australia. The journal's circulation is approximately 5,200 copies. It is distributed without charge to subscribers throughout Australia. It is also sent to people throughout the world.

The Journal endeavours to provide an information sharing forum for all those involved in emergency management. Contributions relating to Australian and international emergency activities, articles identifying and discussing issues, policies, planning or procedural concerns, research reports and any other information relevant to the emergency and disaster management community are welcome.

The aim of this publication is the exchange of information and views across the Australian emergency management community, therefore, the views expressed in this journal should not be taken to be the views of Emergency Management Australia.

The Journal incorporates a review process. Three levels of review–refereeing, editorial board review and editing–are conducted. Material submitted for publication should be on disk or CD-ROM and reach the Editor by the following dates: Summer–September 15th; Autumn–December 15th; Winter–March 15th; Spring–June 15th. The editorial committee reserves the right to determine the suitability of all material submitted and where necessary to edit submissions.

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ISSN 1324 1540

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Editorial

In the Summer edition of *The Australian Journal of Emergency Management*, Rod McKinnon wrote of the consequences for emergency management agencies and the Australian Defence Force of the terrorist attacks in the United States in September 2001. The effects of those attacks on government planning continue to be felt in Australia, and since Rod's editorial, there have been a number of changes at the Commonwealth level. I thought those effects were worthy of further discussion for the benefit of Journal readers.

From the Emergency Management Australia (EMA) perspective, the most significant was on 23 November 2001 when, while announcing his third Ministry, the Prime Minister also announced that EMA would be transferred to the Attorney-General's portfolio. While there had been some discussion earlier about where EMA might best fit in a Governmental sense, the announcement had its genesis from 11 September.

The relocation of EMA to the Attorney-General's portfolio ended a 27 year association with the Department of Defence. The legislative basis for that arrangement was the Administrative Arrangements Order which specified that, in addition to other specific defence-related activities, the Minister for Defence was responsible for 'Commonwealth emergency management, including civil defence'. Under Government policy, the Minister for Defence was able to call on the resources of all Commonwealth agencies in responding to emergencies.

By moving EMA to the Attorney-General's portfolio, the Government has grouped all federal agencies with a role in crisis and consequence management under the one portfolio. This move had obvious benefits in terms of the ability of those agencies to communicate effectively and to coordinate a response to any event in Australia. The Administrative Arrangements Order was duly amended to assign responsibility for Commonwealth emergency management to the Attorney General. EMA now operates as a Division within the Attorney General's Department, falling under the wider Criminal Justice and Security Group, headed by Mr Ian Carnell, the General Manager.

There has been no change in the Commonwealth's commitment in assisting States and Territories experiencing emergency situations and it is important to emphasise that the role and functions of EMA are unchanged from those performed when the organisation was attached to the Department of Defence. While the primary motivation for the move was in terms of the consequence management aspects of the organisation, all other functions continue to operate unchanged.

Similarly, the role performed by the Attorney General is the same as that provided earlier by the Minister for Defence. The Attorney now has the authority to coordinate Commonwealth responsibilities in the event of a disaster, including the seeking of Australian Defence Force (ADF) assistance. EMA's close relationship with the ADF continues unchanged, and a series of working arrangements have been established to ensure that requests for ADF assistance received from States and Territories continue to be met effectively.

The move of EMA to the Attorney-General's portfolio has, however, coincided with a period of overall refocusing of future directions within the emergency management sector in Australia and there are a number of ongoing reviews into the ways in which emergency management is currently conducted. These include:

- Council of Australian Governments (COAG) Review of Natural Disaster Relief and Mitigation Arrangements, which is examining arrangements for natural disaster relief and community recovery, disaster mitigation programs and Australia's capacity to respond to such emergencies. All jurisdictions and representatives from local government are taking part in the review, which is being chaired by the Department of Transport and Regional Services
- COAG Review on Foot and Mouth Disease, which is developing whole of government plans to manage the consequences of a Foot and Mouth Disease outbreak in Australia and the conduct of a national exercise to test response mechanisms
- review of Aerial Firefighting Capability to assess the usefulness of aircraft in a firefighting role following the successful use of large helitankers during the recent NSW bushfires
- consideration of a number of recommendations for emergency services volunteers made at the Volunteers summit conducted by EMA in October 2001.

The Review of Natural Disaster Relief and Mitigation Arrangements, in particular, is likely to have far reaching effects on the way in which disasters are managed in Australia. Clients and stakeholders will continue to be consulted in that process to ensure a reinforcement of the Commonwealth's commitment to assisting States and Territories in an emergency.

The evolving nature of emergency management in Australia is reflected in the recent amendment of EMA's vision to read 'Safer Sustainable Communities'. This change recognises our changing role in the emergency management sector and reflects EMA's mission to provide national leadership in the development of measures to reduce risk to communities and manage the consequences of disasters.

In conclusion, while there have been significant changes to the structure of Commonwealth emergency management responsibilities in response to the terrorist attacks in the United States, the Commonwealth's commitment to support States and Territories has not changed. There is likely to be further refinement of the roles of individual agencies as the current reviews continue, however there will not be a decline in the standard of service and support provided by the Commonwealth when requested by the States and Territories. While there is often a perception in a time of heightened terrorist threat that energies are expended on management of responses to consequences of terrorist acts, EMA is continuing to focus on the broader issues which reduce the risk to communities of all natural, technological and human caused disasters and will continue to do so into the future.

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Emergency Management Australia

Planning for earthquake hazards in New Zealand: a study of four regions

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Introduction

During historic times in New Zealand there have been a number of earthquakes large enough to cause fatalities and damage, and disrupt everyday life (*figure 1*). Due to the nature of New Zealand's placement on the Australian-Pacific plate boundary and the number of faults that are present as a result (*figure 2*), it is reasonable to expect that high magnitude earthquakes will continue to occur in the future. Planning in advance for these earthquakes is the most effective means of minimising or mitigating any adverse effects.

A study was conducted to investigate how New Zealand regional and local authorities (regional and district councils) plan for earthquake hazards. A number of regional and district councils from the North Island were chosen for the study and their plans and policy statements analysed to identify to what extent earthquake hazards are incorporated into these documents. Initially 24 plans and policy statements from the regions of Hawke's Bay, Bay of Plenty and Waikato were studied. This work this has since been supplemented by further research carried out on nine plans and policy statements from the Wellington Region also.

This paper will first outline the legislation that covers natural hazards in New Zealand and will then detail some aspects of planning for hazards. Following this, it will then go on to explain the method of collecting data, and the results of the data collected. Finally we draw some conclusions on the methods used by regional and district councils to plan for earthquake hazards and the effectiveness of the present planning system for mitigating against earthquake hazards in New Zealand.

Legislation covering natural hazards

The Resource Management Act 1991 (and amendments)

Throughout the 1980s and early 1990s an extensive series of reforms took place in New Zealand. It was decided to devolve decision making from central government to the regional and local authorities where problems occurred. Re-organisation occurred at central government level (for example, this included a new Ministry for the Environment, Parliamentary Commissioner for the Environment and Department of Conservation) and at regional and local level with the amalgamation of existing councils and the establishment

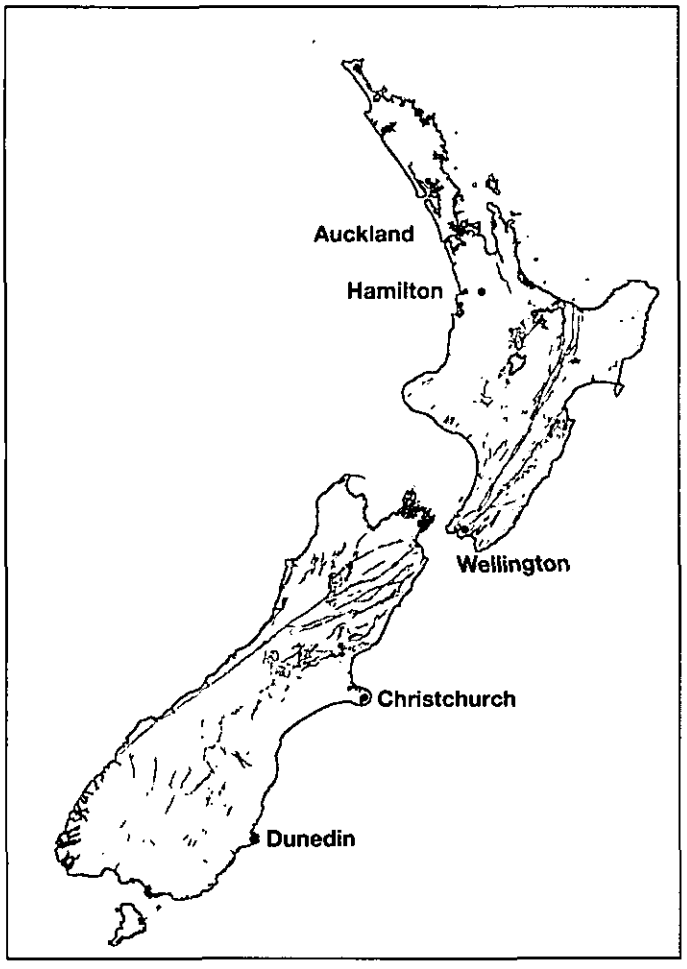

Figure 1: A selection of New Zealand's historic high magnitude earthquakes (GNS).

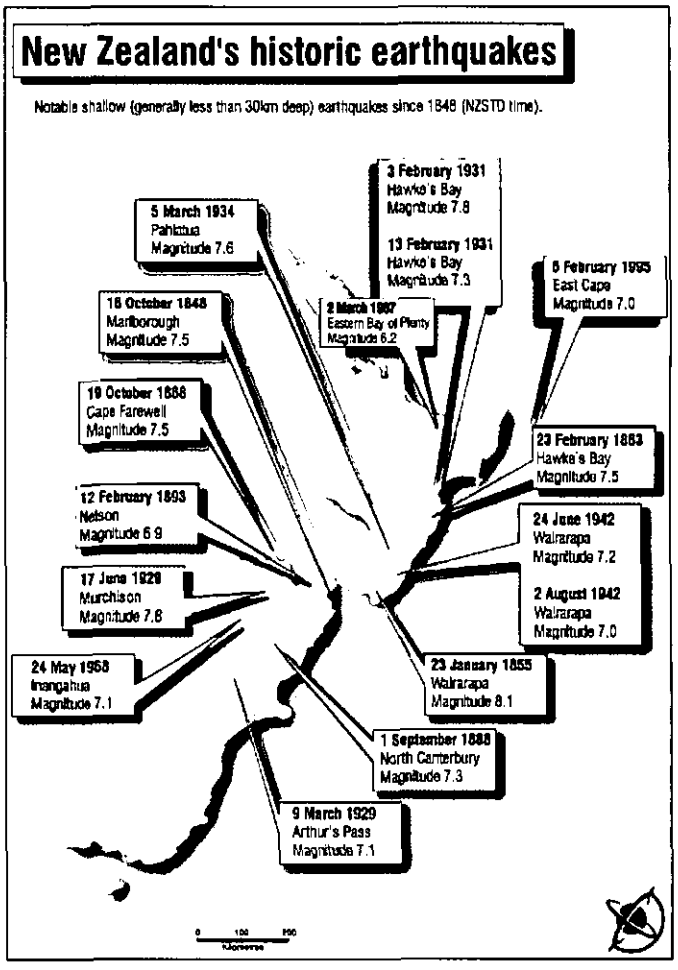

Figure 2: Identified active fault lines in New Zealand (GNS).

of new district and regional councils (Ericksen *et al.* 2000).

As a result of the reforms, New Zealand is now divided into 16 regions that come under the jurisdiction of regional authorities (or in some cases, unitary authorities). These regions are divided again into districts, with different regions containing varying numbers of districts and some districts being positioned so they lie within several regional boundaries.

New Zealand's Resource Management Act 1991 (RMAct) came into being as the government reforms took place and reflected the notion of sustainable management of natural and physical resources. It replaced nearly 70 statutes, regulations and orders with a single comprehensive legislative framework (Ericksen *et al.* 2000). Under this legislation, regional and local councils have overlapping functions and it was anticipated at the outset that councils would work toward the goals of the RMAct in a cooperative partnership, along with relevant central government agencies (May *et al.* 1996).

Both regional and district councils are required by the RMAct to prepare regional policy statements and district plans respectively in which they must identify significant resource management issues of the region, state how they will be dealt with and state expected environmental outcomes. Regional councils are also allowed to prepare regional plans but this is not mandatory. The RMAct requires that district plans and policy statements should not be inconsistent with the region's regional policy statement, however as long as they are not inconsistent there is no requirement for districts to recognise similar issues or follow the same path in dealing with similar matters.

In terms of natural hazards, the RMAct gives both regional and local authorities the function of controlling land use for the purpose of avoiding or mitigating natural hazards (Section 30 (1)(c)(iv) and 31(b)). In general hazard threats of regional level significance are regarded the responsibility of regional councils, while territorial authorities are responsible for hazards of district level significance (Hinton and Hutchings 1994). Plans and policy statements must be prepared in accordance with council functions under Section 30, making it necessary for regional and district councils to consider the avoidance or mitigation of natural hazards when preparing such documents. While the legislation requires that local and regional authorities control land use for the purpose of avoiding or mitigating natural hazards, the RMAct does not prescribe how these requirements are to be met, leaving councils to follow their own methods (Ericksen *et al.* 2000).

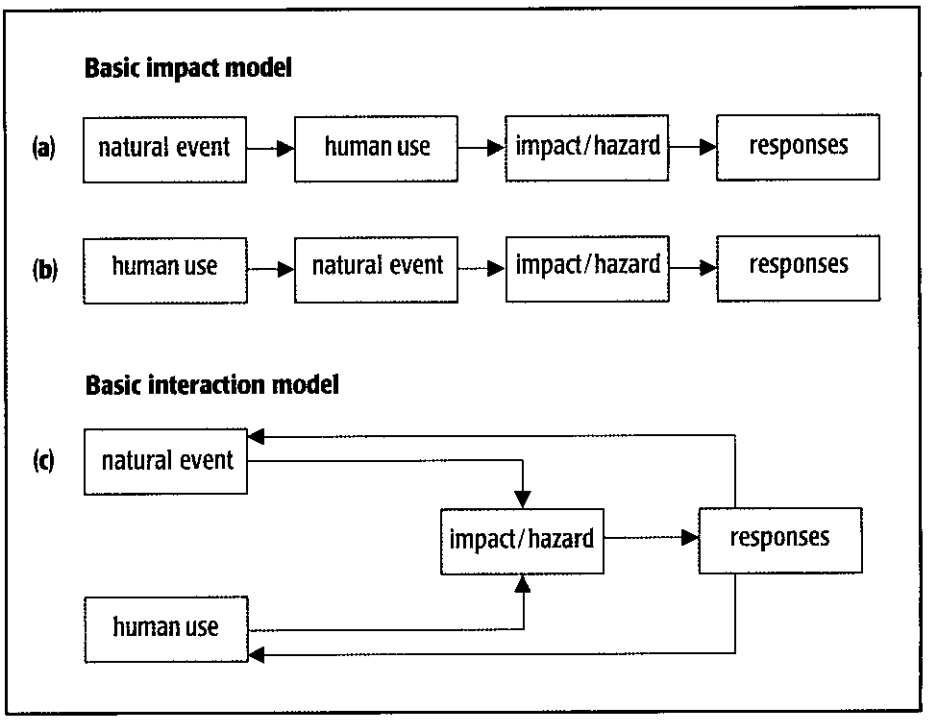

Figure 3: Basic impact models (a) and (b) and an interaction model (c) show differences in assumed relationships in studying natural hazards and approaches to managing them (adapted from Kates 1985, in Ericksen et al. 2000).

At central government level, the Ministry for the Environment has the authority to prepare a national policy statement and standards for natural hazards (Section 34) but these are not mandatory (Ericksen *et al.* 2000; Nathan and Van Dissen 2001). The New Zealand Coastal Policy Statement, which was required by law, is the only national policy statement that has a small section that includes several policies on natural hazards.

The definition of 'natural hazards' in the RMAct has come under some scrutiny since the Act came into being. Section 2 of the Act states:

Natural hazard means any atmosphere or related earth occurrence (including earthquakes, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind drought, fire or flooding) the action of which severely affects or may affect human life, property, or other aspect of the environment.

Ericksen *et al.* (2000) suggest that this definition leans toward a model of natural hazards where natural events adversely affect humans causing a hazardous situation (*Figure 3 a and b*). Natural hazards may be better captured in an interactive model (c) where natural hazards are a function of both natural events and human uses, including measures taken to reduce their damaging effects. The definition of natural hazards in the RMAct does not specifically exclude councils from taking a more interactive approach to natural hazards, but neither does it explicitly define what other interactions may occur. This makes the definition limiting and confusing, with different people taking it to mean different things, and thus acting in different ways (Ericksen *et al.* 2000).

Building Act 1991

As well as the RMAct, the Building Act 1991 (and Building Amendment Acts 1992, 1993, 1996) must also be considered when planning for natural hazards. The main difference between the Building Act and the RMAct is that the Building Act concerns a building's construction and subsequent use while the RMAct, affects the placement of the building as it relates to hazardous land (Ericksen *et al.* 1996).

Under the Building Act 1991 all building work must comply with the Building Code 1992 (Section 7(1)).

Section 31(2) (a) requires that information about site-specific natural hazards (including, but not limited to, erosion, alvusion, alluvion, falling debris, subsidence, inundation and slippage) known to local authorities but not apparent in the district plan, be provided when a Project Information Memorandum (PIM) is issued for a building project.

Section 36 of the Building Act prevents the issue of a building consent for building on land, which is affected by certain (site specific) natural hazards, unless the hazards have been avoided or

mitigated. Under section 36(2) a building consent can be issued in certain circumstances, and a section 36(2) notice is then registered on the title. Once the notice has been registered on the title, a local council is then exempt from liability, should the building be damaged by a natural event (Ericksen *et al.* 1996). It must be noted, however, that the Building Act makes no mention of fault lines or earthquake hazards when listing the types of hazards covered by Section 36. The hazards listed in this section and covered by law include erosion, alvusion, alluvion, falling debris, subsidence, inundation and slippage. The omission of earthquake hazards in the legislation means that councils are not required to refuse the issue of a consent to build on property where a fault line or earthquake hazard is present. They also cannot register a section 36(2) notice on the title on the basis the land is vulnerable to earthquakes (Parliamentary Commissioner for the Environment 2001).

Other statutes

In addition, other statutes exist that also refer to aspects of emergency management, but are not covered in this overview. These include the Local Government Official Information and Meetings Act 1987, the Civil Defence Act 1983 (and Civil Defence Amendments Acts 1988, 1989) and the Civil Defence Emergency Management Bill currently before parliament.

What constitutes a 'good plan'?

A good plan will contribute to a community's ability to successfully mitigate against or reduce natural hazards. There is no single definition of what constitutes a good plan. Kaiser *et al.* (1995) have defined some of the elements that contribute to creating a good plan:

- the plan documents the existing local conditions and issues, and identifies and guides selection of alternative solutions
- the plan has clear and comprehensive goals that represent the shared local vision of a liveable community
- policies in the plan serve as a general guide for action to make decisions and achieve goals.

Several overseas research projects have been completed on what constitutes a 'good plan' with regards to natural hazards (e.g. Berke and French 1994; Burby and Dalton 1994; Dalton and Burby 1994; Berke *et al.* 1996; Burby *et al.* 1997). These studies supported the ideas of Kaiser *et al.* (1995) and also found that better quality plans promote more extensive use of land use controls in hazardous areas. In addition, Burby and Dalton (1994) found that plan quality was a strong predictor of community success in limiting hazard area development.

Berke *et al.* (1996) has identified five dimensions of local policy context that are related to policy outputs:

- local commitment to hazard mitigation
- local capacity to plan
- the local perception (or concern) of threat from natural hazards
- feasibility of taking natural hazard mitigation action in the land development market
- degree of threat posed by hazards—they suggest that as these variables increase, the quality of local plan mitigation elements increase.

A number of New Zealand studies have also been involved in researching what a 'good plan' consists of (e.g. Dixon *et al.* 1997; Berke *et al.* 1999; Berke *et al.* 2000), with a few research projects looking specifically at New Zealand policies that relate to natural hazards (e.g. Berke 1994; Berke *et al.* 1997). Berke (1994) found that none of the eight plans and policy statements he analysed included information on emergency response or specified potential losses from natural hazards in hazard prone areas, while Berke *et al.* (1997) found that only a small number of plans analysed included this information. Berke *et al.* (1997) also noted that New Zealand has an uneven coverage of hazard and vulnerability databases and completed hazard maps over its regions and districts.

Method

The purpose of this study was to investigate whether earthquake hazards are identified in plans and policy statements from the North Island, and to detail what provisions councils make for earthquakes. For the initial study, Hawke's Bay, Bay of Plenty and Waikato regions were chosen and in all a total of 24 district plans and regional policy statements from those regions were analysed (Figure 4).

A number of districts fall under the jurisdiction of several regions, so for the purpose of this study we made the following groupings:

- Hawkes Bay Region—Napier City, Hastings District, Wairoa District, Central Hawke's Bay District.
- Bay of Plenty Region—Opotiki District, Tauranga District, Western Bay of Plenty District, Kawerau District, Whakatane District and Rotorua District.
- Waikato Region—Otorohanga District, South Waikato District, Waikato District, Franklin District, Waitomo District, Hamilton City, Thames-Coromandel District, Hauraki District, Waipa District, Matamata-Piako District and Taupo District.

Using plans and policy statements available as of May 2000 from the regions and districts listed above, a content analysis was undertaken. This involved:

a) deciding which aspects of earthquake hazards and hazards in general to identify as being present in plans and policy statements—the categories that were used are presented in *table 1*.
b) reading through each plan or policy statement and using a simple coding system to denote whether or not a category was present in a plan—for each category yes=1 and no=2, in some cases the question was not applicable and 0 was entered as a data figure.
c) statistical analysis of the coding using Cramér's V statistic to determine the frequency of elements and the relationship between regional policy statements and district plans.

The regions of Hawke's Bay, Bay of Plenty and Waikato are all located in the central North Island and are subject to varying degrees of earthquake hazard. In undertaking a probabilistic seismic hazard analysis (PSHA) of New Zealand, Stirling *et al.* (1998) found that the maps they generated showed the highest levels of peak ground acceleration and 0.5 s spectral acceleration along the axial tectonic belt (i.e. Southern Alps in the South Island), the subduction zones and the Taupo Volcanic Zone. Hawkes Bay Region is located close to the Hikurangi Subduction Zone, while the Taupo Volcanic Zone is situated within the Bay of Plenty Region, both of which, according to the models, are areas of high earthquake hazard. In contrast while the southerly and easterly parts of the Waikato Region are located within the Taupo Volcanic Zone, much of the region lies to the west in a lower hazard area.

After the initial study of central North Island regions was completed, the same process was repeated for the Wellington Region using the regional policy statement and eight district plans available as of April 2001 (nine in total). The districts located in the Wellington Region include Wellington City, Hutt City (Lower Hutt), Upper Hutt City, Porirua City, Kapiti Coast District, South Wairarapa District, Carterton District and Masterton District. In terms of earthquake hazard Wellington Region is located in an area of high earthquake hazard. In fact Stirling *et al.* (1998) report that out of all the major urban areas of New Zealand, Wellington City is subject to the highest seismic hazard.

Results

Relationship between policy statements and plans

From analysis of the data it was found that plans and policy statements vary between regions and districts with some documents containing similar methods of dealing with earthquake hazards, and some detailing very different approaches.

To determine how similar district plans are to their respective regional policy statement, categories from policy statements and plans were cross-tabulated and Cramer's V statistical analysis performed to measure the degree of association. For the regions of Hawke's Bay and Waikato, over 70% of district plans had a strong relationship with the regional policy statement and thus contained similar approaches. In contrast, for the Bay of Plenty only one district plan (17%) had a strong association with the regional policy statement showing that districts followed different approaches to those outlined in the policy statement. When figures were calculated for the Wellington Region it was found that 50% of district plans had a strong relationship with the regional policy statement.

These figures indicate that while a selection of regional and district councils do have similar methods in planning for earthquakes there are still a substantial number of district councils whose appr-oach is different from that of the policy statement for their region. Research completed by Berke *et al.* (1999) confirms this finding. They found a gap between regional and district councils with regional and district planning operating independently, weak inter-organisational coordination, variable policy direction, and little, if any, integration. This may be influenced by the fact that while a district plan must not be inconsistent with a regional policy statement, there is no obligation for district councils to address similar issues or follow similar paths in its plan.

In addition, cross-tabulations were performed between individual district plans within the same region and the results indicate that there appears to be a similar gap between some neighbouring district councils. From the Cramér's V statistical analysis, a number of combinations of district council plans were identified to have strong relationships in the Hawke's Bay, Bay of Plenty and Waikato regions. However, many of those that do have a strong association are not located adjacently. These relationships may therefore be coincidental, with the contents of district plans not purposely developed to coordinate with neighbouring councils. Thus it appears that the district councils from the first three regions studied may be operating independently of one another, and are approaching earthquake issues in different ways even where they share the same hazard. Coordination between councils is desirable as it will assist in consistency in planning for earthquakes, and will allow cross boundary issues (such as fault lines dissecting two districts) to be addressed.

Where a gap appears to exist, it is important to note that some differences in plans may reflect differences in the hazards affecting districts. Berke and French (1994) noted this when comparing how two U.S states (Florida and North Carolina) accounted for coastal hazards in different ways.

When cross-tabulations were performed between district plans from the Wellington Region it was found that six pairs of districts located adjacently had strong relationships. In addition, many of the districts that shared the same fault line and thus potentially were subject to the same earthquake hazard, also had strong

Structure of the plan/policy statement	• No section on natural hazards
Hazard and earthquake definitions	Does the plan/policy statement: • have the definition of a hazard? • list earthquakes as hazards? • mention earthquakes as a hazard that could affect the district or region? • locate the fault lines in the district or region? • describe the earthquake hazard and its effects?
Objectives	Does the plan/policy statement have: • objectives that are 'all hazard' based? • specific objectives for earthquakes? • specific objectives for other hazards?
Policies	Does the plan/policy statement have: • policies that are 'all hazard'? • a specific policy or policies on earthquakes? • specific policies for hazards other than earthquakes?
Methods	Does the plan/policy statement have: • methods that are 'all hazard'? • methods that mention earthquakes specifically? • methods that mention specific hazards but not earthquakes? • 'all hazard' rules? • rules for earthquakes/ fault lines? • specific hazard rules but not for earthquakes/fault lines? • monitoring that is all 'all hazard'? • monitoring specifically for earthquakes? • monitoring of specific hazards but not earthquakes? • monitoring only covered elsewhere in plan and does not mention natural hazards?
Assessment criteria	Does the plan/policy statement have: • general hazard assessment criteria? • specific assessment criteria with regards to earthquakes?
Performance standards for earthquakes	• are there any performance standards for earthquakes?
The Building Act 1991	Does the plan/policy statement refer to: • the Building Act 1991 regarding earthquakes? • the Building Act 1991 regarding hazards in general?
Practicalities of planning for earthquakes	Does the plan/policy statement: • note the limitations/practicalities of planning for earthquakes? • suggest that due to the nature of earthquakes, control is not possible through district plan/regional policy statement?
Earthquake hazard information	Does the plan/policy statement: • recognise there is a need for the council to update the local seismic hazard information, or acknowledge there is a lack of information available to the district or region? • account for new hazard information to come to light?
Environmental outcomes	Does the plan/policy statement have: • 'all hazards' based environmental outcomes/results? • hazard specific environmental outcomes/results?
Hazards on planning maps	• are local hazards included on planning maps?

Table 1: Categories identified in plans and policy statements.

relationships. It appears, therefore, that the districts in Wellington are better coordinated in terms of earthquake content in district plans than the other three districts located further north. It must be noted however that certain elements in the plans did differ. For example, if we look at rules particularly, most of the districts in the Wellington Region that include rules in their plan have differing rules about earthquakes and fault lines. In this case, none of the rules formulated by individual districts coordinate with the neighbouring districts even where they share the same fault line.

Earthquake hazard information

The incorporation of earthquake hazard information into plans and policy statements, and the way that information is utilised varies between the various districts and regions. It was found that in general, plans and policy statements from the Hawke's Bay, Bay of Plenty and Waikato regions contain little information about the nature of earthquakes, the location of fault lines in the area or about the possible effects of earthquakes. This is confirmed by Berke *et al.* (1999) who have identified that most district plans have a limited fact base, no matter what the issue. The quality of the fact base is one of the major factors contributing to a quality plan, so a good plan should ideally contain factual information about earthquakes.

In contrast, the regional policy statement and district plans from the Wellington Region contain more information and facts about earthquakes than their more northerly counterparts. All documents mention that earthquakes are a hazard in the region or district, 89% locate known earthquake fault lines and 89% describe the earthquake hazard and its potential effects.

Objectives, policies and methods of dealing with earthquake hazards

In the Hawke's Bay, Bay of Plenty and Waikato regions, earthquake hazards are mostly dealt with as part of an 'all hazards' framework, and are not specifically singled out for mention in district plans or policy statements (although they may be recorded in a list of hazards that affects the district or region). Most of the objectives, policies, methods and environmental outcomes written in plans or policy statements, are based on the 'all hazards' approach. Only a few district plans that were analysed have actual policies or methods that specifically mention earthquakes or make some attempt to plan for their specific nature. May (1997) suggests that while planning in an 'all hazards' framework has advantages (e.g. it allows hazards to be incorporated into broader policies) it can also be limiting because appropriate tools vary for different hazards. For example, a warning system could be used for a flood event, but is not feasible in the case of earthquakes.

In contrast in the Wellington regional policy statement and district plans, objectives tend to be 'all hazards' based, but one third have specific policies for earthquakes and over half have methods that specifically mention earthquakes.

Methods-rules

Rules are one method of achieving the objectives and policies of a district plan. A district council may include rules in the plan to prohibit, regulate or allow activities. Likewise, a regional plan may also contain rules, but none of these particular documents were included in the analysis of plans and policy statements.

The majority of district councils in the Hawke's Bay, Bay of Plenty and Waikato regions do not have any specific rules written in their plan for earthquakes, although many districts have rules for other hazards such as flooding, land instability, erosion and coastal hazards. Only two district councils out of these three regions have rules in their plan regarding earthquakes. One is a more general rule that lists earthquakes as one of the hazards to have regard for when considering an activity. The other rule makes any activity located 100m within an identified fault line a discretionary activity.

Wellington region is quite different, with three-quarters of district plans (6 plans in total) containing rules that relate to specific earthquake hazards. Two districts make building in a seismic hazard area a permitted activity, with a few restrictions relating to the type of building allowed to be located there. In terms of earthquake hazard mitigation, it is better to avoid developing in areas subject to earthquake hazards, so to permit building in a seismic hazard area places both the structures and people at great risk. Three district councils make building within identified seismic hazard areas either a discretionary, limited discretionary or a restricted discretionary activity. This type of rule gives councils some discretion over whether to grant a resource consent for a particular activity or not and councils therefore have the power not to allow an activity to go ahead in a seismic hazard area if they consider it too great a risk. One other district council states under the standards and terms of the rules that 'no building shall be erected within 20 metres of any earthquake fault line shown on planning maps or any other known earthquake fault line'.

Policy adoption after earthquake events

Burby and Dalton (1994) note that hazard mitigation policy studies universally have found that experienced losses stimulate policy adoption. In this study we found that there was no substantial connection between past earthquake events and earthquake policy adoption in the Hawke's Bay, Bay of Plenty and Waikato regions. In Hawke's Bay Region, only one district council has policies for earthquakes in the district plan, despite the region having a history of damaging earthquake events. One such event took place in the Hawke's Bay in 1931 when a magnitude 7.8 earthquake occurred, causing 256 deaths from building collapse and the widespread fires that followed (Johnston and Pearse 1999). Likewise, in the Bay of Plenty only one district council makes reference to earthquakes in its district plan. The 1987 Bay of Plenty earthquake may have had an influence on the addition of this policy, as the area affected during the 1987 event is located within that district. A third district council located in the Waikato Region, has a number of earthquake policies in its district plan, but is located in an area where no large historical earthquakes have occurred.

There may be some connection between earthquake events and earthquake policy adoption in the Wellington Region. It is possible that the 1855 Wairapapa earthquake may have been an influence on the higher rates of policy adoption in this region, although without further research it is impossible to tell if this event has been truly influential. Even if this event has had some influence it is unlikely that it has been the sole determinant of policy adoption. Other factors that are likely to have been influential in this respect include past investment in hazard education, research and policy development, and political support for such programmes, which have led to a high awareness of the hazard in the community and the formation of a significant 'earthquake culture'.

The Building Act

Our findings indicate that while a third of councils from the Hawke's Bay, Bay of Plenty and Waikato regions include a specific paragraph on the Building Act 1991 with regards to earthquakes (and

verify that adhering to the Building Code (as is legally required) is an important way of mitigating against the effects of earthquakes on buildings), few of these councils have backed this up with any other means in plans or policy statements. Only 38% of central North Island councils that make reference to the Building Act have specific earthquake policies in their documents as well. In Wellington Region 44% of councils mention the Building Act in plans and policy statements but only half of those who make mention of the Act also include earthquake policies in their plans and policy statements.

Caution must be exercised when relying on the Building Act and the Building Code alone to avoid or mitigate the effects of earthquakes. It may be possible that if used independently, the Act or the Code may not be totally effective. For example, the Marmara earthquake in Turkey in 1999 saw widespread destruction of buildings despite measures being in place to ensure that buildings were earthquake resistant. Inadequacies in the control mechanisms of local municipalities for checking the work of local building contractors meant that many buildings were not built to standard (Özerdem 1999). The Building Act principally deals with how a building is to be constructed and not where, which means that while a few provisions do exist in the Act with regards to the placement of buildings, it does not allow complete control over building placement. This is especially pertinent with respect to earthquakes, as these are not specifically mentioned in the legislation as a hazard to account for.

After investigations following the Marmara earthquake, Sharpe *et al.* (2000) suggest that in addition to ensuring building standards are adhered to, New Zealand must also improve its efforts in hazard and land use planning. They suggest preventing or restricting new construction on, across, or immediately adjacent to, known active fault traces, and advocate the continued identification of unknown faults.

Conclusions

While more hazard information and policies are incorporated into plans and policy statements than they were pre-RMAct, it appears that there is still not enough being done, with many councils undertaking the bare minimum to meet legislative requirements. The three central North Island regions have very low levels of earthquake information and virtually no earthquake specific policies in plans and policy statements despite being located in areas identified as being subject to earthquake hazards. Councils from Wellington Region have a greater extent of earthquake hazard information in their policy statement and district plans but still fail to address many of the crucial details such as what development is appropriate for land in seismic hazard areas.

Judging by the lack attention given to earthquakes in many plans and policy statements, it is evident that councils still require guidance on how to use earthquake information and plan for earthquakes. Nathan and Van Dissen (2001) suggest that to address the lack of national consistency and coordination a national policy statement on natural hazards or national guidelines could be prepared. National guidelines could first be prepared for fault rupture hazard, and followed by further guidelines on other earthquake hazards. A recent report by the Parliamentary Commissioner for the Environment (2001) supports the idea of best practice guidelines for mitigating seismic hazard. Best practice guidelines would provide a basis for councils to plan for hazards but would still allow authorities to devise local solutions for local problems.

One area where best practice guidelines could assist is in the setting of rules. Careful consideration must be given to the types of rules used in district plans. Currently, while six Wellington districts have rules regarding earthquake hazards only four have any reasonably robust measures for limiting building in seismic hazard areas as the other two councils make building in these areas permitted activities.

The Resource Management Act has provided an approach that allows regional and district councils to deal with local natural hazard issues in their own way. Despite visions of a coordinated approached envisaged at the inception of the Act, in practice there have been a variety of responses from councils, with each following a different path. Results from this study show no strong coordination between councils with few consistent policies and rules between regional and district councils and adjacent district councils, even where they share the same earthquake hazard. When plans and policy statements were cross-tabulated a number of councils did show strong relationships with other local authorities, but this occurrence appeared to be random. In addition some strong relationships were based on councils following similar poor earthquake planning practices as opposed to effective ones. To be successful in planning for earthquakes, councils need to consider a whole range of issues to achieve the best possible

results. They need to look carefully at the types of policies they are going to incorporate into plans and policy statements, whether they are going to achieve the aims of the district or region and how this will coordinate with other councils so that issues can be integrated across local bodies.

With regards to the Building Act 1991, 33–44% of district plans in all the regions studied make particular reference to this legislation (and the Building Code) to reinforce the fact that buildings in the district must be built to specification in order to perform in an earthquake. However, of those that do specifically mention the Building Act, only 38% in the central North Island and 50% in the Wellington Region have any additional earthquake-specific policies as well. Sole reliance on the Building Act and Building Code to account for any earthquake hazard should not be encouraged as some overseas cases have shown the implementation of a Building Code to be inadequate when an earthquake has occurred. In addition, the Building Act itself has only limited functions to control the development of buildings on geologically unstable land and therefore should not be used independently, but in combination with the Code, RMAct, hazard maps and other relevant documents and measures.

Finally, a review of the relevant sections of the Building Act and Resource Management Act would assist in addressing issues with respect to the interpretation of those Acts. The Department of Internal Affairs is currently undertaking a limited review of the Building Act with a focus on Section 36(2). In addition, there is still uncertainty over the interpretation of 'natural hazards' in the RMAct and the roles and responsibilities of councils in mitigating natural hazards. Some case law does exist on matters (such as the roles of respective councils), but this could be clarified and supplemented by the creation of more detailed hazard guidelines.

Future Research

While this study has been undertaken within a limited geographical area and focuses on only one hazard (earthquakes), future research will involve analysing a wider range of natural hazards in a greater number of plans and policy statements. Surveys and interviews with staff at local and regional councils will also be undertaken, and will enable us to link the information found in district plans and policy statements with the processes that occur in regional and local government. From this, we will be able to identify barriers to the effective implementation of natural hazard policy and compile a set of 'best practice' guidelines for natural hazards.

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This article has been refereed

Improving procedures and minimising distress:

issues in the identification of victims following disasters

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This paper is based on a submission by the author to the public inquiry (held during 2000) into the Marchioness Riverboat Disaster of 1989 in which 51 people died[1]. It covers issues arising from the second and third terms of reference of the inquiry into the identification of victims. Reflecting on previous and current practices and experiences, it draws on the procedures followed in the UK when establishing the identity of victims following disasters and highlights the differing needs, interests and issues arising for both professionals and the bereaved. The aim of discussing such post-disaster relationships is to highlight the need for sensitivity, careful planning and proper training in dealing with issues of bereavement, identification and relative liaison following a major disaster. Some attention has started to be paid to these issues, but it is argued here that training needs to be more systematically developed and delivered if distress surrounding a range of post-disaster procedures is to be mitigated for both responders, the bereaved and survivors.

While it is sometimes suggested that cost is a prohibitive factor in considering better training and awareness-raising in the field of trauma and disaster management, it is suggested that planning and preparation for dealing with disaster is cheaper economically, socially and morally than dealing with the effects of poorly managed incidents after the fact. Further, these issues must also be considered in the legal context of the duty of care owed to responders and the increasing emphasis on the rights of the dead and bereaved (IBCA 1996) as well as the general public (as incorporated in human rights legislation) in relation to expectations and treatment following traumatic death.

The practical implications of this paper are presented in italics. The paper concludes with a summary of suggestions about what the bereaved need following a disaster.

Thinking from the perspective of the bereaved

Thinking from the perspective of the bereaved seems a good and obvious place to start. However many of the manuals and guidelines for disaster management have developed instead from the perspective of responders' needs in terms of plans, procedures and protocols. Dealing with the physical and logistical demands of disasters has been an important priority but, as will be shown forthwith, may inevitably conflict with the needs and interests of the bereaved. In the past such conflicts of interest do not appear to have been understood resulting in insensitive liaison or lack of communication with next of kin. Today awareness and understanding of the needs of the bereaved are improving but there is still much to be gained by considering disaster management from the perspective, needs and interests of the bereaved. Experience has shown that getting it wrong may have devastating effects on the bereaved, compounding the loss, grief and anger associated with sudden death. Pam Dix, of *Disaster Action*[2] reflects the sentiment of many of those bereaved by disasters in the 1980s. Her brother Peter was one of the 270 people killed in the Lockerbie air crash over Scotland on December 21 1988. His body was identified 11 days after the disaster by means of fingerprints and dental records. Pam states:

> 'How my family was treated during those 11 days remained with me and influenced my life ever since.'
>
> (*The Lancet* (1998, p. 1061)

As I have argued elsewhere (Eyre 1998), for many bereaved by disaster in the 1980s, the way they were dealt with in the days and weeks following disaster has, in their view, had as devastating an effect as the fact of the deaths themselves. This is a sobering testimony on how we dealt with disasters in the past and highlights why it is important to work through all the processes involved in managing disaster as sensitively as possible in future. *Adopting approaches which consider, take account of and respond to the needs, interests and concerns of the bereaved at every stage is an important priority.*

Dealing with the body: multi-agency perspectives

This is, however, easier said than done. It partly arises from the fact that there are many facets of disaster management which are complicated by the sheer number of agencies and organisations involved in responding (take for example the basic practical difficulties simply in communication, a factor which is often identified as being a key problem not only across but within organisations in the heat of disaster response). The fact that such agencies all bring with them their own assumptions, priorities, needs and interests to the disaster site can lead to some inevitable differences in opinion and actions. In many respects, the different organisations represent complementary tasks and duties; otherwise they would not be present at all (one would hope!). However, as I shall go on to show, the disaster site (by which I mean not just the literal physical site of an incident but the broad context of disaster response,

Notes

1. The public inquiry into the collision between the Marchioness pleasure boat and the Bowbelle dredger on the River Thames in August 1989 commenced in 2000 after a broader inquiry into safety on the River Thames. The inquiry into the disaster was achieved largely as a result of continuing campaigning by the Marchioness Action Group over the previous decade. The terms of reference for the non-statutory inquiry into the disaster were as follows:

   - To consider and report on the procedures followed to establish the identity of the victims of the collision between the Bowbelle and the Marchioness
   - To review and report on the procedures currently followed when establishing the identity of victims following similar accidents
   - In the interest of minimising distress to the families of victims:
     (a) to advise on what additional procedures should be followed, if any, when the need to identify victims arises following similar accidents
     (b) to consider and advise on procedures for the notification and involvement of the next of kin in cases when it is necessary to establish the identity of such victims (Clarke 2001: 7-8)

2. Disaster Action is a UK charity set up in 1991 in response to a series of major incidents in the UK in the late 1980s. Its members are all survivors and bereaved from disasters. It provides support, training and campaigning on issues including the rights and needs of disaster 'victims' and corporate responsibility.

management and decision-making) is inevitably one of potential conflict in terms of interests, needs and perspectives. Herewith the bereaved may become just one of a number of stakeholder groups.

So what organisations are we talking about when it comes to issues surrounding body recovery, storage, identification, release and disposal? Consider the differing command/authority structures, personnel, assumptions and priorities of the following organisations, which may be called on in the aftermath of disaster:

- police
- fire and rescue services
- emergency medical services
- body recovery companies
- social services
- debriefing and counselling organisations
- coroners
- funeral directors
- local authority emergency planning staff
- voluntary bodies
- representatives of faith communities
- action groups
- media.

The bereaved may need to deal with some or all of these at some stage or another. In the past these have been uncoordinated by any single agent with the effect that, for example, giving basic information has had to be repeated many times over.

Today with the development and extension of the role of trained police family liaison officers in major incident response in the UK[3], the police may play an important part in negotiating such contacts and support, working as they do with the needs of the bereaved as a central consideration. However this does not detract from the fact that some agencies will have priority regarding decisions and protocols which need to be followed. In terms of dealing with the dead, for example the coroner has ultimate authority in deciding what protocols shall be followed after adisaster; others are responsible to them with regard to the manner in which body recovery, identification and release takes place. The fact that this is traditionally a very male-dominated profession, exclusive of specialist training in dealing with the bereaved from disasters, has historically had implications for the rights and opportunities afforded the bereaved.

'In a major disaster, as with any death, the coroner has responsibility for the body until such time as it is released to the relatives. He must arrange for the body to be recovered from the place of death and for it to be kept in a proper place. He must ensure that there are suitable facilities for such examinations, that the body is properly identified and that any evidence of crime is preserved for the police to deal with further. There must be liaison with the relatives. Eventually the body, and connected property, must be released for disposal to those lawfully entitled' (Dorries 1999:251).

Dorries, (1999) himself a practicing coroner, acknowledges that other organisations, such as those mentioned above, inevitably want to have input into decisions that the coroner must take, while still respecting that he will make the ultimate decision. However, he states, once disaster has occurred it is far too late for these views to be expressed and discussed in a meaningful way. Dorries thus suggests 'it is incumbent on both parties to take an opportunity in calmer circumstances, even if this involves much opposition' (1999:253). The implication here, then, is that *pre-planning, discussion and multi-agency training is needed before disasters occur.* A key question for representatives of disaster response teams reading this then is: do you currently know the policy your coroner will take on issues such as viewing, release and identification? Might relatives be looking to you for advice and guidance on legal technicalities and will you be competent to respond? Might you anticipate interagency confusion and conflict and might this be resolved? As Dorries states:

> Building sound relationships with the other major players in the disaster scenario (updating these contacts as those personnel change) and educating them as to the coroner's responsibilities is a vital part of preparing for a major disaster' (1999:253).

Person, property of public interest? Post-disaster perspectives on the body

In order to illustrate the various stakeholders active in the foray of disaster management, let us now examine differing assumptions, perspectives and priorities relating to the body. Post-disaster relationships reflect the fact that individuals and organisations sometimes have conflicting needs and interests arising from these perspectives and priorities. *Figure 1* illustrates this in terms of the perspectives of the coroner ('property'), the bereaved ('person') and the media ('public interest') in relation to the body.

As stated earlier, in terms of decision-making around the body, the coroner has the authority to make key decisions regarding the manner and timing of release. Technically no one *owns* the body, but the coroner's responsibility for the body (see Dorries' statement above) may operationally mean that access to the dead is denied relatives arriving at a disaster site. There may be good and sensitively considered reasons why access to the dead at this point should be so restricted. However there are ways of communicating this to the bereaved. An inappropriate statement would be to communicate directly to relatives that the 'body' is the 'property of the coroner' as allegedly happened after the Hillsborough Disaster (personal communication). In this instance the understanding and language of the coroner's officer reflected not only huge insensitivity but also an emphasis on the coroner's needs and interests. He could have considered and expressed himself more sensitively simply by taking account of the needs and perspectives of the bereaved parent addressing him.

In contrast to the coroner or pathologist, from the point of view of the bereaved, the body represents a loved one, a life and a relationship. Obvious though it may seem, it follows on from this that the use of language such as 'this body', 'cadaver', 'reconstruction' etc. can cause serious affront and dismay if employed in direct communication with next of kin. *Thinking from the perspective of the bereaved may require practitioners to rethink their use of language and tone when addressing the next of kin.*

Furthermore, while disasters, by definition, may involve mass casualties, it needs to be remembered that the bereaved are only interested in their loved one and need to be responded to in terms of that one person. This needs to be borne in mind even though the reality for the practitioner might be that they are dealing with the complications associated with fatalities on a large scale and might wish to state this as an expression of the degree of strain under which they may be operating. This again illustrates the point

Notes

3. The role of trained police family liaison officers in disaster management is a dynamic one. Although relative liaison has historically been practicised as laid down in police guidelines for dealing with major incidents, in the past they were not given specialist training in this function. More recently, however, and following on from practices developed with families of murder and road death victims, a number of forces are extending their training to cover major incidents. Notwithstanding this, complex issues remain to be resolved in relation to the resourcing of such a response should a major incident occur. A number of working groups in the UK are examining the development of this function.

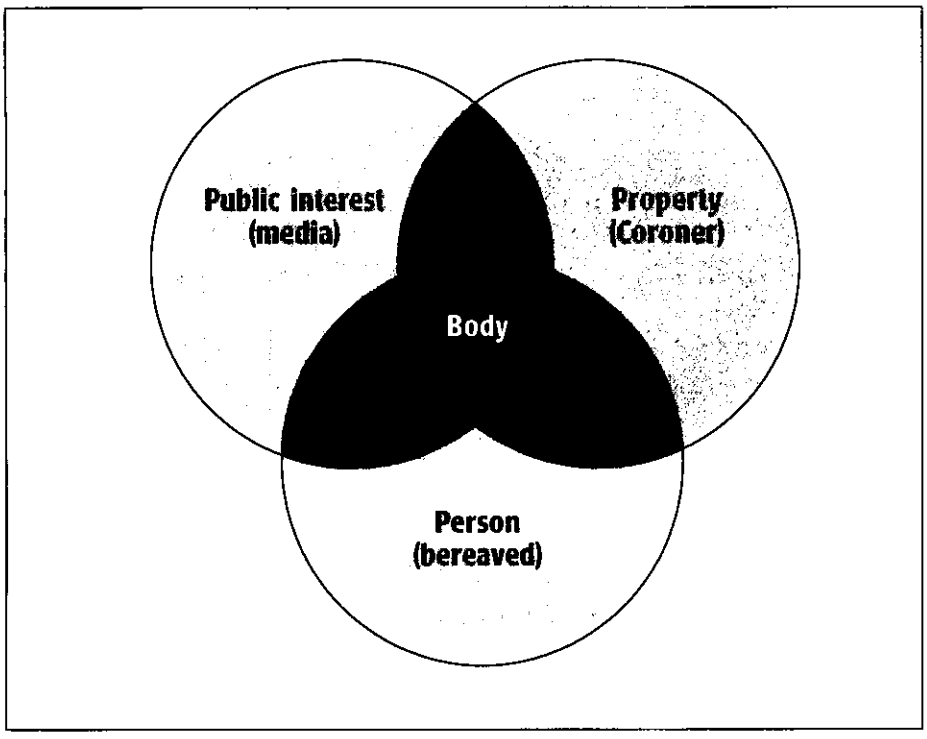

Figure 1: Post-disaster perspectives on the body.

that in preplanning and in the actual event of disaster management, thinking from the perspective of the bereaved might make a difference in terms of the interaction with and treatment of those already traumatised by the impact of sudden death.

As a final illustration of the different players and their respective perspectives on the body, consider the media. Their entry into the disaster is in relation to a potential headline news story. Newsworthiness rests partly on immediacy rather than accuracy. They want a story and they want it now!

> 'The media will inevitably hear of a disaster event, will report that news, and will search for more information both by telephone and by sending reporters to the scene. If the event is judged newsworthy enough the media may descend on the scene en masse... Once on site, the media will make extensive demands on local disaster managers, often using pack pressure (media tend to operate in groups) to force the holding of news conferences and to demand answers to specific questions, questions to which there are seldom satisfactory answers in the immediate post-impact period.' (Scanlon et al 1985, p. 124).

For many journalists 'public interest' as a legitimisation for such intensive inquiry overrides concerns about sensitivity for the bereaved and even responding personnel. For them then, the body takes on a very different meaning than for the bereaved. They want to know how big a story this is, which is partly defined in terms of the number and scale of deaths. The media response to the Paddington train crash in October 1999 illustrates this. Not only was immediacy of story illustrated by the arrival of a Sky News representative within 20 minutes of the crash (Williams and Harrison 2000); regular bulletins on the television news throughout the day also kept this headline news. As well as gaining camera access to the crash site 24 hours a day during the body recovery period, media personnel continuously speculated on the numbers of dead, even to the extent of having a dramatic impact on decisions and actions taken by professionals managing the response. While it is increasingly self-evident that the different types and technologies of media communication must be taken account of in disaster planning, training and response, their impact on the nature of that response, the timing and way it is broadcast and analysed is broadening with each disaster. *However the needs and interests of the bereaved do not appear in the main to be taking any higher priority in media coverage of tragedy. This area deserves further research and action.*

I have suggested so far that there are differing needs and interests relating to perspectives on the dead after disaster. It is also suggested here that these may inevitably produce irreconcilable demands and situations of conflict in the post-disaster scenario. Focusing on the particular perspectives of the coroner and the bereaved, consider which of the needs in *Table 1* is a priority?

Removing the body from the place of death

This may not be a priority for the coroner from whom permission is needed before the dead are removed from a crime scene. Indeed Dorries suggests that, from the coroner's perspective, once death is established there is nothing to be gained by rushing to recover the bodies. He discusses the potential impact of premature removal on forensic evidence and efforts to establish the identity of the deceased for forensic purposes (1999, p. 263).

For the bereaved however, a common cause of upset is that the deceased are left in situ for some time. For them a common wish is to know details of their loved ones' final moments before and after death and a desire to know that their dignity was not affronted. The following quotes from two bereaved relatives illustrate this:

> 'I also made contact eventually with the doctor who found my brother and pronounced life extinct. It was extremely important to me to hear a straightforward, firsthand description of how Peter had been found' (Dix 1998, p. 1062)

> 'There was always this searching to find out where she lay, who came in contact with her, what did they say to her the last time they saw her...all these things were important to me

	coroner? (*yes, no, maybe*)	bereaved? (*yes, no, maybe*)
Removing the body from place of death		
Explaining procedures to relatives		
Allowing relatives to view the body		
Involving relatives in formal visual identification of body/body parts		
Facilitating prompt release of the body		
Cleaning personal property before return		

Table 1: Differing needs and interests relating to perspectives on the dead following a disaster.

to try to fabricate those last few times in her life'. (*Lockerbie: My Trial*, Channel 4 Television May 2000).

Explaining procedures to relatives

In terms of mitigating the effect of having to leave bodies in situ, an important issue is communication with the bereaved to explain why such procedures are followed. As mentioned earlier, the UK police are now extending and developing the role of family liaison officers whose role includes liaison between the bereaved and other organisations, and facilitating explanation and understanding of such details.

The role of the family liaison officer in explaining clearly and sensitively in the aftermath of disasters, has the potential to resolve the conflicts generated in the past by a lack of communication and provision of information to the bereaved. One relative bereaved by a 1980's disaster, states:

> 'What we wanted was information about exactly how and why people died, why we were being dissuaded from viewing the crash site, how the identification process worked and why we were not allowed to see the bodies. This would have helped far more than counsellors telling us how we should feel' (quoted in Dorries 1999, p. 254).

An important point to be made here is that the practices often followed in disaster management deviate from the principles, plans or recommendations laid down. By way of example, though it is true that relatives have a right to know about the conduct of post-mortems and the right to view the deceased, in practice after disasters including Lockerbie and the Marchioness, relatives were denied such opportunities. As I have discussed elsewhere (Eyre 1998), their grief was subsequently compounded by anger at the responding authorities. Hence while useful explanatory literature exists, such as leaflets produced by the Home Office on coroners and inquests, (Home Office 2000), *local authorities need to ensure they have such resources available and built into their plans and practices in the aftermath of disasters.*

Allowing relatives to view the body

Our instinct in dealing with bereaved people is often to seek to protect, with the effect that when it comes to decisions such as viewing the deceased in Britain the attitude has traditionally been to discourage it. Coroners and others may wish to encourage relatives to remember the deceased as they were rather than take the opportunity to view. Such a view is now changing and the need to offer informed choice is recognised as important by many bereavement professionals and by disaster action groups. From the coroner's perspective viewing may not be a priority at an early stage, but Dorries suggests that there is little point in preventing families from viewing the body since when it is released they are entitled to decide to view anyway. Considerations such as the state of the body need to be taken into account, but the notion of informed choice about the state of individual bodies as opposed to blanket decisions (made on behalf of all the dead and regardless of the state of individual bodies) has been promoted by organisations such as Disaster Action. Their membership includes relatives who have had personal experience of bereavement through disasters. As one member states:

> 'It is important to see the body for the relatives in most cases. Many relatives are told that they can open the coffin much later when the body is released and have a look at the body there if they want to. What I say to that is that it is not the same. I still can't really explain why, but it is important for many relatives that I have spoken to, not just in disasters but in road traffic accidents as well, to see the body as soon as possible after death. It's sort of like being as close as possible in time as to being there with them when they died. And being told that you can, a week later, or a couple of weeks later, you can open up the coffin is just not the same at all... It's not the same way of actually having the information that they are actually dead because that is really all you want to know. Are they really dead? Half of your brain is still considering 'well it could be a mistake, there could be somebody else', particularly in the Kings Cross fire where anybody could have been there at that particular time.' (Tarrasenko 1999).

An important implication for the role of support workers arises from this consideration. Suggesting that social services and others owe a duty of care to relatives to ensure that they understand what they will find if they insist on viewing the remains, Dorries states:

> 'Perhaps one of the best ways forward is to offer a facility for trained clergy or social workers accompanying the relatives to see the body first so that they can realise for themselves the terrible traumas that have occurred. They are then better placed to assist the families in their own decision' (1999:266).

Issues arise here in relation to the training and preparation of social workers and others on trauma support teams as well as the care and support made available through debriefing etc.

Involving relatives in formal visual identification of body/body parts

This may or may not be a priority for either coroners or relatives. In some disaster contexts damage to bodies may be such that visual identification is impossible and for the suddenly bereaved visual identification may anyway be unreliable. With the increasing development of technologies such as DNA, identification may be carried out inn alternative ways; indeed DNA was largely the method used in the aftermath of the Paddington rail crash where the impact of the train crash and intense heat of the ensuing fire caused severe mutilation and disfigurement. For identification purposes, personal items such as toothbrushes, combs or fingerprints may be requested from relatives. An important issue for the bereaved here is sensitivity in terms of explaining and conducting potentially intrusive home visits. Those coordinating inquiries and family liaison in the aftermath of the Paddington Disaster have highlighted the priority that was placed on an open, honest and sensitive approach to questions surrounding lineage etc. in pursuing identification methods and inquiries (Williams and Harrison 2000). Anecdotal feedback from relatives (personal communications) has suggested that this was much appreciated, though this needs to be systematically researched. The Emergency Planning Society's Welfare Subgroup (1998:4.4.4) gives further useful guidance on information relatives need during identification procedures.

Facilitating prompt release of the body

The timing of release of bodies highlights a further potential difference in needs and interests between the coroner and the bereaved. In mass disasters, the coroner will generally prefer not to release a single body for funeral until it is firmly established that each victim has been properly identified (Dorries 1999:269). This is to prevent difficulties such as the release and disposal of a wrong body to the wrong family. For the bereaved however, cultural and religious requirements (such as timely disposal for Jews) may lead to requests irreconcilable with the demands

of the coroner. Here it is important for those working with the bereaved to recognise a key theme in this paper—that there will be some needs and desires that it may not be possible to satisfy. *Support for staff managing difficult negotiations is important if a sense of personal responsibility and failure is to be avoided.*

Cleaning personal property before return

Individual coroners and relatives may take different views on this question. This highlights a further important point, which is the need to be aware that, just as individual professionals and volunteers may have different experiences and feelings regarding the same disaster, so it is with bereaved relatives and survivors. It is sometimes assumed that relatives will wish for personal effects to be cleaned and repaired prior to return but this is again an area where informed choice should be exercised. Items returned clinically clean or repaired when they had been cherished as damaged pre-disaster may be upsetting as may personal effects, which are soiled. One bereaved relative highlights the emotional significance of the return of her daughter's property after disaster:

> 'I remember the day that the package arrived. I knew what it was... they put it in the front hall and I left for the day. We all came back that evening and the house was filled... with this smell, and it was a combination of disinfectant, jet fuel and mildew, very distinctive smell that in some ways was offensive but in another way it was filling the house with whatever was left of Alexia in some way' (*Lockerbie: My Trial* Channel 4 Television May 2000).

Conclusion

This paper has discussed a number of the procedures followed after death in disaster with a view to highlighting how procedures can be adopted in a manner that is more sensitive to the needs and feelings of the bereaved. Discussions with colleagues involved in responding to the Paddington Disaster have highlighted the potential *extension of the role of the family liaison officer* as a step forward in developing and improving procedures for the notification and involvement of the next of kin in matters relating to the body after death. While there are some complex issues to work through further here regarding the concept, training and impact of family liaison officers, this seems to be a good way forward. Interestingly, and to positive effect, Disaster Action was consulted by the coroner at Paddington for advice and feedback with a view to learning from those with direct experience of bereavement through disaster. In terms of being a grass-roots organisation, the *further involvement of organisations such as Disaster Action* in training and consultation regarding disaster planning and response is recommended. Their members offer unique perspectives to disaster experience and management as complementary to practitioners' viewpoints.

As others gathering evidence for the Marchioness Inquiry will have noted, disaster management in the UK is fragmented, dispersed and inevitably multidisciplinary, such that evidence for the inquiry was drawn from a wide variety of sources, organisations and individuals. There are historical reasons for this relating in part to the evolution of emergency management from Civil Defence and the priority that has been placed on local rather than national planning. What this means on the ground is that opportunities to share information, develop discussion and dialogue in the manner encouraged by the inquiry have previously been limited and the opportunity for lessons to be more effectively pooled, centralised and shared has been lost. One theme highlighted by the current national review of emergency planning[4] is the strong general opinion among emergency management professionals that disaster planning should become a statutory responsibility. *A broader recommendation, then, is for more discussion and support for such initiatives by the Cabinet Office and others.*

As an academic specialising in Disaster Studies and Management, I have worked alongside and with those involved as practitioners in planning, preparing and responding to major incidents. At the same time I have been privileged as a disaster survivor to work with relatives and survivors of many UK disasters through Disaster Action, and hence appreciate the role they too can play in informing, educating and training. I have tried to embrace all three approaches to disaster, from academic, practitioner and relative/survivor perspectives in my work and in the *Study Group on Disasters* recently founded through the British Sociological Association. The focus of the Study Group is primarily the psychosocial or human aspects of disaster. Clearly this sort of approach complements the more procedural approach that has predominated historically within disaster management. In an era when the concepts of human rights, duties of care and community-based approaches are becoming prioritised, it is suggested here that this approach has much to offer in developing and improving disaster management in the coming years.

Postscript

Lord Justice Clarke's report was published in March 2001, twelve and a half years after the disaster. Among its recommendations was the adoption of four key principles after disasters: providing honest and accurate information at every stage, respect for the deceased and bereaved, a sympathetic and caring approach throughout, and the avoidance of mistaken identification. Other key recommendations included: a detailed review of the role and law relating to coroners, including consideration of their training; meetings between coroners and families to explain identification and other procedures; the development of formal protocols between coroners and the police and others in order to avoid confusion and consideration to placing the 'right' to view the body on a statutory basis. For fuller details of all the recommendations see Clarke (2001).

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4. National review of emergency planning has been initiated by the Home Office but was suspended in the run up to the general election, June 2001. The review remains on hold at the time of writing; meanwhile in the aftermath of the general election, responsibility for emergency planning has since passed from the Home Office to the Cabinet Office.

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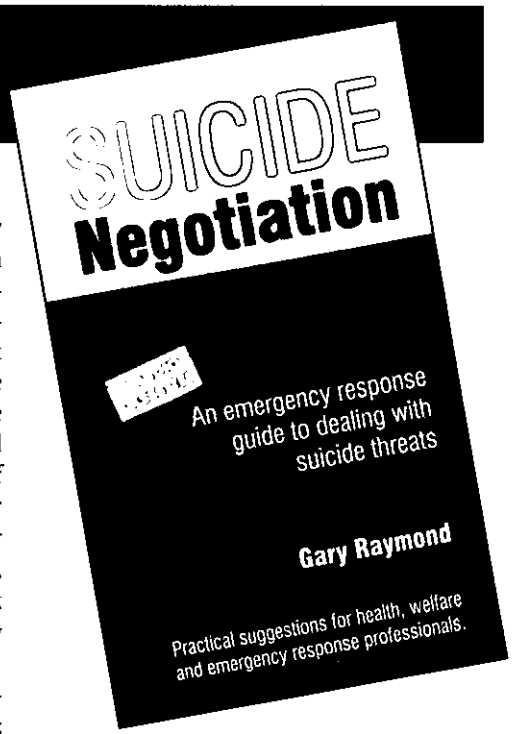
Tape Review



Suicide Negotiation: An emergency response guide to dealing with suicide threats

by Gary Raymond
2 audio tapes
Produced by Emergency Support Network
ISBN 0 9579012 1 6

Reviewed by Simon Brown
Chief Executive Officer of Occupational Services of Australia

Suicide Negotiations: An emergency response guide to dealing with suicide threats is presented as a two cassette audio package with a brief written summary included.

The presenter is Gary Raymond, a NSW Police Inspector with a wealth of practical experience in responding to and managing suicide threats. The tapes are produced by the Emergency Support Network, a well known Australian provider of quality information and material in the broad area of critical incident management.

The tapes are based on a live presentation in late 2001 by Inspector Raymond with a lively and interactive audience of health, welfare and emergency response professionals.

After a somewhat slow start, Inspector Raymond warms to the task, and presents an interesting, knowledgeable and practical overview of the challenging task of negotiating with persons threatening suicide.

Using real life illustrations, Inspector Raymond deals with strategic and safe negotiation approaches with a strong emphasis on safety—for both the negotiator and the suicidal person. It is a little frustrating at times when audience responses are difficult to hear however, Inspector Raymond generally paraphrases relevant imput.

It is important to note that Inspector Raymond approaches the subject very clearly from the perspective of an operational police officer, often talking about the 'back up' and support available to police in such high risk situations. The focus is firmly on safe rescue and retrieval, rather than on counselling, therapy, or mental health management.

One of the most useful elements of this presentation is the emphasis upon differentiating counselling from suicide risk management. Inspector Raymond tactfully and consistently reminds the audience that dealing with a person at immediate risk of suicide is not about counselling or necessarily resolving their often considerable list of issues: rather he demonstrates that what is required is a firm directive style in a time critical situation. Unlike the counsellor, the suicide negotiator has a clear and predetermined acceptable, primary outcome — preservation of life. Counsellors may listen to some of Inspector Raymonds strategies and wonder about their longer term impact on the distressed person, however as he points out, the counsellors work often begins when the negotiator successfully finishes their task.

The tape follows a logical sequence, summarised in the brief accompanying document; starting with self-protection and assessment; moving through tactical communication; defusing dangerous or aggressive behavior and concluding with verbal contracts to resolve the situation.

The strategies are consistent with generally accepted best practice and are punctuated with common sense interventions in the context of a fundamental desire to preserve life. Some listeners may be surprised by a few of the anecdotes, analogies and self-disclosures used by Inspector Raymond to make his points. They do not detract from the overall message and simply serve to reinforce the obvious underlying motivation for Inspector Raymond's dedication to the task!

While the focus of the tape is primarily upon the immediate responder, it may have been useful to include additional material about broader incident management principles. From my experience, the skill of the negotiator is critical, but equally relevant is the response of those around, albeit less directly involved. Evacuation principals, crowd control and environmental management issues receive peripheral attention, but would be important factors for anyone listening to the tapes.

From my experience, the tapes are a useful adjunct for any person potentially involved in the management of a suicide threat. It would be useful as an additional training resource for Correctional Officers, Security Personnel, Human Service Workers and Residential Care Workers for example. It would be particularly useful for health care practitioners in that Inspector Raymond consistently reinforces the importance of moving away from traditional client care practices when idealing with high risk suicidal situations.

Listening to a recording of a live presentation has its difficulties, and I suspect that the audience had access to some form of PowerPoint display. This package might have been enhanced by a more detailed booklet, which followed the speakers content and allowed for revision and reinforcement of the key points.

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Occupational Services are contactable Nationally on 1300 367 008.

'Suicide Negotiations: An emergency response guide to dealing with suicide threats' is available from Emergency Support Network
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Approaches to community safety: risk perception and social meaning

by Dr Paul Barnes, Manager (Corporate Risk), Corporate Performance Division Department of Primary Industries (QLD)

Introduction

In representative democracies it is a reality that many decisions with potential to affect our lives are almost invariably made by others. People can evacuate their homes as a cyclone approaches or choose to take part in certain hazardous activities, but they cannot avoid the results of another person's decisions. Such power differentials often result in long-term concerns among members of the public who find themselves distant from the decision-making processes.

A number of additional factors are important for any examination of these concerns. They may be related to a lack of public trust and confidence in the institutions involved in the control of hazards and regulation of risk (Wynne 1987, p. 10; Slovic 1993), a reputation of institutions for not disclosing key pieces of information, or inefficiencies in the process of communicating with the public (Wynne 1989b).

A common problem in situations of conflict over known or suspected links between industrial hazards and suspected health impacts, for example, has been a generic public disbelief about reassurances by regulatory experts of minimal risk to health, and in some cases life, posed by inadvertent or inescapable exposure to hazardous material. Public fear of large scale industrial disasters or concern about harm from less visible slow-burn toxic exposures are often seen as misplaced by authorities who point to more obvious threats to health and well-being existing in everyday life (Otway & Simms 1987, p. 131). Other factors such as inequity in exposure to harm, or fear of the catastrophic potential of some hazard or the safety and acceptability of a range of modern technologies, are also important (Kasperson 1987, p. 44; Otway & von Winterfeldt 1982, p. 254).

Recognition of this phenomenon is not new. It was once thought that the public were exhibiting irrational behaviour or had a deficient understanding of science, especially the science of risk assessment (Dunwoody & Neuwirth 1991, p. 12). While this explanation is initially inviting, it is by itself, too simplistic.

Members of the public are concerned about the *safety* of the wider environment and their surroundings. At the same time, regulators may be seen to be concerned about helping to provide safe environments. An impasse arises in this mutuality when regulatory expertise loses credibility in the eyes of the public it is meant to protect. Reduced public trust in and disbelief of authority can be a result.

In addition to political and bureaucratic factors, this gap of trust and credibility is characterised by significant social and cultural differences between regulatory expertise on the one hand and the public on the other. These factors can be deconstructed further to consider contrasting approaches to the concept of *risk* and semantic variation in the use of terminology by institutions and members of the public.

This paper examines aspects of this phenomenon of trust and credibility as a core issue impacting on the capacity of government to enhance health and safety at the community level. It argues that greater understanding of community viewpoints can be gained from a detailed consideration of the conceptual underpinnings of risk and an appreciation of human responses to real emergency situations and the uncertainty and dislocation that often accompany them.

The professionalisation of risk

In traditional societies explanation of the meaning and purpose of disasters and other catastrophic events disruptive to the social fabric are known to have relied heavily on the use of myth and metaphor (Covello & Mumpower 1985, p. 103). In such situations, consideration about the nature of danger, anticipation of calamity and knowledge about the avoidance of hazardous situations manifested at a community level. This in fact might be expected as it has been noted that in situations where doubt, uncertainty and risk are present, shared ritualistic practices are often evident (Poggie Jr. 1980, p. 123)[1].

In post-traditional times however, response to danger and situations of harm have been transformed from the level of *folk* discourse to that of an *expert* centred concept (Plough & Krimsky 1987, p. 5). The translation of responsibility from community to expert occurred alongside the increase in both the scale and amount of industrialisation and technological development worldwide and the rise of the 'modern state' as a dominant political institution (Plough & Krimsky 1987, p. 5). The process of vesting accountability for community safety with a professionalised bureaucracy was part of this broad-based societal change (Plough & Krimsky 1987, p. 5).

The move towards government regulation of hazards (as opposed to total control) is not only linked to the rise of the nation state and industrialisation, but is also linked, in a temporal sense, to the successes of late 19th and early 20th century public health initiatives. Responsibility for decisions about, and regulation of, seemingly intractable health hazards came to rest with a professionalised bureaucracy and the scientific community (Plough & Krimsky 1987, p. 5; Rip 1991, p. 351).

Socially and culturally, these groupings became very different from the lay-public overtime. In addition to specialist education and regulatory roles these groups possessed linguistic conventions, processes of socialisation that further cemented their separation from the masses. In most cases the management of regulatory safety operates from within institutions (Heimer 1988, p. 512) with decisions relating to societal safety being made at a centralised, institutional level rather than at an individual or community level (Clarke 1988; MacLean 1982, p. 60). A further factor is that because of specialist training and their societal role the

Notes

1. Poggie is citing the work of Horton, R. (1960). Similarly, Australian Aboriginal people often described their 'lived' and 'spiritual' landscape in terms of safe and dangerous places. This form of meaning system is embedded within the cultural life of a people often sourced from a numinous reality.

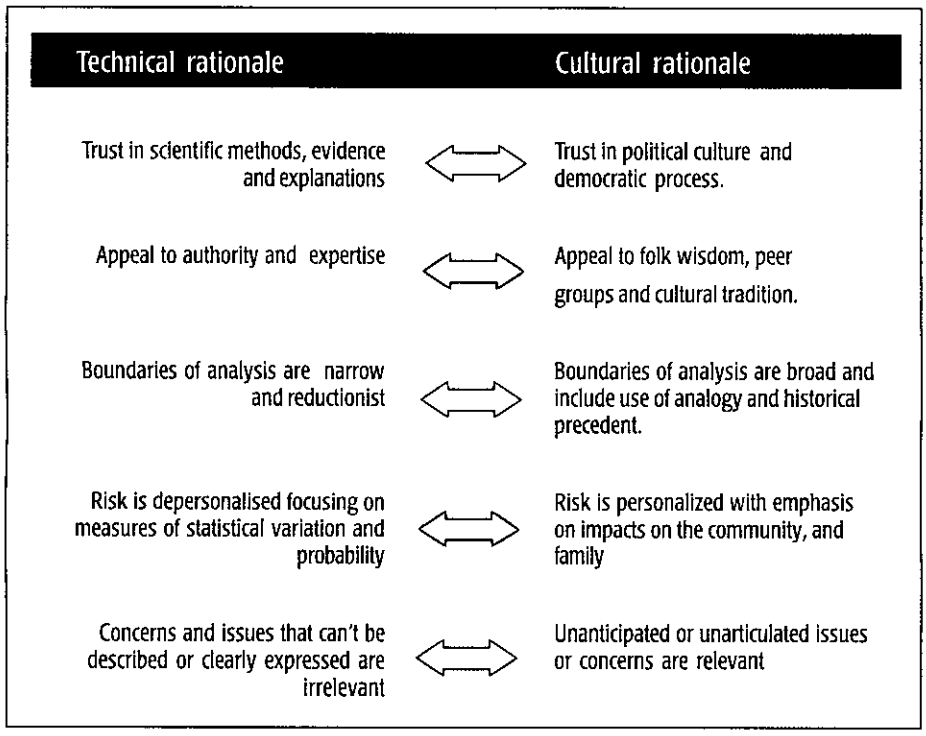

Figure 1: Technical versus cultural rationality (derived from Krimsky & Plough 1998).

activities of these elites became invested with scientific and decision making authority especially in the area of policy formation (Dietz & Rycroft 1987).

Along with these processes of professionalisation came preferred frameworks for problem definition, assessment and decision making that were based on particular preferred styles of thinking. For expert risk assessors, information of relevance was more likely to be expressed in technical terms and their approach to risk communication problems was to assume the inability of the public to understand technical knowledge (Bradbury 1989). For such a technical elite, the inability of a public audience to understand (accept) institutional risk estimates, may be seen as analogous to the situation faced by engineering students in their first semester: 'they are ignorant but well-intentioned, hard working but without a clue' (Beck 1992, p. 58). Of course if the public are really 'would-be' engineers then they need only to be filled with the requisite amount of technical detail. Then they would share the same understanding as the technical elite and all perceptual differences would dissolve.

A number of explanatory frameworks have been developed to examine important factors and symbolic dimensions of expert and public attitudes towards hazards and the risks they create (Plough & Krimsky 1987; Spangler 1982; Michael 1992). A definitive model identifies two broad thematic worldviews: a *technical* rationale and a *cultural* rationale. This model is displayed in *Figure 1*.

A technical rationality encompasses the position that risk can be studied independently of the social context in which it is embedded and experienced. A cultural rationale however, does not discount technical knowledge but seeks to incorporate it into a broader experience-based decision making framework. Both themes are valid within their own value systems but are potentially antagonistic.

For adherents to such a technical rationale the reliance on scientific frames of reference encompassing the certainty of technical knowledge would be likely. Such assumptions would be symptomatic of institutional blind spots reflecting an automatic devaluation of the contextual experience of risk. Technically focused frames of reference would miss a whole dimension of perceptual and evaluative criteria relevant to public concern (Wynne 1989b, p. 123).

These contrasting positions may be seen as symptoms of the differences between a personal experience of some reality and science's explanation of the same reality (Gifford 1986, p. 230). When communicating information about the nature of harm resulting from a technology or exposure scenario for example, 'technically focused' messages may be seen as representations of the facts as the communicators and assessors see them.

The notion of the experience of harm is of critical importance. While human reactions to high risk situations have been recognised as a socially created and defined phenomena (Beck 1992; Giddens 1990 & 1991; Renn 1992b; Clarke & Short 1993) little work exists offering a systematic assessment of the social and cultural dimensions in which threats are experienced.

Further, given the major differences between both groupings it might be conjectured that each group is responding to completely different phenomena.

The nature of hazard and risk (from semantics to practice)

It is suggested above that socialisation, the regulatory role itself and use of language varies significantly across both groupings. An analysis of the lexical roots of hazard and risk for instance, highlights wide semantic variation in language development over time. The derivation of hazard is attributed to an Arabic word *al-zahr* meaning 'the dice.' From this, the word *khatar* meaning to gamble was derived and in around 1100AD, the Spanish *azar* (a game of chance) was in usage. Linguistic diffusion was noted from Spanish to the French as *hasard* and then into English with similar meaning. Thus hazard, historically, has been linked with games of chance and outside direct human control. It has been associated with involuntariness and unforseeability (Ingles 1990, p. 69).

Risk is a more recent addition to the English language. Sources linking it to the low Latin *resecare*, alleged to mean 'to being shipwrecked' or the Greek *rhiza*, (reef), have been noted in a number of sources. Risk, however, is more likely to have originated from the Greek *riskos*, (a money chest) and then into Arabic as *rizq* (wealth) and as *al-rizq*, (a fateful windfall). From Arabic links have been established to Moorish Spanish as *arrisco* at around the 14th century. From around the year 1477, risk can be found in High German as *arreschq* and by 1518, as *risigio*, a precursor to the contemporary Germanic usage, *risiko* (Ingles 1990, p. 70).

A dominant semantic difference between risk and hazard is that the former had connotations of voluntariness and the latter, involuntariness. At a meta-level they can be differentiated into the notions of whether divine influence or humankind is the master of events (Ingles 1990, p. 69). Voluntary human control, as adventurousness was a feature of the meaning of risk. Thus we find in many forms of modern English usage the phrase 'to take a risk.'

Figure 2 is a representation of the analysis of the semantic roots of hazard and risk. Derived from Ingles (1990) it classifies effects on money (or things) and those that threaten life.

A further layer of classification on

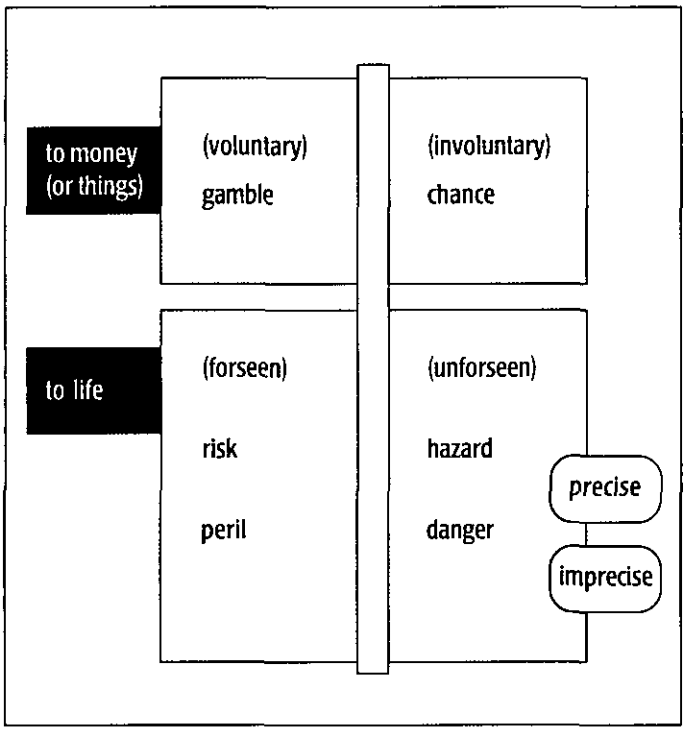

Figure 2: Etymology of risk and hazard (Ingles 1990).

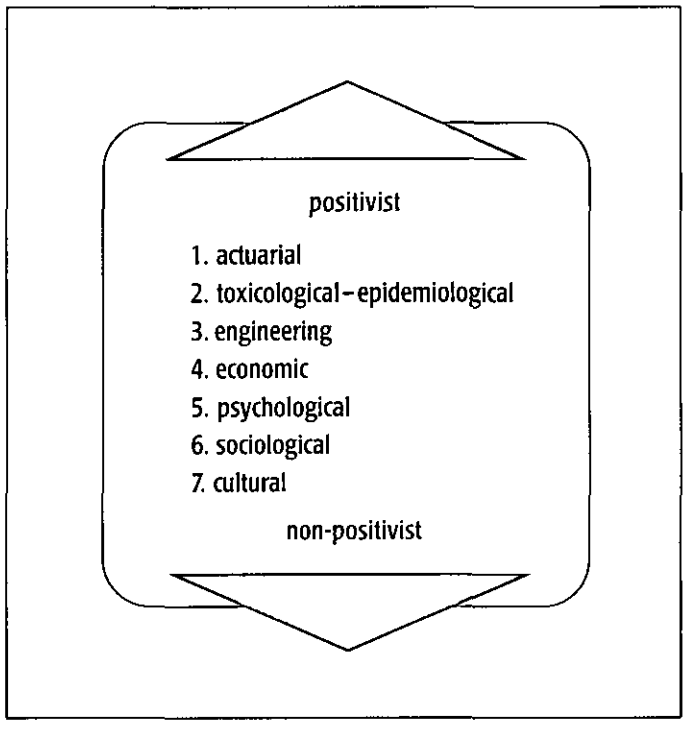

Figure 3: Classification of professional applications of risk (Renn 1992b).

money separates voluntary action (gamble) and involuntary action (chance). For life threatening events the framework extends further to list voluntary and involuntary categories (foreseen and unforeseen respectively), and precise and imprecise terms.

Figure 2 clearly shows the detailed semantic variation inherent in the language of risk and hazard. Beyond the obvious differences in preferred positions embodied in the technical and cultural worldviews shown above (*Figure 1*), variable usage of language adds a further dimension to the complexity of differences between regulator and the lay-public.

Empirical evidence exists suggesting that members of the public do not speak about risk in terms of its probabilistic connotations. De Marchi & Rota (1990, part IV) in a major European study of risk information needs for communities near hazardous industrial sites report that the public often think of risk as an amalgam of cause, as evidence or as an effect, all within a wider context that gives rise to the meaning of the hazardous event.

Making judgements about risk involves more than matters of probabilistic prediction (Smithson 1991a, p. 8). The use of mathematical processes will enhance manipulative and calculation power but at the expense of descriptive and contextual meaning for those involved or affected by some hazardous exposure. An important point in relation to knowledge about hazards and related harm is that a *measure* of risk may have little meaning if separated from the social and behavioural context in which risk is experienced and described.

It has been noted also by Otway & Wynne (1989, p. 141), that many of the early theoretical findings about risk communication were developed from studies into public risk perception that were in-turn *based on simplistic models of human* behaviour. These models obscured aspects of the interactions and contexts that define authentic social communication. For the public, mathematical expressions of risk can be like a foreign language. Douglas (1990, p. 4) also states that regulators (technocrats) prefer to use the term risk over danger because risk (as a metric), allows the calculative pretence of accuracy. Danger, which may be a more compatible description of a situation where risk (as a potential for harm) is experienced, does not however carry the aura of science.

While the epistemological and semantic approaches to risk issues shown in *Figures 1 and 2* define a comparative baseline for appreciating expert-lay person differences, consideration of the complexity of professional usage of risk adds further context.

A conceptual framework developed by Renn (1992b, p. 56), lists widely varying applications of risk and underlying conceptual bases. Each involves differences with respect to operational definition, application, epistemological status and derivation as well as academic and professional usage. *Figure 3* displays a graphic of these classifications.

The seven approaches form a continuum that covers the intellectual divide between positivist and non-positivist traditions. As conceptualised in items 1 to 3 of *Figure 3*, risk is a measured entity. The base unit of each item is an 'expected' value, a 'modelled' value, and a 'synthesised expected' value respectively (Renn 1992b, p. 56). Like any estimate however, such *measures are open to conjecture about* their inherent uncertainties. Estimates however are often given a status that is not warranted by their degree of accuracy. Such status might be created by political and bureaucratic need. There is often a tendency in regulatory authorities try to define risk in ways and contexts that make it appear controllable or at least manageable.

In *actuarial* mode, a risk may be expressed as a loss of goods or some expected or potential loss. In *epidemiological, toxicological* and *engineering* mode, risk is treated as compound functions involving probabilistic expressions of the occurrence of some negative event or phenomena. In these disciplines, risk is generally approached as a tangible phenomenon (ie. obvious losses or impacts on human health and/or ecosystems). Socially and culturally defined consequences are normally excluded from technically based assessments of risk or at the least discounted.

This narrow focus is both a strength and a weakness (Renn 1992b, p. 61). By limiting and reducing the terms of reference, the concept of risk becomes uni-dimensional and easier to operationalise. On the other hand, by focusing on notions of physical harm other related

consequences that people might find undesirable may be excluded. The *technical* viewpoint on risk derives from 'positivist' epistemologies and realist ontologies that treat risk as existing independently of those who experience it (Bradbury 1989). There has also been a tendency by past researchers within the technical framework to over emphasise nomothetic approaches to methodology. The conceptual approaches used in items 1 to 3 of *Figure 3* are inherently reductionist.

The *economic* perspective while still based on probabilities, enhances more formal technical approaches to risk by including broader definitions of unwanted consequences and by adding a social dimension related to these consequences (gains and losses) based on individual conceptions of utility (Renn 1992b, p. 61). This perspective entails the transformation of notions of physical harm or other adverse events into subjective utilities. This approach promotes techniques and instruments to measure and compare losses or gains in 'utility' from the choice of different options. Economic notions of risk are applied in questions of resource allocation, economic planning and related decision-making (Warner 1992, p. 5).

Within *psychological* perspectives on risk, subjective judgement is expanded in a number of ways. A focus may be placed on personal preferences with consideration of why and how people make judgements about risk (as a potential for harm). Many early psychological approaches to risk were based on expectancy value theories. These approaches assumed that people made judgements about possible future harm based on a rational comparison of the costs and benefits of engaging in certain health behaviours. Following these deliberations, they would then choose the path of maximal benefit (Adler *et al.* 1992, p. 232; Cleary 1987, p. 6). Arabie & Maschmeyer (1988, p. 301) suggest that such context-stripping approaches to human activities have little to offer towards an understanding of real world situations where the public react to actual danger or threats. Cognitive versions of risk perception have not been useful in predicting socially important behaviours such as self-protection. The social contexts within which behaviour occurs needs to be incorporated into theory and research design (Miletti *et al. 1975*, pp. 33–34).

Sociological approaches to risk study human reactions and attitudes towards hazards and the harm presumed to follow from exposure to them. There is more emphasis on consideration of the range of underlying beliefs and values that are incorporated into an individual's assessment of risk. This approach to risk starts from the premise that reactions to hazards are the result of (group-based) social processes and therefore are socially constructed (Renn 1992b, p. 67). Risk is not conceptualising as a physical phenomenon existing independently of the humans who assess and experience it. It focuses on the examination and identification of the context(s) of risk taking behaviour, the identification and explanation of public concerns about certain hazards and related risks and the representation of personal experiences in ways that may not be possible via technical representations of risk (Renn 1992b, p. 77).

Cultural approaches to risk emphasise personal and culture-based values and the insight they can provide in the understanding of risk perceptions and policy formation (Renn 1992b, p. 72). The expression of worldviews as forms of risk perception was a major change in theoretical approaches to risk as the concept matured and it moved reactions to harm beyond the range of the individual (Pidgeon 1992, p. 113).

The cultural approach to risk brings insight into debates on policy formation by establishing the existence of very heterogeneous groups of stakeholders. It changes the focus of attention from the previously insurmountable position held by regulatory authority to that of the perceiver of harm. More emphasis for example would be placed on the essential role of participation of the recipients of both the benefits and costs of a technology in making decisions about the societal acceptability of the technology (Bradbury 1989, p. 391). From the cultural perspective arguments about hazardous technologies are not just concerned with choosing a safer technology or a more stringent standard over another. They are linked to fundamental questions about the social and political meaning of technologies and their broader societal implications (Dake 1992, p. 23).

In any consideration of cultural factors and social meaning language and communication are closely linked. It has been noted by Otway & Wynne (1989, p. 141) that much of the research and theoretical findings about risk communication were developed from studies into public perception of risk that were based on simplistic models of human behaviour. Such models obscure aspects of the social interactions and contexts that define authentic communication about risks and hazards. For the public, mathematical expressions of risk can be like a foreign language. Douglas (1990, p. 4) also states that regulators prefer to use the term risk over danger because risk (as a metric), allows the calculative pretence of accuracy. Danger, which may be a more compatible description of a situation where risk (as a potential for harm) is experienced, does not carry the same aura of science.

However, like information, risk is not a thing. Risk as a theoretical construct, is of prime importance to any examination of human behaviour in dangerous situations. Three meta-theoretical positions on risk emerge from an examination of the literature. They are shown in *Figure 4*.

In each theme, *risk* derives from quite different ontological and epistemological bases. As a reductionist phenomenon it is treated as extra-human and context free. Risk in this form is generally expressed as a numerical measure (often a probability). This usage and expression is valid for epidemiological measures and form an integral part of the regulation of population health. Similarly, in 'actuarial' settings the creation of frequency tables for determining the probability of monetary losses or the calculation of insurance is also a valid use. Generally where there is a focus on the analysis of the likelihood of effects on things, reductionist approaches to risk as a cognitive tool are philosophically sound.

A tension exists between *reified* and *experiential* notions of risk. This is very evident in research on risk analysis and societal reaction to situations of threat that emphasise the well-defined differences that exist between institutional regulators and the public. This natural separation carries with it definite adversarial potential. Trust and credibility issues emerge as key factors in such situations where differences between the modern state and its constituents occur. Often concerns are about purported health impacts from waste dumps or treatment facilities, sites of illegal dumping of toxic material, industrial accidents or concerns about proposed industrial developments. Some sources of concern may be less obvious or tangible such as chemical residues in food or water supplies (Kasperson & Kasperson 1991).

While human reactions to risks (threats - unrealised harm) have been recognised as a socially created and defined phenomena (Beck 1992; Giddens 1990 & 1991; Renn 1992b; Clarke & Short 1993) institutional response to cases of public concern historically has been to discover the scope of public misunderstanding or misperception of the *real* risk. Once the level of misapprehension has been gauged and its

Risk	as .. reified	as .. experienced	as .. metaphor
	a technical/ rational phenomenon	an individual or group phenomenon	an societal or cultural phenomenon
	a historical extra-human		

Figure 4: Thematic approaches to risk.

Category	Associated Images
Dangerous	Toxic, hazardous,deadly, destruction, accidents, poisonous, explosive, kill, harmful, Bhopal, cancer, bad
Pollution	Love Canal, greenhouse effect, smelly, air pollution

Figure 5: Symbolic associations with the word chemical (Slovic 1992, p. 148).

extent mapped out a common institutional reaction has been to treat it with risk communication. It seems logical to assume that if a comprehensive appreciation of the nature of public concern about an issue is not available then attempts to communicate away these worries may be at best ineffective and inappropriate. At worst, presumptive attempts to educate the public could add to what may already be a *situation of distrust and diminishing* confidence.

Notions of *risk* as a metaphor are evident in the work by Beck (1992) and Giddens (1990 1991) and aspects of work by Sontag (1988). Mary Douglas' use of *risk* as danger and subsequent use in analysis of policy frames is also an example of the metaphorical theme in risk research.

More easily recognised examples of *risk* as metaphor reside in the symbolic status of places such as 'Bhopal,' 'Chernobyl' and 'Three Mile Island.' *Figure 5* is derived form the work of Slovic (1992) and examines how images of an industry (in this case chemical), can become negatively stigmatised.

The risk-as-metaphor theme seeks to capture elements of an emergent societal reaction to an increasingly hazardous world. It is also associated with social perceptions of safety and threat and is further linked to the social impacts from both slow-burn and sudden technical disasters. The source of harm (technology) becomes imbued with risk as does, in many cases, the corporate world and related regulatory and bureaucratic institutions.

Social and cultural factors: risk perception in the real-world.

While psychometric methods used in risk perception generally can only provide an outsider's view of the public experience of danger, they have provided useful explanatory frameworks about how people assess risk and think about related issues. *Figure 6* displays a generic set of assessment criteria derived from this research tradition.

The list of attributes (mental schemas) listed in *Figure 6*, are considered influential in personal assessment about, or outcomes of, contact with a range of natural or technical hazards. Some understanding of the danger myths of modern society can be gained from these cognitive 'rules of thumb'. While psychometric methods can identify generic decision-making criteria associated with a range of behavioural responses they cannot uncover why such associations exist or the social contexts within which they are important. Furthermore, while these behavioural factors are obviously useful, the influence of information on personal decision-making (including sources and contexts) remains unaddressed in many approaches to risk perception (Dunwoody & Neuwirth 1991, p. 18). An overall critique of psychometric approaches to risk perception is the absence of a credible coverage of the experience of danger in the real world.

A key difference between studies of risk perception focused on 'what if' scenarios and real world disaster research is the existence of real threat in the latter. Threat may be seen as having two components (Kasperson & Pijawka 1985, p. 15):

- a degree of danger (perceived or real)
- some notion of control over that danger (i.e. choice of exposure or contact)

There is evidence that a belief that you have been exposed to a toxic substance, even if you have not, is sufficient to cause a traumatic stress response (Baum 1987, p. 31). Such beliefs may also become a *threat to health (Burdge 1989, p. 96).* For example, the effects of stress among residents living near the Three-Mile-Island (TMI) nuclear reactor persisted for a number of years after the reactor accident. A survey of TMI residents in 1983 reported a number of trauma

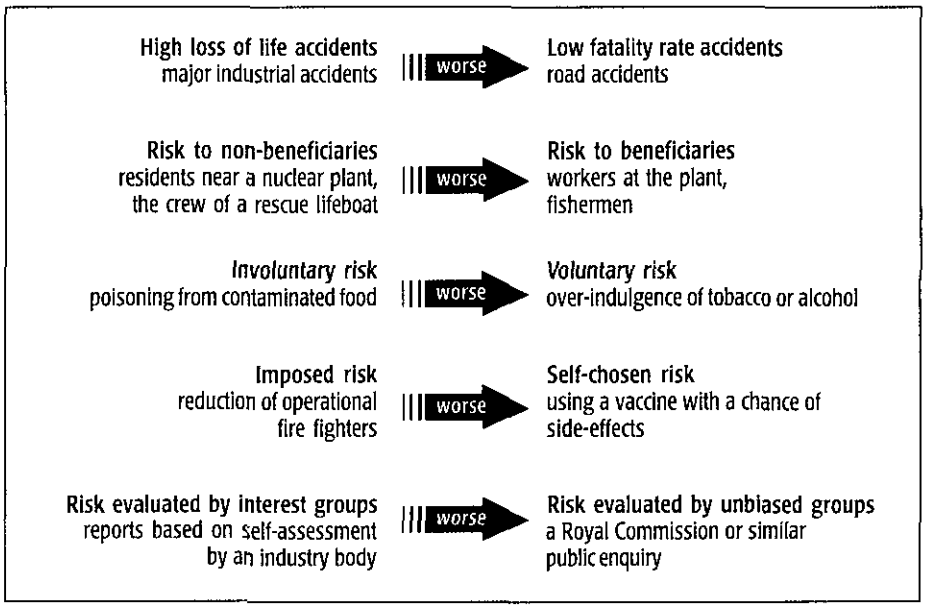

Figure 6: Criteria for personal risk assessment (Sprent 1988 & Sandman 1989).

symptoms such as psychic numbing, hopelessness, feelings of being trapped by the situation and a lack of peace of mind. These feelings continued to exist a number of years after the event although concern about radioactive releases and other hazards linked to the reactor faded within a year of the accident (Bell *et al.* 1990, pp. 209, 211).

Many types of environmental contamination are both phenomenologically and medically invisible. Radiation is invisible, silent and has no odour. It may be impossible for community members to determine, by themselves, whether they have been exposed, or their degree of exposure. The nature and fact of their exposure may also be invisible to physicians treating them (Vyner 1988, p. 13) and to regulatory institutions. It might not matter that the suggested degree of exposure is low. If people believe they have been exposed and there is evidence of contamination in the community, then that is enough to cause concern. During the TMI accident there was little residents could do themselves, to reduce exposure. Also given the severity and 'dread' nature of the hazard itself (radio-activity), the lack of any personal control over the situation would be an obvious cause of anxiety and emotional disturbance (Kasperson & Pijawka 1985, p. 15).

A further issue is that social and community responses to natural hazards have been shown to differ from that seen for technological hazards. After a natural disaster, a 'therapeutic community' response is a well-known phenomenon. This community response often entails spontaneous, altruistic behaviour among victims and non-victims for mutual support and to replace institutional resources or infrastructure that may have been destroyed (Perry 1983). After a technological disaster, especially if characterised by prolonged exposure to harmful agents, the 'therapeutic community' is not a regular occurrence. In such cases there often seems to be a feeling that the 'community' has been destroyed and cannot be rebuilt (Kasperson & Pijawka 1985, p. 16). It may be that a lack of the self-help response derives from a realisation that they've lived unknowingly, in danger. Their confidence in the safety of their surroundings is destroyed by unfamiliar and unexpected hazards.

Controversies about contamination promote a type of cultural stress. This cultural disruption is centred on the shared community belief (confidence) about the safety of their surroundings. Community groups may disagree about a range of minor issues but they are likely to continue to live and invest time and money in their homes if there is a mutual trust (and confidence) and the air and water is clean and it is safe to live there. Toxic chemicals leaching into ground water or asbestos fibres floating in the air do not damage buildings or flatten houses but they seem to destroy the *safety* of community life (Kroll-Smith & Couch 1993, p. 87).

The potential harm of technological hazards challenge the human social and cultural need for safety and normality in life. Furthermore, technology is not supposed to breakdown and technological catastrophes are never supposed to happen (Baum 1987, p. 36).

People in general make sense of their world in collaboration with other people in social settings and in social contexts. Therefore notions such as safe and hazardous are consensually determined *meanings* not reified phenomena (Douglas 1985, p. 34).

A social constructivist view on the perception of risks and threats would hold that although individuals experience psychosocial stress, it arises from within a social context and can be intensified or attenuated within such a context. A public reacting to disastrous events is not acting in response to physical factors alone, but also to what those events mean and represent as socially constructed and experienced crises (Kroll-Smith & Couch 1993, p. 81).

In a practical sense, studies of communities affected by toxic exposures are not examining risk perceptions. A more appropriate term is threat beliefs. Kroll-Smith & Couch, (1993, p. 87) after studying a number of communities affected by major industrial accidents identified four themes relevant to such belief systems. These themes varied depending on type of contamination, social and historical factors and cultural differences across communities, but they are useful starting points. They were:

- a certainty that the environment or parts of it are now dangerous and should be avoided
- a belief that the community is being poisoned
- a conclusion that they (as victims) could expect little empathy or assistance from neighbours or the Government
- a belief that escape and/or relocation are the only reasonable means to avoid the danger.

Adherence to the content of threat beliefs in uncertain situations confers a form of certainty to experiences. Technical experts may disagree over the presence of toxic chemicals in a community but residents are certain that they are there. Such certainty also extends to ambiguous factors or events related to the hazards in question (Kroll-Smith & Couch 1993, p. 85).

Residents at the 'Love Canal' organised themselves around shared beliefs about the amount and nature of the danger they were facing and their rights for institutional support as taxpayers (Levine 1982). The inhabitants of Centralia, Pennsylvania responded to the impacts of a fire in an underground mine on the basis of linked ideas about amounts and types of danger faced by families (Kroll-Smith & Couch 1987& 1990). Residents near the TMI nuclear plant also developed coherent beliefs about safety and trust in government regulators after the event (Vyner 1984).

A general lack of familiarity with the hazards (and the nature of the threat) may also promote a greater reliance on scientific based regulatory institutions over friends, relatives or even supportive strangers (Kasperson & Pijawka 1985, p. 16). The social communality (therapeutic community) seen in natural disasters may not occur because unaffected people feel that either the geographical setting is contaminated (dangerous) or the effected people (victims) are not safe. Socio-technical disasters tend to affect the long-term psychosocial health of people more than natural hazards because they do more than just damage and wreck things. They contaminate, taint, and pollute things. Moreover, they scare people (Kroll-Smith & Couch 1993, p. 80).

Exposed people or contaminated communities lose their 'purity'. They become dangerous to a wider society[2] and may have become stigmatised. For community members who are known to have been exposed to toxic substances ritualised avoidance behaviour by neighbours, friends or even relatives inform the exposed that they are now beyond the boundaries of a pure and safe society. Ongoing contact with them then is to risk impurity and danger.

Victims realise that they are no longer part of a traditional community that provides support and sympathy (Kroll-Smith & Couch 1993, p. 83). Such breakdowns in social support may be seen as leading to a form of alienation. Related issues such as social isolation (lack of meaningful contact with others) and powerlessness (little control over life events) increase feelings of being at mercy

of forces beyond their control. Loss of a sense of personal control has also been identified as important where victims feel powerless to adequately protect their families and themselves from harm (Mirowsky & Ross 1989).

Community members are threatened by a physical world that once provided security and alienated from the social contexts in which they once found meaning and comfort (Kroll-Smith & Couch 1993, p. 84). Personal apprehension is often felt among individuals in contaminated communities. Essential questions are likely to remain unanswered such as 'What part of the environment is contaminated,?' 'Is it really dangerous,?' 'How should I behave in these circumstances?' (Kroll-Smith, & Couch 1991, p. 363).

A range of literature sources supports this notion of alienation. For example, links between social and psychological distress and high levels of alienation (Mirowsky & Ross 1986), powerlessness and demoralisation (Wheaton 1980), lack of coping ability (Wheaton 1983), depression (Garber, Miller & Seaman 1979) and problem drinking (Seeman, Seeman & Budros 1988).

There are also links between social reactions to hazards and classical notions of anomie. While Durkheim's use of anomie was noted for its association with deviant human behaviour, he also applied it in relation to negative human reactions and major social difficulties with changes in the modern world, that resulted in a sense of aimlessness and purposelessness (Giddens 1989, p. 692). Normlessness has also been correlated with instances of mistrust, paranoia, brooding and worrying in wider social settings (Mirowsky & Ross 1983). What may be discernible among impacted individuals and groups in contaminated communities is a form of social dysfunctioning manifesting as a form of 'emergent anomie' (Kroll-Smith & Couch 1993, p. 85).

The realisation of a generalised loss of safety and certainty and wider psychogenic effects are key issues in socio-technical incidents. Giddens (1991, pp. 126,127) described a social condition he referred to as a 'world of normal appearances' in which life becomes routinised within the social contexts of daily life. Life is predictable and thus 'normal.' Within this normality there is a sense of trust in (expectation of) the absence of unexpected calamity and danger. This trust is learned and reinforced by from habit and personal experience.

The basis of this condition is derived from phenomenological sociology and is based on the theoretical concept of the *Umwelt*. The original theoretical meaning of *umwelt* entailed an individual's own understanding of the world around them (their surroundings), based their experiences in that world (Shutz 1970, p. 16). The interpretation of *umwelt* used here, relates to a habituated (taken for granted) personalised sense of safety space that people carry around with them and is transferred to their immediate environment (Goffman 1971, p. 255). Giddens theorised about a 'moving world of normality' that people carry around with them. Thus a sense of safety requires the participation of other people in a consensual, cooperative context (1989, p. 128). So if, as many theorists have stated, risk is socially constructed then this sense of safety is also likely to be socially constructed.

It could be argued that the *umwelt* of residents in affected communities has been shattered by the occurrence of some acute technological threat or a realisation of having lived with unsuspected or emergent danger. What results may be a form of critical incident stress.

Similar reactions have been found in studies of communities affected by industrial accidents or other forms of toxic pollution. For example toxic contamination of community water supplies in Woburn, Massachusetts (Brown 1987, 1992 & 1993); sheep farms contaminated by radioactive fallout from the Chernobyl nuclear accident (Wynne 1989) and chemical contamination at Love Canal in Niagara, New York (Fowlkes & Miller 1987). All of these events involved both temporary and permanent disruption to normal community life.

The degree of risk faced by people and communities in such situations does not have to be statistically significant before political action is required. The trigger for action should not be an increased incidence of some disease, or evidence of significant exposure to contamination but consideration of the question of whether a reasonable person would feel safe in such a community and continue to be confident about continuing to live there (Couto 1985).

Conclusion

This paper has examined an important factor that can both enhance and detract from promoting community safety—the distance between the beneficiaries of regulation and regulatory institutions. This chasm of distrust and disbelief is one of the most significant problems relating the regulation of potential health impacts from industrial technology in recent times (Otway & von Winterfeldt 1982, p. 247; Slovic 1993) and in a broader sense, community safety.

Community interest in safety may be driven by a belief that modern life is riskier than in the past. Issues such as pollution from industry, food safety, contamination of water supplies or air pollution are often cited as contributing not only to an increase in the likelihood of harm and disease in society, but as symbols of the increasing hazardousness of the modern world.

But is our goal Community Safety or Safer Communities? As a societal outcome Community Safety can be sought via efficient and effective regulation at an institutional level. Associated with this regulation must be similarly high standards of risk management applied at the community level.

The establishment of safer communities however, is a different matter. Before this can be sought as a goal, determinations must be made about what safety means to the communities themselves. To do this, institutional regulators must ensure that use of their expertise does not promote inflexibility in understanding the needs and world-views of the public.

A core requirement would seem to be an understanding that becoming better safety regulators, from a technical perspective, is not enough and is unlikely to return significant improvements. What must occur is a greater understanding of how ordinary people living ordinary lives make sense of, and cope with, the uncertainties inherent in the modern world. If both safety regulation and enhanced understanding can be achieved the result is a reduced likelihood of harm, and an improved capacity to support real and sustained community recovery when chaos emerges from normality.

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Notes

2. This experience may be a modern analogue to Mary Douglas's work on taboo (see Douglas & Wildavsky 1982)

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Conference Announcement

5th New Zealand Natural Hazards Management Conference 2002

Te Papa, Wellington, New Zealand,
14-15 August 2002

Optional Field Trip: 16 August 2002

The Institute of Geological and Nuclear Sciences (GNS), the National Institute of Water and Atmospheric Research (NIWA), Ministry of Civil Defence and Emergency Management, Wellington City Emergency Management Office, Wellington Regional Council, and the Earthquake Commission (EQC) invite you and your colleagues to participate in the 5th New Zealand Natural Hazards Management Conference in August 2002.

Target Audience

Emergency managers, planners, risk assessors, utility managers, natural hazards researchers and scientists.

Theme

The conference will provide a forum to discuss the integration of hazard information into effective risk management, including:

- applying hazard information to best practice planning
- exploring new technologies — advances in science application
- natural hazard mitigation for industry
- creating resilient communities through integrating science and practice

Conference Format

The conference will feature keynote addresses, case studies, formal presentations and poster sessions.

Pre conference short courses

Several pre conference short courses are planned. Further details will be available later.

Post conference Field Trip

A one-day optional field trip is planned for 16 August 2002. The trip will visit sites around Wellington to discuss local hazard issues and see examples of successful hazard mitigation strategies.

Registration

Registration and program details will be sent out late May 2002.

More information

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This article has been refereed

The challenges and future opportunities of emergency management education:

a student's perspective

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Introduction

With only fifty years as an organised field, emergency management is still relatively new both academically and professionally. The Federal Emergency Management Agency is therefore justified in promoting the establishment of emergency management curriculums throughout the United States. While the quantity of emergency management programs is being addressed, there is also a need to assess the quality of such curriculums. In other words it is imperative to ensure that emergency management curriculums will encompass the full scope of issues that face professional emergency managers.

This paper will mention a few of the challenges facing current emergency management curriculums and discuss how the University of North Texas Emergency Administration and Planning (EADP) program is addressing them. Recommendations will be put forth for current and future programs, including the means to overcome present difficulties in emergency management curriculums. The goal of this paper therefore is to provide some direction, from a student's perspective, on where emergency management curriculums should be headed in the future. Before proceeding, it will be necessary to provide background information about the EADP program.

Information about the EADP program

In 1983 the University of North Texas developed a degree program specialising in emergency management. Currently, the university provides the opportunity for students to earn a Bachelor of Science degree with a major in Emergency Administration and Planning. As a four-year college, the University of North Texas requires that students complete 128 semester hours, 42 of which must be advanced, in order to become a candidate for an EADP degree. Specifically, EADP degree candidates must complete 36 hours within the major. Students are also required to complete 18 hours within a selected minor, nine of which must be advanced.

While the University of North Texas has cultivated a successful program, it has faced challenges that are likely to be common to any educational institution offering an emergency management degree. Based on my personal observations and discussions with Dr. David McEntire, the EADP program coordinator, these challenges include emergency management program structure, providing interdisciplinary courses, integrating academic and pragmatic perspectives on emergency management, relying on diverse literature sources, providing practical experience and utilising modern instructional technologies. Each of these issues will be discussed in turn.

Emergency management curriculum structure

A fundamental challenge facing emergency management education is curriculum structure. With the prevalence of emergency management related minors, certificates, Associate degrees and Bachelor degrees, curriculum structure is becoming increasingly important. The structure of a curriculum is going to be determined by the goals of the program. For example, programs must determine whether to focus on the theoretical aspects of disaster issues, or to address the more practitioner related aspects of emergency management. Furthermore, rather than teach a comprehensive emergency management curriculum, some programs may focus on specific issues, such as engineering, meteorology or sociology.

The purpose of a program and the availability of resources will determine whether a curriculum should be independent or housed within a pre-existing related program, as well as influence curriculum placement within a four-year or two-year college. For example, institutions seeking to offer emergency management issues as a minor, certification program or Associate degree will most likely provide curriculums that address specific emergency management issues. Thus, institutions may choose to place such curriculums within an existing department, such as public administration, political science, and public policy degree programs. In addition, while emergency management minors may be applicable to either four-year or two-year colleges, the limited scope of certification programs and Associate degrees may make them more appropriate within two-year educational institutions.

Emergency management Bachelor degree curriculums are best suited to four-year institutions. Four-year colleges are more likely to have the necessary resources to support comprehensive emergency management degree curriculums. Thus providing the option of supporting an independent emergency management program or placing an emergency management curriculum within a pre-existing department. Four-year colleges are also able to structure curriculums to provide an assortment of interdisciplinary courses, as well as meet the needs of a diverse student body.

The University of North Texas is a four-year college that has structured its EADP curriculum to provide a comprehensive emergency management education. The goal of the EADP degree program is to prepare students to become emergency management practitioners. The interdisciplinary structure of the EADP degree program allows it to be housed within the Department of Public Administration, while also collaborating with other departments. For example, the EADP curriculum incorporates several electives from various departments, such as sociology, geography, and business administration. Furthermore, the EADP program also has degree requirements with other departments, such as Technical Writing as a component the English requirement, as well as Geology courses that are part of the laboratory science requirement. EADP students must also

select a minor, thus encouraging students to broaden their awareness of related fields.

The EADP curriculum is also structured to accommodate a variety of students. These include traditional and non-traditional students, full-time and part-time students, as well as pre-service students and in-service professionals. This is accomplished by offering evening classes that meet once a week. Thus enabling working adults to study for a degree while maintaining their professional occupations.

Facilitating interdisciplinary instruction

Perhaps the largest obstacle currently facing emergency management programs is the lack of interdisciplinary courses. The broad scope of emergency management requires that courses from various disciplines be incorporated into academic curriculums. There are several relevant disciplines that should be included in emergency management curriculums. Sociology courses aid in the understanding of patterns of human behavior including emergency warnings and evacuations, as well as a variety of other response and recovery issues. Sociological studies also give insight into organisations and their complex interactions.

Public Administration courses provide insight into the processes of leadership and management within governmental agencies, which also has linkages to the private and nonprofit sectors. Political Science courses offer a wide variety of economic and governmental theories that provide the contextual setting of the constraints and opportunities related to the emergency management offices and functions. Physical and natural science courses such as chemistry, physics, geology, and meteorology prepare emergency management students for the variety of radiological, nuclear and natural hazards they will encounter as professionals. Technical writing courses may add an important element to emergency management curriculums as the ability to communicate clearly is a fundamental component of writing grants, plans, and proposals, and educating the community. Finally, secondary languages aid in communication with various special populations.

It is essential to teach a broad academic perspective to students in order to better prepare them for entry into the field of emergency management.

The University of North Texas has attempted to resolve this issue by offering a wide variety of courses that apply to the major. Courses include:

- Introduction to Emergency Management
- Emergency Preparedness
- Disaster Response
- Disaster Recovery
- Hazard Mitigation
- Leadership and Organisational Behavior
- the Capstone Course in Emergency Management.

Elective courses within the program include:

- Images of Natural and Technological Disasters in Film and Media
- Special Populations
- Computers in Emergency Management
- Terrorism and Emergency Management
- The Federal Emergency Management Agency and Disasters
- Flood Plain Management
- Private Sector Issues (Business Continuity)
- International Disasters
- Hazardous Materials Planning and Management.

Students are also required to take a technical writing course and either geography or geology to fulfill their University English and Laboratory Science requirements. A variety of seminars (such as public administration, sociology, risk management, workplace health and safety) also earn credit as electives toward the Emergency Administration degree. Furthermore, professors also strongly encourage students to minor in a related field such as sociology, public administration, criminal justice, natural or physical sciences, chemistry, computer science, anthropology, foreign languages, business management, political science and psychology.

The possibility of integrating other courses (e.g. non-profit sector issues, geographic information systems, urban planning) into the curriculum is currently being explored as well.

The EADP program also incorporates a large amount of interdisciplinary articles and essays into its curriculum. These readings address all types of hazards, and the diverse actors and activities involved in each of the four disaster phases.

Many of these articles are case studies of particular disasters while others review previous research findings on a plethora of mitigation and/or emergency management functions. These articles allow students to become familiar with the broad scope of emergency management and the inter-related nature of various fields and actors.

Integrating academic and practical perspectives

Emergency management programs have a unique opportunity to incorporate a practitioner orientation into their curriculums, both as course material and as guest lecturers. Emergency management practitioners are able to relate real-world experience to academic subject matter. An example of a practitioner-oriented topic for emergency management education is the Incident Command System. Notably, one of the more complex concepts of emergency management, practitioners who have real-world experience with the Incident Command System may be able to present a pragmatic approach to the subject. By presenting a working model of various concepts, practitioners will be able to facilitate the student's education with a realistic approach to emergency management.

At the University of North Texas, alumni of the program and other emergency management related professionals are frequently invited to guest lecture to classes in order to facilitate a better understanding of course material and to bring course content to life. These and other practitioners come from diverse organisations and agencies, and include Federal Emergency Management Agency program managers, local emergency managers, Red Cross disaster specialists, Radio Amateur Cicil Emergency Services personnel, hazardous material responders, private sector consultants, hospital risk managers, insurance representatives, wind engineering researchers, and fire department officials. In many cases these practitioners provide specialised information, such as mitigation, exercise development and implementation, emergency communications, grant writing, and hazardous material regulations and response procedures. Professors in the program have also coordinated with practitioners to provide field trips to FEMA Region VI Headquarters, local and county Operating Centers, Red Cross chapters, and FEMA's National Teleregistration Center. These trips also allow students an opportunity to link emergency management principles to their real world settings.

Because competition for jobs in emergency management is fierce, students need to gain experience in a professional setting in order to increase opportunities for employment. The University of North Texas has attempted to facilitate this goal by requiring that all Emergency Administration and Planning students participate in an internship based on interests in the

public, private, and non-profit sectors of emergency management. Students have completed internships recently with the FEMA, local emergency management offices, the Red Cross, hospitals, consulting companies, congressional representatives (involved in disaster committees), the aviation industry, and the military. In many cases, students have helped to develop emergency operations plans, participate in disaster exercises and perform a plethora of daily functions. Such internships provide students the opportunity to apply their academic knowledge. Internships likewise supplement education with real-world experience. Through internships students are also able to earn academic credit, become associated with professional organisations, and become involved with emergency management practitioners. One of the most valuable experiences that emergency management curriculums can offer students, therefore, is the opportunity to serve as an intern.

Another way emergency management students can gain experience is through emergency management student organisations. At the University of North Texas, students have organised and participate in the International Emergency Management Student Association (IEMSA). IEMSA is a student organisation founded on the principle of advancing emergency management knowledge among students. IEMSA helps students become involved in community activities, as well as attend academic and professional conferences. Previous community service projects have included assisting in the development of a local school's emergency operations plans and revising an area hospital's disaster procedures. IEMSA has also developed conferences, such as the Professional Development Workshop, where students and professionals assemble to discuss issues such as damage assessment, shelter operations, severe weather events, and various aspects of planning. Another benefit of IEMSA is that it allows students to network with professors and professionals throughout the world. Each year the University of North Texas hosts an International Disaster Day Conference in which IEMSA helps to coordinate activities, booths, and guest speakers. Consequently, IEMSA is another unique forum in which emergency management students can increase their experience and interact with academics and practitioners in the field.

Utilising modern instructional technologies

The advancement of technology is furthering the opportunities available to emergency management curriculums. The internet is becoming an important tool for emergency management students. With today's computers, students are able to communicate with professors and professionals, and contact virtually any governmental agency or professional organisation. Students can also harness modern technology to research vast amounts of emergency management and disaster related information through access to distant libraries and databases throughout the world. The Federal Emergency Management Agency, the American Red Cross, the Office of Foreign Disaster Assistance in the United States Agency for International Development, the United Nations Department of Humanitarian Affairs, the Disaster Research Center, and the Natural Hazards Center provide clearinghouses of emergency management related information that can be accessed through their Internet sites.

Technological developments are also valuable in that they allow emergency management students to witness events as they occur and to keep abreast of current world disaster news. In addition, there are also various CD-ROM and multi-media applications that are available to facilitate student's learning. Current CD-ROM technologies include professional applications such as the Computer Aided Management of Emergency Operations (CAMEO) and Areal Locations of Hazardous Atmospheres (ALOHA), which aid in responding to hazardous material events. Advancements in multi-media software, such as the encyclopedias Britannica and Encarta, allow students to simultaneously access text, audio and video information for a variety of topics. Exposure to professional related applications can be used to supplement emergency management student's education. Finally, computers and the internet also open up opportunities for long distance learning by increasing access to emergency management programs.

Professors at the University of North Texas are attempting to capitalise on this technology. For instance, lists of web sites are distributed and students are encouraged to monitor the internet to facilitate class discussions regarding current events. In fact, time is set aside in most classes to discuss on-going disaster activities. Students are also encouraged to use the internet when looking for information for term papers. Currently, the University of North Texas does not offer distance learning courses. However, it has created one on-line course and intends to create four additional web-based courses to enable non-degreed practitioners to obtain emergency management credentials and certificates. Such technological advances therefore open many learning opportunities for students and should be incorporated into the emergency management programs of various universities.

Conclusion

A great deal of emphasis is being given to the quantity of emergency management programs. However, the quality of such programs also deserves examination. The arguments presented here indicate that the majority of emergency management programs are likely to face various challenges and opportunities resulting from the complex nature of the profession and the limitless possibilities of technology. Emergency management programs will have to overcome these challenges and capitalise on such opportunities as providing interdisciplinary curriculums, incorporating practitioner and practical oriented materials, offering students the opportunity to work with professionals, and utilising modern technology. While the Emergency Administration and Planning program at the University of North Texas has seen significant changes over the years, it still has room for improvement. Primarily, it needs to further its practical orientation and continue to solidify its ties with the local emergency management community. The program would also benefit by increasing its number of faculty and continuing its emphasis on interdisciplinary knowledge.

It is hoped that this examination of emergency management programs, specifically the Emergency Administration and Planning program at the University of North Texas, has provided some lessons for current and future emergency management programs. Current and future programs must be assessed in order to facilitate the development and professionalisation of emergency management education.

Acknowledgments

I would like to thank Dr. David McEntire (program coordinator of the Emergency Administration and Planning Program, University of North Texas) for his contributions to this article.

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This article has been refereed

Reconciling development with flood risks: the Hawkesbury-Nepean dilemma

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Introduction

The New South Wales (NSW) government has committed some $58 million to the Hawkesbury-Nepean Floodplain Management Strategy over the five years to 2003. This substantial financial commitment reflects not only the magnitude of the flood risk but the need to find a regional solution to the dilemma of reconciling flood risk with the continuing settlement and demands for growth in Western Sydney.

This paper discusses the elements of the Strategy, which have particular reference to the management of existing and future development on the floodplain, and the assistance being provided to local government, (given that in NSW, the management of floodplain development is principally a local council responsibility).

Why are the flood risks in the Hawkesbury-Nepean valley different?

Topography and flood behaviour

The Hawkesbury-Nepean River is one of the major river systems of NSW with a catchment of 22,000km2 stretching from Goulburn and Lithgow to Broken Bay. Warragamba Dam which provides 80% of Sydney's water supply, lies in the catchment (see *Figure 1*). Although 130km from the sea, the river is tidal to Windsor Bridge where the normal water level is only 0.8 metres above sea level.

This part of the eastern seaboard experiences irregular and unpredictable weather events. Exceptionally heavy rainfall over several days can lead to severe flooding in the Hawkesbury-Nepean River valley, basically because water flows into the valley at a far higher rate than it can flow out. The narrowing of the valley downstream at Castlereagh controls the flow of water between the wide floodplain at Penrith and the even larger floodplain at North Richmond and Wilberforce. The flow of water is restricted by the narrow gorges downstream of Wilberforce which act like a bottleneck and result in backing up of floodwater producing flooding much deeper than on a typical coastal river in NSW.

This backwater flooding can be extremely deep and it is the depth rather than the velocity that is the key component of the flood hazard in most areas. For example, in the largest flood of record in June 1867, floodwaters reached 19.2m Australian Height Datum (AHD) in Windsor — three metres higher than the majority of development there today and two metres higher than the current flood planning level of 17.3m AHD. The probable maximum flood (PMF) will reach to 28.9m AHD or 11 metres above the planning level in Windsor (see *Figure 2*). Even with the new Warragamba Dam spillway[1], a PMF will reach 26.4m AHD. Detailed estimates provided by Sydney Water shows that the PMF could cover an area of 300km2 — completely inundating Richmond, Windsor, McGraths Hill and partially flooding Penrith, Emu Plains and Riverstone. Such a flood or smaller ones would cause untold devastation and potentially significant loss of life.

Along the Lower Hawkesbury beyond Sackville, where the floodplain and the channel are narrower, both high velocities and depth aggravate the flood hazard. Damage increases dramatically with increasing flood severity.

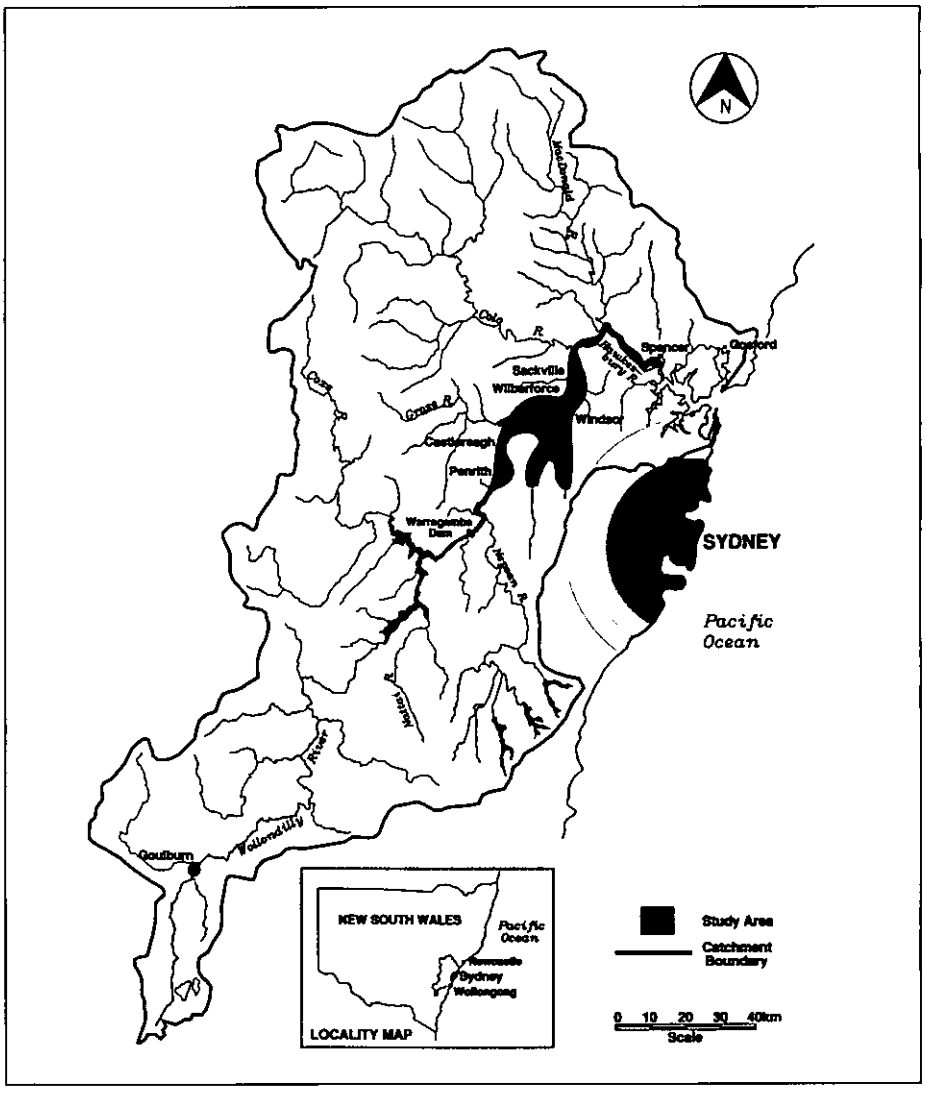


Figure 1: The Hawkesbury–Nepean Valley.

Notes

1. A new auxiliary spillway has been built to move water around this water storage dam during extreme floods.

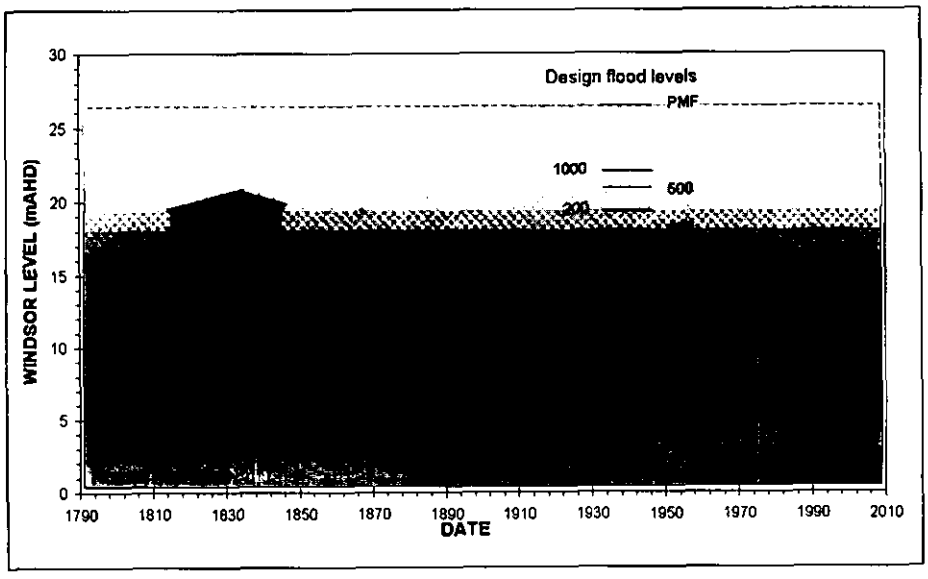


Figure 2: Hawkesbury River floods 1799 to 2000.

Many areas of the Hawkesbury-Nepean floodplain can become 'shrinking islands' as floodwaters rise, particularly during very large floods. This can occur not only in rural areas such as that shown in the above photo (during the 1988 flood) but may also include some populated urban centres. This is potentially a very serious situation given that these islands may themsevles be completed overtopped, leaving the inhabitants with no safe refuge. Evacuation planning is therefore of critical importance.

Established urban centres

Flooding of this magnitude is hazardous because of human occupation of the floodplain. The fertile soils of the Hawkesbury lowlands were recognised as a valuable resource by the earliest colonists. Being adjacent to the river was essential to the new settlers, as it offered a means of transport in advance of road and rail links. Even in 1810, Governor Macquarie recognised the flood risk although he seriously underestimated the scale of the flooding problem (but then he did not have the benefit of today's technology). He required the first settlers to relocate on high ground in Windsor, Wilberforce, Pitt Town, Castlereagh and Richmond, out of reach, or so he thought, of the damaging floodwater.

Windsor and Richmond are now thriving urban centres although the river is now used for recreation not transport. A diverse economic base exists for an ever increasing, young population. Expansion in the 1980's and 1990's with the new suburb of Bligh Park has resulted in a total population of 35,000 in Windsor, Richmond South Windsor and Bligh Park. Parts of Penrith, Emu Plains and Riverstone are all major urban areas with growing populations. All are vulnerable to Hawkesbury-Nepean flooding. Protecting existing residents and their property is a key goal of the strategy.

Isolation during floods

It is only in the last decade that the full extent of potential flooding has become known. A critical problem in the Hawkesbury-Nepean is the potential for the roads leading from Windsor, Richmond, McGraths Hill and Emu Plains to become cut by rising floodwater, leaving ever shrinking islands. Once a decision is taken to act upon a flood prediction, the emergency services mobilise and issue flood warnings and commence the evacuation. The safety of residents relies on an effective emergency evacuation going according to plan within extremely tight timeframes that give very little margin for error or delay. Evacuation planning for isolated towns has emerged as the most complex and by far most costly part of the implementation of the strategy. This is not only because of the provision of numerous road upgrades but also the serious limitations on future urban growth due to constraints on improving the timeframe for implementing evacuation plans during floods.

Metropolitan growth

Extensive tracts of land have been urbanised, often without the potential hazards and risks associated with mainstream flooding being addressed. Western Sydney remains a target for urban growth. Although Planning NSW promotes urban consolidation, there remains a need to find new 'greenfield' sites to meet housing demand.

Lack of flood awareness—a critical problem

In general, the Hawkesbury-Nepean community has little awareness of flooding and few realise the potential scale or depth of the flooding. Unlike many coastal NSW floodplains that regularly experience extensive flooding, the floods of the Hawkesbury-Nepean that have occurred in the last 135 years, have not been severe and have therefore had little meaningful impact on the community as a whole—merely an inconvenience or a nuisance to affected individuals.

It is because the community lacks members who have had personal experience of threatening floods in the area, that severe flooding is perceived as a remote event which is easily dismissed or denied. Images of flooding in rural NSW are seen as someone else's problem and not applicable to metropolitan life. There has never been a 100 year flood recorded in the Valley—the largest flood on record, the 1867 flood was estimated to be a 250 year event in Windsor, but as in the rest of NSW, the 100 year event is generally used as the flood planning level. Above the 100 year level, it is assumed, wrongly, by the general community that the land is 'flood free'.

By not recognising the risk, the community is leaving itself very vulnerable indeed to the devastating social, economic and emotional impacts of a flood. The present community is ill prepared for a flood yet studies repeatedly show that communities recover better from a natural disaster when they are aware that the disaster can happen. To quote a Czech spokesman on flooding events on the Morava River in the late 1990's 'being unprepared is what floods forgive least'[2].

Organisational barriers

A further factor working against finding effective floodplain management solutions, is that there are six local government

areas downstream of Warragamba Dam affected by Hawkesbury-Nepean flooding. Applying the traditional model of floodplain management at the local council level has not allowed the full range of flood hazards to be addressed and it became apparent that solutions would only be found through a comprehensive regional approach. To address this very real problem, the NSW Government commenced the Hawkesbury-Nepean Floodplain Management Strategy.

The Hawkesbury-Nepean Floodplain Management Strategy

In April 1997, the NSW Government established a community based Advisory Committee and work began on the Hawkesbury-Nepean Floodplain Management Strategy. For the first time the government addressed the need for a comprehensive floodplain management strategy designed to ensure the safety and security of people living in the floodplain.

The strategy is a regional action plan for dealing with flooding and floodplain management. Adopting the strategy in 1998, the government committed $58.4 million over five years to implementing its recommendations. State government and councils, to ensure that flood losses and damages are kept as low as possible, have adopted a cooperative approach.

The strategy consists of a number of key components, one being to finalise the Regional Floodplain Management Study (RFMS) through the following tasks:

- prepare and implement a detailed evacuation infrastructure program
- prepare best practice floodplain management methodology in the Valley, including:
  - best practice land use planning guidelines
  - best practice subdivision guidelines
  - best practice building guidelines

  for use by councils, planners, developers, builders and others involved in the development process.
- prepare and implement a tailored regional public awareness program to ensure that community members and those in authority are able to make informed decisions about living and working in the floodplain
- ensure that critical utility service providers and government agencies have the information necessary to prepare flood recovery plans.

The remainder of this paper discusses current work towards the preparation of land use guidelines for future development and redevelopment. In developing these guidelines, a principal question to be considered is 'how can a homeowner or home purchaser recover financially from the losses caused to home and contents from flooding?' To answer this question, two studies have been undertaken to assess firstly the community's attitude to risk and secondly the ability of homeowners to recover from the financial losses associated with a flood. Both studies have examined those purchasing or owning their own home. This is firstly because western Sydney has traditionally provided 'affordable' housing for first time home buyers, and because such family groups appear to be particularly vulnerable to flood losses, given high levels of mortgage commitment and the general lack of availability of flood insurance. A third study has examined the house price impacts of flood notifications on Section 149 certificates.

The City of Wollongong, in NSW, received disastrous flooding in August 1998. Excessive runoff from the adjacent escarpment produced significant inundation problems on the numerous small creeks and watercourses that traverse the established urban areas of the city. In particular, debris in the form of rocks and boulders, vegetation, cars and other household items caused blockage of numerous culverts and small bridges. This debris exacerbated inundation problems. Recent studies have identified that many of the city culverts were virtually fully blocked during the flood. This debris problem, and the additional inundation resulting from it, placed unexpected demands on the local SES personnel.

The morning after the August 1998 flood in Wollongong NSW.

Notes

2. Ministry of Environment of the Czech Republic, 1998, *Flood—An Evaluation of the July 1997 Flood Events in the Czech Republic*—Film Supplement for the Czech Hydrometeorological Institute.

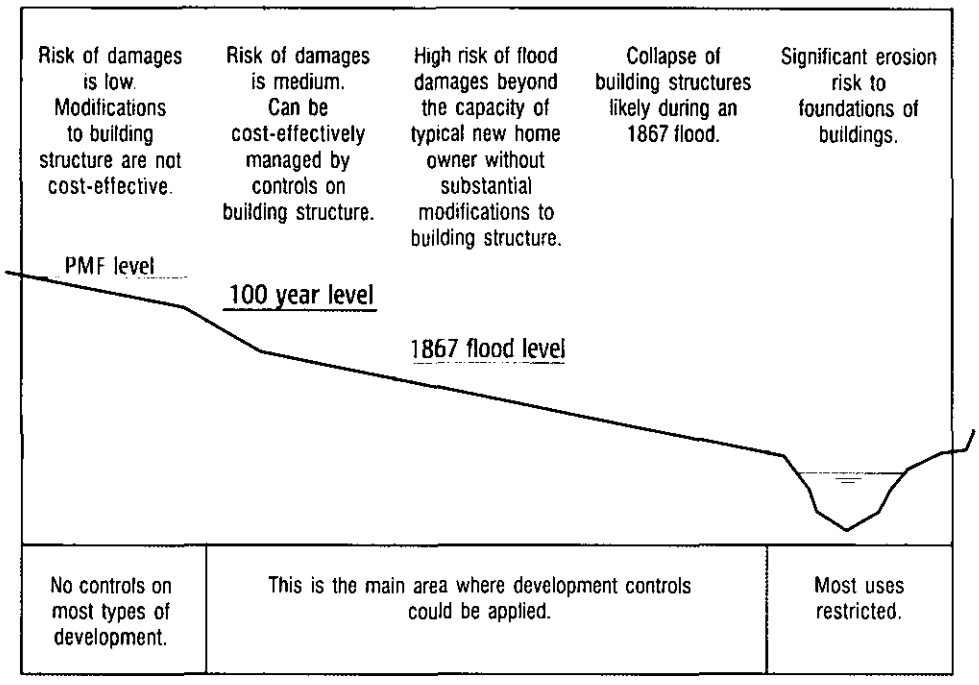


Figure 3: Draft planning controls under consideration

Survey and analysis of community attitudes to flood risk

This survey determined and compared:

- the attitudes to risk held by the present community living on flood prone land in the Valley
- future migrants to the area
- selected communities within the metropolitan area who either had or had not experienced a natural disaster.

The work has been undertaken for the Hawkesbury-Nepean Floodplain Management Strategy Project Team by GHD Pty Ltd and Cox Consulting Pty Ltd. The findings indicate community support for more effective controls on development in high hazard areas and an *expectation* that a high level of protection by authorities already exists. It reveals that a majority of households in all groups believe they have a limited ability to finance flood losses from their own resources. Only 30% of first time homebuyers in the PMF area believe they can find more than $10,000 from their own resources. Households stated they would be willing to pay 10% more for house ($20,000 on a $200,000 house) if it was built to a standard that offered protection from flood damages. Interestingly, most respondents were willing to pay relatively significant proportional increases in their existing home and contents insurance premiums to obtain increased peace of mind through flood insurance (if it was available).

Household financial flood risk investigation

This study, undertaken by the Department of Actuarial Studies, Macquarie University, has provided objective projections of the financial impact of flooding on a variety of typical owner-occupier households living in the Strategy area. The findings reveal that households with lower incomes and lower levels of savings prior to the flood occurring, take longer to recover financially. Given the high prices of houses in the Sydney metropolitan region, dual incomes emerge as an important factor in ensuring a household's successful recovery over time. In households where there is only one wage earner, e.g. a one-parent family, a lone person, or if one partner becomes unemployed following the flood, the household is extremely vulnerable to any financial downturn. A flood of any size shortly after buying a house or close to retirement would have a very serious impact on the lifestyle of the family.

Valuation study

A study has been undertaken by Egan's National Valuers addressing the matter of house prices in relation to flood notification on Section 149 certificates[3] in the Blacktown, Penrith and Hawkesbury council areas. The study concluded that general lack of understanding and awareness about the nature of flooding in the Hawkesbury-Nepean Valley has lead to a state of confusion and misinformation within the real estate industry and hence within the buying public. The study reinforced the need for an effective and sustained public awareness campaign. The robustness of the residential housing market is such that individual property characteristics (presentation, state of repair, location etc.) were stronger determinants of price than flood notification. Using a bushfire affected suburb in the Blue Mountains for comparison, they concluded that whilst an actual flood event would have a short term effect on lowering prices, this would be unlikely to have a long term effect as collective memories of disasters fade, are downplayed by vendors and ignored by purchasers who, in a buoyant market seek to buy regardless of apparent contra-indications.

Land use guidelines

The preparation of these guidelines is currently underway and is a key output of the strategy. Their principal aim is to assist each council to adopt planning controls, which respond to the flood hazards in their area and to the needs and wishes of the local community. Management of the flood risks above the planning level needs to be a relevant consideration in reaching planning decisions. The 1867 flood is an uncomfortable reminder of the reality of this risk, given that it would inundate some of the existing development by over one building storey.

In most NSW floodplains the 100 year flood level may be an appropriate planning standard because of the relatively small differences between the 100 year flood level and the PMF level. In this floodplain however, there are many urban areas where there can be one storey in height difference between the flood planning level and the 250 year event and four storeys to the PMF. In these towns alternative approaches are essential to protect people and property from the impacts of larger floods. Regrettably, impacts of larger floods have generally not been addressed at the planning stage of the development process for land lying above the 100 year flood level.

Little consideration has been given for the hazard to life and property caused by the particular characteristics of flooding, or for related issues such as isolation because of flooding in the local area. The risks and hazards associated with all levels of flooding, particularly the continuing risks of events more severe than the adopted planning standards, are difficult to address fully in the valley. Property damage and disruption to urban infrastructure may also be unnecessarily increased because opportunities to reduce these losses are not recognised in the planning and development processes. The strategy's digital flood data display tool[4] linked to councils' GIS will assist in informed

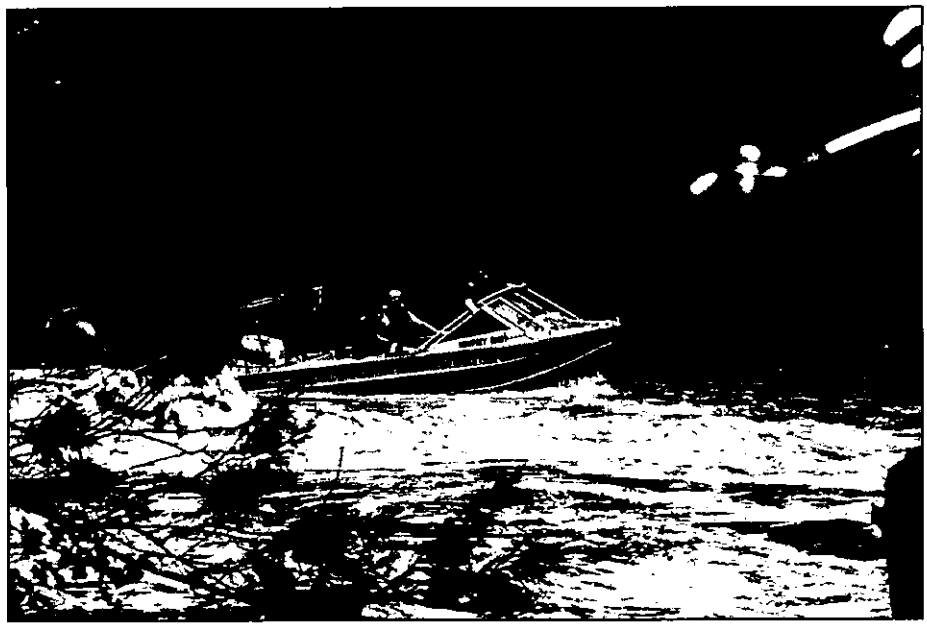
decision-making. Given the extent of urban development, the lack of household flood insurance adds to the vulnerability of residents. Research for the building guidelines (other work currently underway) has demonstrated that the depths to which dwellings will be inundated or the forces to which they will be subjected in various floods, will potentially lead to serious damages which would be every expensive to rectify. Total loss of the building and its contents may occur, depending on the severity of the flood event, the house type and its location.

Many families in the process of buying their home have large debts and few assets. The financial study discussed above has identified that loss of, or severe damage to, the dwelling and its contents may result in families dropping below the poverty line. Renters will have different losses but will nonetheless suffer hardship. Social well-being is closely linked to financial security and stability. The scale of potential suffering would be catastrophic in both social and economic terms, from which it would be very difficult to recover in the short term. On a societal basis, there would be tremendous pressure placed on welfare agencies and public donations to provide restitution and to manage the subsequent trauma. The risks borne by the residential sector of the community when floods greater than the design flood occur, are unquantified and largely unrecognised by the individual residents, institutions, agencies and companies involved in the residential property market. Individual households would have a potentially unmanageable burden to bear solely. It is believed that the community (both residents and decision makers) perceive the risk of flooding above the 100 year level to be low even though compared to other risks there is a high risk of its occurrence. This low perceived risk influences the community's willingness to modify its decisions in relation to the floodplain.

Based on the above studies, preliminary land use controls such as those summarised in *Figure 3*, are being developed for consideration by local councils.

Summary and conclusions

- People are prepared to pay more for housing that incorporates measures to reduce unaffordable damage bills after a disaster.
- Flood damages to houses could potentially place an unsustainable financial burden on individual households.
- Householders are prepared to pay for flood insurance to get peace of mind.



Flood boat operation by the Kempsey NSW, SES unit. Because many areas of the Hawkesbury–Nepean become 'shrinking islands' as floodwaters rise, early evacuation of the urban population by road is essential to avoid the need for rescue by flood boats and helicopters.

In order for the majority of people from the Hawkesbury–Nepean Valley to be safely evacuated at the onset of a major flood, it will be necessary for them to reach the regional evacuation roads in their cars. However to reach these regional routes, they will need to negotiate various local roads which may themselves be cut by flooding.

- House prices are unlikely to be adversely affected by improved public awareness of flood risk.
- There are very real limitations to growth in parts of the Strategy area. This is particularly the case where that growth would result in increased numbers of households requiring evacuation from isolated towns, beyond those being serviced by the Strategy.
- There is a crucial need to raise public awareness of the range of flood risks. This will enable those in authority and the community to make informed decisions, based on knowledge of this natural hazard. During a flood event, this increased awareness will help elicit an effective response, will be less socially

Notes

3. A Section 149 certificate is a certificate issued under the NSW Environmental Planning and Assessment Act 1979. It is issued by a local council, usually to a vendor or prospective purchaser of land, in respect of a parcel of land and specifies the applicable planning instruments and policies including any restrictions on the land. In the context of floodplain management, if council's policy relating to flood prone land applies to the land, this would be stated on the certificate.

4. This computer software package has been produced for the strategy by consultants and will provide the means to link hydrodynamic flood modelling results with GIS layers such as cadastre, property data, aerial photographs, flood emergency intelligence data, etc.

disruptive and will aid the recovery process afterwards.

- As the community perceives flooding to be a low risk, it has not as yet demanded a higher level of flood protection through planning and building controls. However, the community expects authorities to regulate for damage arising from natural hazards and indeed, controls have been in place for many years for fire, earthquake and cyclone, through appropriate building codes. A flood-aware community would expect similar protection from damages arising from that other natural hazard—flood. Through the Regional Floodplain Management Strategy, best practice guidelines will include land use planning, development and building controls which seek to manage the range of flood risks above the 100 year flood level to reduce flood losses and property damage. The guidelines will be available for councils to use when formulating their local floodplain policies and plans in order to meet these valid community expectations.

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The views expressed in this paper are entirely those of the authors and are not necessarily those of their employers or the NSW Department of Land and Water Conservation. For further details concerning this paper please contact the authors.

This article has been refereed

EMA UPDATE

Autumn 2002

Produced by
Emergency Management Australia through the
Emergency Management Australia Institute
Main Road, Mount Macedon, Victoria 3441

United Nations General Assembly Resolution on International Search and Rescue

EMA has continued to play a major role in the development of a United Nations General Assembly Resolution on International Search and Rescue which is proposed to be presented at the 57th Session on the UN General Assembly in New York late 2002. The Turkish Government has agreed to sponsor the Resolution.

A 4th Meeting of the Core Group of countries developing the resolution was held in Geneva in February 2002. The meeting developed a working document which will form the basis for final development of the resolution.

For further information contact:
Rod McKinnon
phone: 02 6266 5328
email: rmckinnon@ema.gov.au

Urban search and rescue exercise in Singapore

In early March 2002, the Singapore Civil Defence Force and the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) co-hosted an urban search and rescue exercise in Singapore for Asia-Pacific countries.

Australia was one of the 20 participating countries. EMA sponsored a nine person Australian delegation comprising representatives from the emergency services of each State and Territory and EMA.

The exercise was very successful and has engendered greater cooperation between countries of the region. The outcomes of the exercise will benefit Australia's ongoing development of Urban Search and Rescue capabilities and ensure a more standardised approach to international response in the Asia Pacific region.

For further information contact
Trevor Haines
phone: 02 6266 5169
email: thaines@ema.gov.au

Radiation accidents at sea

Development of the Commonwealth Maritime Radiological Response Plan which is expected to be published in mid-2002 is progressing well. The plan will outline how the Commonwealth would manage an accident involving a ship carrying radioactive waste between Europe and Japan transiting near Australia. The draft plan is currently out for comment.

For further information contact:
Don Patterson
phone: 02 6266 5165
email: dpatterson@ema.gov.au

Fact finding mission to the United States

EMA recently participated in a post-September 11 fact finding visit to the United States organised by the Victoria Emergency Management Council.

The team met with emergency management and health officials in both New York and Washington DC and gained an excellent overview of how the events at the World Trade Center and the Pentagon were managed.

The visit has enabled EMA to identify speakers to be invited to Australia to participate in workshops to be hosted by EMA later in 2002.

For further information contact:
David Morton
phone: 02 6266 5325
email: dmorton@ema.gov.au

Exercise Northern Trilogy 2002

EMA recently participated in an Australian Defence Force Exercise called Northern Trilogy 2002 in Darwin. Northern Trilogy is a Headquarters Northern Command (HQNORCOM) Command Post Exercise designed to exercise the Headquarters in operational planning, confirm core processes and test HQNORCOM Standing Operating Procedures.

To confirm inter-agency arrangements a number of key key civil agencies also participated in the Exercise.

For further information contact:
Steve Banks
phone: 02 6266 5505
email: sbanks@ema.gov.au

New faces in EMA community awareness

For many years EMA's Disaster Awareness Program has provided the Australian community with hazard awareness and education products, as well as being responsible for the Australian Emergency Manuals Series of emergency management principles and practice. Many would know Peter May who managed and developed these products successfully for 15 years.

With Peter's retirement in January 2002, the responsibility for these products has been split between the two EMA sites of Canberra and Mt Macedon. Christine Jenkinson, formerly Library Manager, is now Manager Community Awareness Program, and is responsible for all existing community awareness products. Grahame Parker, Manager Corporate Information Services, has taken on the additional responsibility of the Australian Emergency Manuals Series and EMATrack, the Australian Disaster Database which is accessible via the EMA website.

This changing of the guard is an ideal opportunity for EMA to review and evaluate the current community awareness products and programs, to ensure that the programs or products remain relevant and effective and meet the information needs of our clients – the Australian community.

Chris and Grahame would welcome any feedback on the existing products and comments can be forwarded to the email addresses listed below.

For further information contact:
Mrs Chris Jenkinson
phone: 03 5421 5241; email: cjenkinson@ema.gov.au

Mr Grahame Parker
phone: 02 6266 5218; email: gparker@ema.gov.au

Australasian Libraries in Emergency Services (ALIES) workshop

15–17 April 2002

The third ALIES Workshop (the first since 1993) was successfully held at EMAI from 15 to 17 April 2002. The event attracted 28 participants, either librarians or information managers, representing a variety of emergency service agencies from throughout Australia and New Zealand.

The workshop was a valuable opportunity for a number of very experienced information specialists to share their combined knowledge in the area of information management and retrieval. It provided a forum for informal interaction and is recognised as a living breathing example of a knowledge network.

There were two key outcomes arising from the workshop:

1. EMA agreed to provide funding for an annual ALIES Workshop providing that at least two case studies relating to innovations in knowledge management are presented at each workshop. The next workshop will be held in April 2003.
2. A comprehensive directory of contact staff and services provided by libraries within the ALIES network was produced.

The group also developed a series of recommendations for consideration by EMA, covering such issues as establishment of a Consultative Committee to guide the development of the network, cooperative purchasing and website development.

For further information contact the Workshop Convenor:
Chris Jenkinson
phone: 03 54215 241
email: cjenkinson@ema.gov.au

Research

EMA and Research

Improving emergency management practice and policy in Australia will require a strong research effort, coupled with effective management of information. To date Australia has had an excellent track record on scientific research related to hazards, but research in areas such as assessing social, economic and environmental costs, public policy, developing and implementing risk treatment strategies has received little attention. These areas have all been identified by the sector as high priority areas for research. In addition, research is vital for developing the capacity to identify and respond pro-actively to changing risk, and to provide the evidence base for best practice disaster management. EMA's role in research and development is: 'to provide national leadership in generating knowledge and inspiring innovation and action in emergency management'.

EMA has, over the past year initiated the following activities towards implementing this Research and Development Strategy.

- EMA established the 'Occasional Workshop Series' as an opportunity for senior emergency managers to have access to the best disaster management researchers from around the world. To date Dennis Miletti, Silvio Funtowicz and Prof. Bruna De Marchi have conducted workshops.
- EMA established an Assistant Director Research Management position in August 2001. This position provides a focus for all EMA research activities, and the point of contact for research activities in the EM Sector.
- The Risk and Community Safety Research Initiative (RCSRI) (a partnership between EMA, RMIT and CRES ANU) was established by EMA/AEMC in January 2001 to act as a core of research capability under the Directorship of Professor John Handmer a disaster management researcher with over 20 years experience both nationally and internationally. This research group provides a critical mass of research expertise in emergency management and is building links with other emergency management research groups such as James Cook University and Macquarie University.
- EMA has sponsored a series of consultations with key emergency management stakeholders in the States and Territories and a number of Commonwealth Departments to identify research priorities. The results of these consultations are outlined in the report 'The Strategic Research Agenda for Emergency Management 2001 (RCSRI)'.
- The National Studies Program has now been realigned to reflect the priorities of the Strategic Research Agenda.

Copies of the 'Research Agenda' and EMA's 'Research and Development Strategy' and workshop reports can be found in the research section of the EMA Web site www.ema.gov.au.

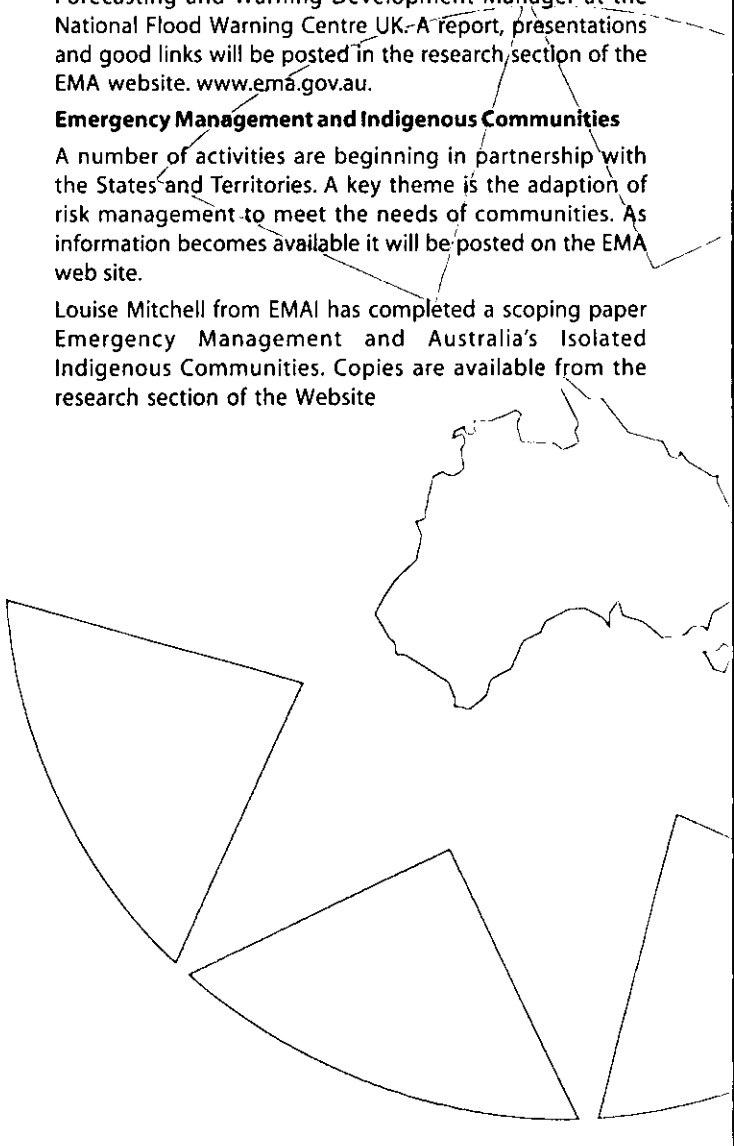
Warnings

Warnings and emergency management is a theme that will be developed over the next year. The first in a series of workshops was on Flood Warnings: Status and Latest Trends was held EMAI Mt Macedon on April 9th 2002. This workshop was an opportunity for researchers and practitioners to review and discuss current best practice in flood warnings. The second part of the workshop identified key issues and challenges for research and practice in the field. Guest Speaker for the workshop was Chris Haggart is Flood Forecasting and Warning Development Manager at the National Flood Warning Centre UK. A report, presentations and good links will be posted in the research section of the EMA website. www.ema.gov.au.

Emergency Management and Indigenous Communities

A number of activities are beginning in partnership with the States and Territories. A key theme is the adaption of risk management to meet the needs of communities. As information becomes available it will be posted on the EMA web site.

Louise Mitchell from EMAI has completed a scoping paper Emergency Management and Australia's Isolated Indigenous Communities. Copies are available from the research section of the Website



What's on at EMAI

Developments in EMAI training and assessment system

Emergency Management Australia Institute is re-structuring it's education and training system in response to national vocational education and training initiatives including:

- the endorsement of the Public Safety Training Package which includes competency standards and a qualification in emergency management
- additional requirements for Registered Training Organisations [outlined in the Australian Quality Training Framework Standards for Registered Training Organisations (ANTA 2001)]
- increasing emphasis on industry competency standards and qualifications as a factor in career progression.

What is changing?

Changes to EMAI training and assessment system include:

- courses will align with national competency standards where they exist
- Statements of Attainment will be issued for the achievement of national competency standards—providing pathways into national qualifications
- if there are no competency standards to meet a training need, the course will be accredited and a Statement of Attainment issued which can be used towards an RPL assessment
- the assessment system will be revised to ensure compliance with the requirements of the Training Package and the AQTF
- the RPL system will be revised and their will be transition arrangements for people converting to the competency standards
- EMA is working with the Emergency Management Sector Working Group to establish an assessor network to support quality and consistency in the assessment of emergency management competency standards.

What does this mean for participants and the Public Safety industry?

- people who successfully complete EMAI courses that align with national competency standards will be achieving competency standards towards the Advanced Diploma in Public Safety (Emergency Management)—some courses may align with competency standards from other sectors or industries
- competency standards from endorsed Training Packages are nationally recognised and therefore have portability between one state and another and between sectors and industries, offering a range of career and study pathways for participants
- EMAI assessment decisions will be based on a range of evidence collected through one or more of the following:
  - pre-course work
  - on-course activities
  - post-course work
  - third party reports from the workplace.
- participants will be responsible for collecting evidence, including third party reports from the workplace
- through the moderation activities of the assessor network, participants and the industry can be confident that assessment processes for emergency management competency standards are being nationally benchmarked and continuously improved.

EMAI program of activities for the financial year 2002/2003

There are a number of ways that the Program of Activities and details about courses can be accessed. They are:

- The EMA website: www.ema.gov.au
- The EMAI Handbook, which will be available from the beginning of May. The Handbook is obtainable from EMAI or the state/territory nominating authorities

Changes to the Educational Activities Offered at EMAI

As a result of the Training Needs Assessment (TNA) Project and a number of other influencing factors, EMAI has made some additions to what is to be offered in the financial year 2002/2003. The new educational activities are related to:

- managing response
- community awareness and education
- recovery/community development

These activities have been timetabled. It should be noted that they may not be a course, they may be a workshop or seminar or a series of meetings. The development of these activities will be undertaken in the proceeding months and more information will be provided on the EMA website or through the state/territory nominating authorities.

EMAI will no longer be offering Exercise Management as a residential course at Mt Macedon. It will be offered only in the states and territories. An Exercise Management Train the Trainer course is to be offered to assist trainers in the delivery of this course.

Graduate Certificate in the field of emergency management

EMAI is conducting a study to identify the potential for an accredited Graduate Certificate in the field of emergency management for delivery by the Institute. It is proposed that the Graduate Certificate would benefit people working in emergency management who have extensive experience but no relevant qualifications or people who have qualifications in related disciplines and wish to specialise in emergency management. There is also the potential for Graduate Certificate students to support and strengthen the Institute's nationally agreed research agenda through assignments and research projects. If you would like further information on this proposal please contact Margery Webster, Assistant Director Education Development on 03 54 215 283 or email mwebster@ema.gov.au

Flexible learning

The Institute is developing a strategy for introducing flexible learning opportunities for EMAI courses including on-line delivery. Research indicates that a strategic approach which recognises the importance of appropriate student selection, orientation and support together with professional development for staff is essential to successful flexible learning.

Further information is available from:
Margery Webster
Assistant Director Education Development
phone: 03 54 215 283
email mwebster@ema.gov.au

Australian Emergency Management Volunteer Forum

A major recommendation of the 'Value Your Volunteers or Lose Them' Summit held in October 2001 was that a national peak body for volunteers in the emergency sector should be created. The inaugural meeting of the 'peak body' (now known as the Australian Emergency Management Volunteer Forum) was held in Canberra on 11 April 2002.

At that meeting, volunteers determined that the purpose of the Forum is 'to facilitate better communication between the organisations within the group and to provide advocacy for the emergency management volunteer sector'. The Forum will also carry forward the Summit recommendations in the four key areas of recognition, training, legal/protection and funding.

The Forum contains representatives from both emergency services and relief and recovery agencies.
The organisations and their representatives are as follows:

- Volunteer Ambulance Officers Association (Ms Dianne Coon)
- Volunteer Fire Fighters Association (Mr Cam Stafford)
- Volunteer Rescue Association (Mr Ray Gill)
- Royal Volunteer Coastal Patrol (Mr Michael Stringer)
- Australasian Fire Authorities Council (Mr Len Foster)
- Australian Council of State Emergency Services (Maj Gen Hori Howard (Retd))
- The Salvation Army (Maj Kevin Hentzschel)
- The Australian Red Cross (Ms Margaret Golack)
- St Vincent de Paul (Mr Greg Hogan)
- Surf Lifesaving Australia (Mr Peter Agnew)
- St John Ambulance (Mr Len Fiori)
- Australian Volunteer Coast Guard (Mrs Patricia Gillett)
- Victorian Emergency Services Association representing State/Territory Emergency Service Volunteers (Mr Laurie Russell)
- Adracare (Mr Chris Olafson)
- Anglicare (Ms Jennifer Davies)
- Volunteering Australia (Ms Sha Cordingley)

Emergency Management Australia was granted ex-officio membership of the Forum and Maj Gen Hori Howard was elected Chair. Volunteers are encouraged to raise issues for consideration by the Forum through their Forum representative.

For further details contact:
Maj Gen Hori Howard
phone: 02 4267 3043
email: hori_howard@austarnet.com.au

Australian Disaster Medicine Group (ADMG) News

Medical Preparedness and Medical Response to Radiation Accidents

The ADMG part sponsored Dr Trevor Leong, Radiation Oncologist, Peter MacCallum Cancer Institute to attend a training course on 'Medical Preparedness and Medical Response to Radiation Accidents' held in Chiba, Japan in August 2001. The meeting's main aim was training and educating participants in responding to radiation accidents. Secondary objectives included:

- updating knowledge of basic radiation biology and physics
- radiation medicine and uses for radiation in industry and health
- fostering relations between participating countries with the aim of developing a regional emergency response network that can provide emergency assistance in the event of a radiological emergency.

Trevor noted that much of the material covered during the course is included in the Australian Radiation Protection and Safety Agency (ARPANSA) 2000 guidance manual.

National Triage Tag

A national standard triage tag has been an outstanding issue in Australia for many years. The ADMG is now pleased to say that, following various research papers and representations by Tony Nocera and Alan Garner, Standards Australia have agreed to sponsor the development of a national triage standard. A working party, chaired by the ADMG, has been formed with membership drawn from all interested groups such as Australasian College of Emergency Medicine (ACEM), ambulance, military and coroners. The first meeting, held in March was extremely beneficial and all parties agreed on the way forward. It is hoped that another one or two meetings will finalise the issue.

6th Asia Pacific Conference on Disaster Medicine

This conference was held in Fukuoka, Japan 19-22 February 2002. The conference attracted approximately 250 worldwide delegates. Many of the issues discussed related to the outcomes of the September 11 terrorist actions in the USA and the further 'white powder incidents that followed. CBR response activities and decontamination of casualties were high on the agenda, with education and training of health professionals being of importance.

Defence Symposium

The ADMG is sponsoring a concurrent daylong session at the ADF Health Symposium being held in Sydney on 26-28 July. The day's theme is 'Maintaining the Rage—Emergency Preparedness among Competing Demands'. A number of speakers will address the underlying issues with a panel discussion completing the day.

ADMG Meeting

The annual meeting for 2002 of the ADMG will be held in Wellington, New Zealand on April 18-19. Among matters listed for discussion are the anthrax hoaxes following September 11, air disasters in remote areas and coordination issues in the health sector.

Flood damage analysis using GIS at Gold Coast City Council

by Haydn Betts FIE Australia,
Coordinator Flood Strategies,
Gold Coast City Council

This paper is a modified version of a paper presented to the NSW Floodplain Management Authorities Conference at Wentworth May 2001 co-authored by Don Carroll and Haydn Betts titled Integrating GIS and Flood Damage Analysis.

Introduction

The Gold Coast City has extensive floodplains, most notably the Nerang River floodplain, which is 90 sq km in area and contains nearly 60, 000 dwellings, 40% of which are flood prone.

Many of the residential areas were filled to the 1:100 year flood level—however, once this level is exceeded many thousands of dwellings become affected by above floor flooding. Therefore, it is critical to Council that no increases in flood levels occur through new floodplain development.

A GIS based Flood Damage model was developed to assist the Council with assessment of the economic benefits of proposed flood mitigation options and secondly to assess proposed floodplain developments. This paper describes the development of the model and how it is used within a GIS environment.

A prerequisite of the model is that it could be run quickly and the results could be integrated with Council's GIS based data. Therefore it was also decided from the outset that MapInfo/Vertical Mapper would be used as the model platform. This facilitated direct access to Council's property database and visual interpretation of results.

The overall philosophical approach was to estimate flood damage for each property and then accumulate property flood damage over a prescribed region. This approach requires that for each property, the floor and garage levels for each dwelling on the property are known.

The dwelling type is also required to be determined i.e. whether it is detached/ semi-detached, a town house, multiplex unit etc.

The dwelling type is then used to assign flood damage costs based on the estimated depth of inundation above floor level.

Model inputs

The model requires five basic input components. These are:

- a property database
- a floor level survey database
- a topographic Digital Elevation Model (DEM)
- flood surface DEMs
- stage damage relationships for differing dwelling types.

These components are combined to form a property flood damage database. Once formulated, standard SQL techniques using MapInfo's MapBasic are used to perform statistical analysis by suburb or by electoral division. Each component is discussed, in turn, below.

Property database

A series of 14 property databases were created using information from the Digital Cadastral Data Base (DCDB) and Citipac (Council's property rating database). Each database represents a catchment. Each property entry in the database is geocoded as using the property centroid. (Properties over 1500 square metres are excluded from the analysis as the centroid of the property may not pass through the dwelling).

The location of this centroid is used to 'inspect' flood and topographic surfaces described later in this section. The Citipac database fields contain information on fire, town planning and land use codes. These codes, when combined with lot plan numbers are used to determine the number of ground floor dwellings/units per property and whether the dwellings are part of a single or multi storey complex.

Survey database

This is a MapInfo database containing fields detailing floor, garage and road levels for each surveyed dwelling. It also contains descriptions of the dwelling such as age and building material type. These descriptions are for explicit checking that the survey sample is fairly representative of the whole.

The database is geocoded as points using property centroids.

The database has two purposes:

- to establish the relationship between estimated property level (from topographic DEM) and floor, garage and road levels as surveyed
- to update the flood damage database with surveyed floor, garage and road levels, replacing those levels estimated by statistical relationships.

The database is updated periodically through field survey.

Topographic DEM

This consists of a grid of the X,Y and Z values for the area under investigation. The X and Y values represent the coordinates of a grid point on plan, whereas the Z value represents ground level at that point. Grid location points are equally spaced in the X (east) and Y(north) directions.

For the Gold Coast area fine resolution grids are used—typically a 5m grid is preferred as coarser grids resulted in interpolation errors for properties close to canal estates where sudden changes in land profile sometimes caused misleading results. The grid information is also used to establish a relationship between estimated property levels (Z value at property centroid) and surveyed floor levels.

Flood surface DEMs

These are grid surfaces generated by hydraulic models, for example MIKE21 (DHI), MIKE11 (DHI) or USF (Qld State Govt). The flood surface grid is used to determine the flood level at each property. This is done by point 'inspection' of the flood surface using the property centroid. Mike11 and USF are 1 dimensional models.

The generation of flood surface grids using the results of these models is described by Khan & Betts (2001) in a paper presented at the NSW conference. This method takes the peak flood level at the end and 'mid points' of each hydraulic model cross-section, triangulates them, deletes spurious triangles, and then develops the rectilinear grid using Vertical Mapper (a MapInfo 'plug-in').

Residential stage damage relationships

The residential stage damage relationships were extracted from a Water Studies report titled 'Assessment of Flood Damage across the Nerang River Floodplain' dated 1997 and the March 2001 extension of that study. These reports contain tables of internal, external, structural damages related to flooding depth. Clean-up and financial costs are also included. The latest unit costs include inflation rates and an allowance for the impacts of GST.

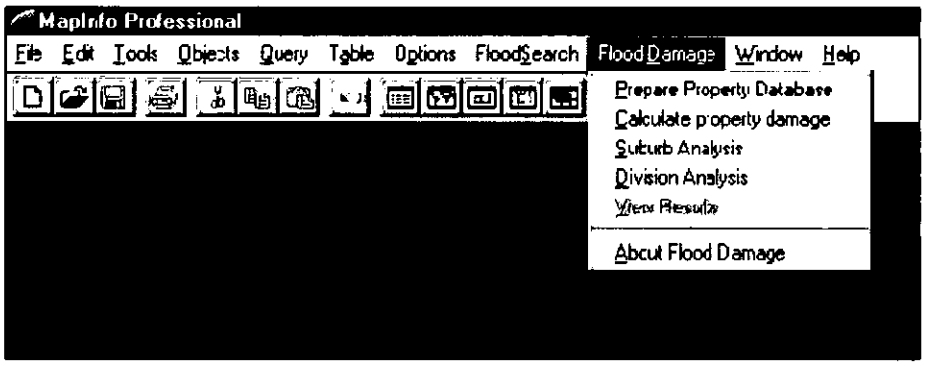


Figure 1: MapInfo flood damage model menu.

Model process

There are 4 basic steps to undertake flood damage analysis. These are:

- prepare the property database
- calculate the property damage on a property by property basis
- analyse the data by suburb or by division
- view the results.

These steps are incorporated into the flood damage MapInfo menu as shown in *Figure 1.*

Broad outlines of each step are shown in *Figure 2 (opposite)* and a brief discussion on each step follows.

Prepare the property database

The purpose of this step is to create the property damage database by defining the area or catchment to be investigated and adding topographic and flood surface levels to each selected property in the database. The property polygon centroid is used to determine these levels. The property database is a subset of the catchment-wide property database.

Calculate property damage

The purpose of this step is to estimate the number of ground floor dwellings per property, and calculate floor and garage levels using pre-determined relationships for each dwelling within each property. Where dwelling survey data are available, the estimated levels are replaced with surveyed levels. Where a dwelling is found affected by flooding, the damage is also calculated.

Once the property, garage and floor levels have been established, the damage statistics can be calculated for each dwelling. These include the number of dwellings per property; whether the dwelling(s) are flooded above property, garage and floor levels; and if so, the calculated dollar flood damage for that property.

Typically damage estimation for a 60,000 property sized database using 7 floods takes approximately 30 minutes to complete using a Pentium 600 machine.

Analyse results

The purpose of this step is to undertake statistical flood damage analysis by suburb or by Council division (electoral boundaries). The analysis involves estimating the number of properties affected in each suburb or division and calculating the total dollar cost by suburb or by division.

The results for each flood surface are stored in a MapInfo table. Each table contains damage statistics for each suburb or division, e.g. number of dwellings flooded above property, garage and floor level, the damage cost per suburb/division etc.

View results

The purpose of this step is to view the results prepared in the previous step. Various degrees of flooding can be viewed through selecting the depth of flooding - as shown in *Figure 3.*

An example of the results is shown in *Figure 4.* Stars indicate potentially affected properties.

Model limitations

In its current form the model has several limitations. These are:

- Unless a property is surveyed, it cannot be said with any confidence that the property will be actually flooded for a given event. This is because the dwelling floor level is derived from a statistical relationship between the estimated topographic level for the property centroid and surveyed floor level. This relationship, while providing reliable average results, is not correct on a property by property basis.
- This model does not calculate commercial or industrial damage. However,

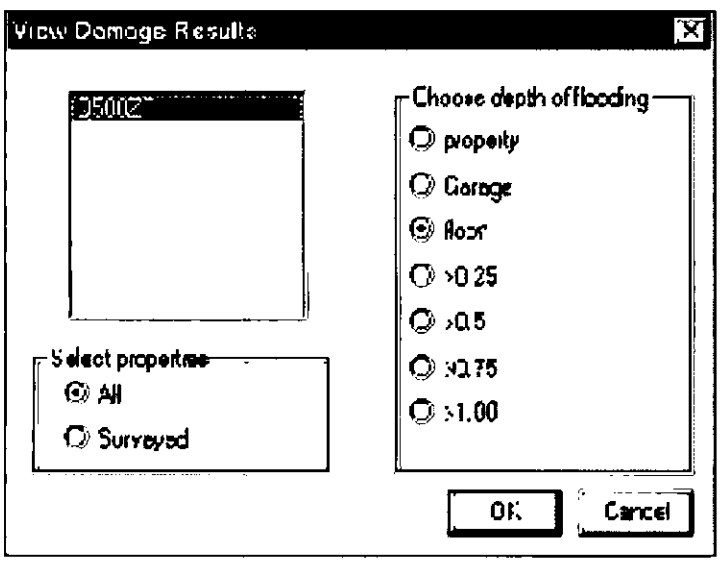


Figure 3: Menu to view results.

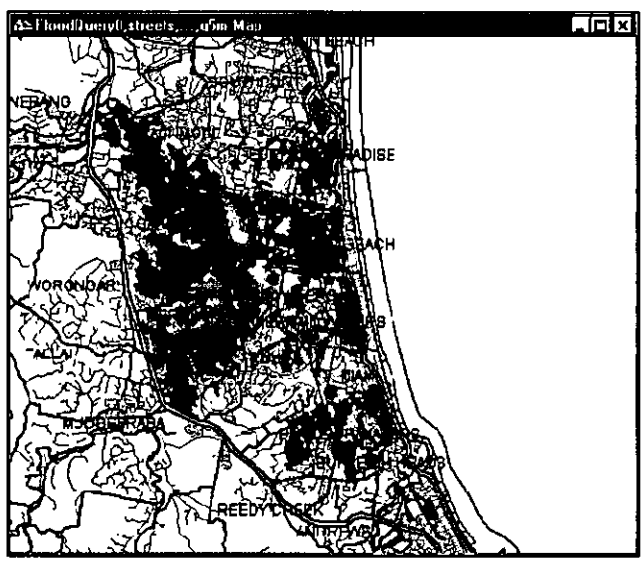


Figure 4: Typical results from flood damage model—note also the flood surface grid.

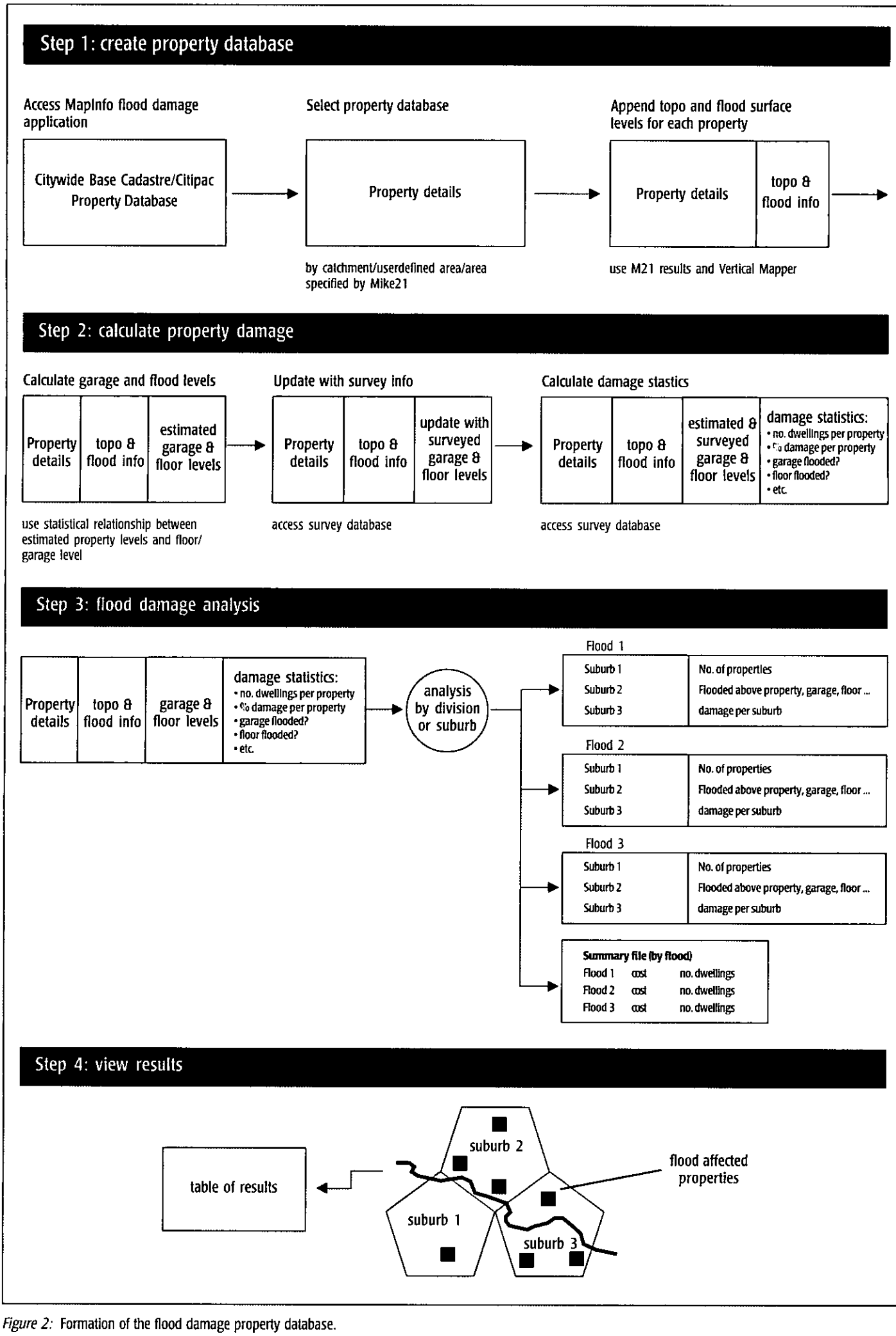


Figure 2: Formation of the flood damage property database.

these can easily be incorporated using dollar damage–square metre relationships predominantly used for commercial and industrial properties.

- The model does not take explicit account of the duration of flooding that a dwelling may experience. This is currently an area of research and has not been widely applied in practical applications throughout Australia.
- Finally, the stage-damage parameters, and parameters that define the relationship between topographic DEM and floor level are 'hardwired' in the model. However, changes are being made to allow the user to define these parameter values. This will be done by creation of a special initialisation file that the model can read and assign parameter values accordingly.

Model testing/calibration

The results of the model were tested against those results prepared by the Water Studies 1997 report 'Flood Damage across the Nerang Floodplain' (Water Studies, 1997).

The Water Studies approach used distributions of flooding depth derived from surveyed properties, and applied this distribution on a suburb by suburb basis to all flood affected dwellings.

The flood damage results of both models were found to be within 20% of each other, after allowance was made for use of differing surveyed dwelling data sets.

Flood damage model use

The flood damage model has now been used several times in different ways.

Development testing

Testing the relative impacts of development by comparing the flood damage statistics pre- and post-development. This not only provides the number of properties/dwellings affected by a particular development but the financial impacts and individual identification of properties that would be disadvantage by the development.

Flood mitigation works

Flood mitigation projects that would reduce the impacts of flooding can be similarly assessed. The results provide the financial benefits of mitigation projects that can be used in benefit-cost studies. Such projects currently being examined include dredging, bridge replacement or modification, weir modification, and dam raising.

Floodplain planning

Council has recently completed a study of the Tallebudgera and Currumbin Creeks in the southern part of the City, conducted under the auspices of the Natural Disasters Risk Management Studies Program. Both creeks are subject to the coincident events of storm surge and flooding and in this study, it was found that storm surge is a significant problem. A series of rainfall and coincident storm surge events were routed through hydrologic and hydraulic models and the flood damage model.

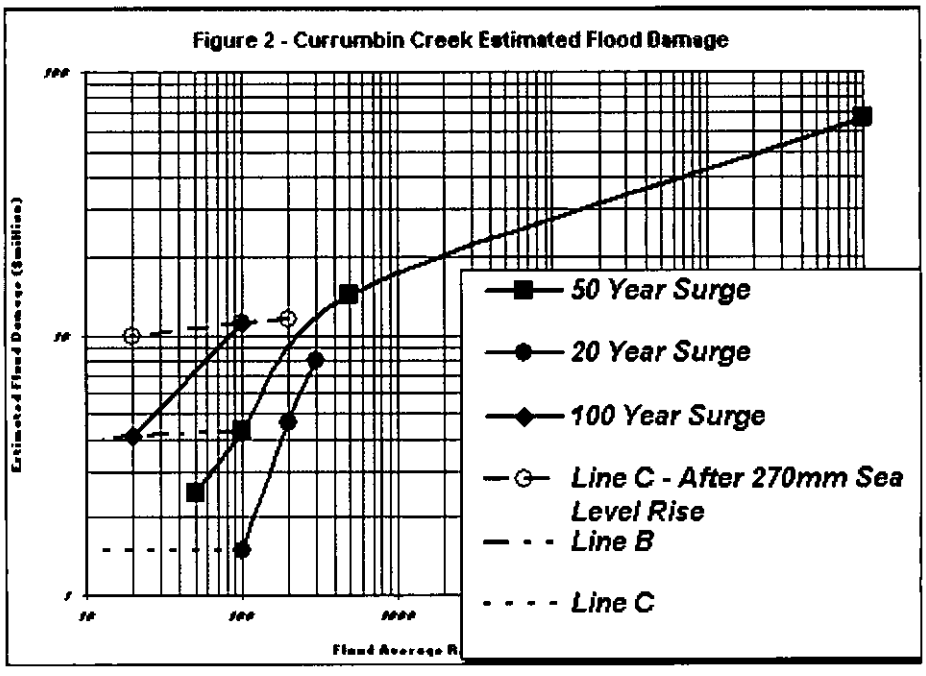


Figure 5: Currumbin Creek–residential property damage

It was postulated that:

- For any given tidal surge, there is a flood of sufficient magnitude to force the saltwater prism from an estuary. A larger surge requires a larger flood. The form of a plot of the envelope of flood and surge probabilities will be different for each riverine system depending on the shape and hydraulic capacities of the waterways and floodplains, as well as the relative locations of the floodplains.
- In fully developed floodplains, flood damage is a coarse indicator that could suggest the interdependence of storm surge and flood magnitude and the shape of the envelope.

Plots of flood damage vs. inundation probability are shown in *Figure 5* (a reprint of Figure 2 in the NSRMSP report – GCCC 2001). A series of dotted lines (A, B & C) have also been drawn on the graph.

- Line B is a line drawn between the 1:100 year surge/1:20 year flood and 1:100 year flood/1:50 year surge points. (This line most closely represents the likely coincidence of flooding and storm surge as now perceived).
- Line C is a repetition of Line B except that an amount of 270 mm has been added to the storm surge levels as an allowance for future sea level rise under 'Greenhouse' climate change conditions.

Note that the damage is for residential property only. The area below Line C and to the left of the 1:100 year flood probability represents the likely future risk to existing development, and provides an inundation envelope below which future development should not be permitted.

Further analysis is required to examine the likely impacts of higher rainfall intensities and storm surge impacts when global warning scenarios are further advanced. (The same conditions are being recommended for Tallebudgera Creek).

Conclusion and future directions

A flood damage model has been developed that integrates the Gold Coast City Council's property and rating databases, flood model results (via grids) and topographic DEMs. The model, while sophisticated in its database access, management and analysis, is very simple at the elemental level i.e. the calculation of flood damage for each property.

The model has been successful because the flooding impact of development proposals and flood mitigation options can now be routinely assessed in dollar terms.

Furthermore model outputs can be viewed visually, so that risk assessors can assess where key damage areas are. The results can be also analysed by electoral division so that elected representatives can get a better sense of flooding problems within their division.

The model when used in combination

with other GIS/Hydrological model routines provides Council the ability to assess the city-wide flood damage impact due to proposed changes in land use/town planning zones.

It is anticipated that as more dwelling floor levels become surveyed, the model will be used in real time to assist Emergency Services personnel prioritise evacuation strategies in the event of the major flood.

At some time in the future it would be desirable for the model to be extended to include commercial properties but that will mean the development of appropriate stage-damage curves.

References

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About the Author

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This article has been refereed

Wollongong storm of August 1998: a survey of affected residents two years on

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Introduction

Wollongong with a population of 177,000 is situated about 70km south of Sydney, NSW. It has unique geographical features that contribute not only to its beauty, but also to its vulnerability in storm events. Many small creeks traverse this narrow coastal strip. Previous floods in the Wollongong area have caused landslip, railway embankment collapse and flash flooding into homes, businesses and property.

Persistent rain fell in the Wollongong area from late July to early August 1998. Between 15 and 17 August, parts of the Wollongong catchment received up to 375 mm. On 17 August 1998, suburbs from Helensburgh in the north to Dapto in the south experienced steady rain with heavy downpours between 1500 and 1530 Eastern Standard Time (EST) and between 1700 and 2000 EST. The highest 24-hour total was 445mm at Mt Ousley. This rain saturated soils and filled drains and creeks. The most intense rainfall was around 1900 EST. This storm event resulted in one death, widespread flash flooding, road and rail disruptions and considerable property damage (Evans & Bewick 1999).

The storm had a devastating effect on residents in Wollongong. Anecdotally, many people still experience anxiety when it rains. In addition, there was community concern that lessons from the storm event were not learnt by individuals, Wollongong City Council (WCC) or government agencies. This paper investigates ongoing anxiety when it rains, community preparedness for another storm and current attitudes to the actions of WCC, government agencies and insurance companies with regard to storm/flood issues.

Method

Sample

A survey of residents affected by the Wollongong storm of 17 August 1998 was undertaken in August 2000. A self-completed anonymous questionnaire was mailed to people registered with the Wollongong Storm Water Action Group (SWAG), a community action group formed in the aftermath of the storm. Media releases were sent to the Illawarra Mercury, the Advertiser and ABC and Wave FM radio stations on 7 August 2000. The study was approved by the University of Wollongong's Human Research Ethics Committee.

A draft survey was completed mid-July 2000 and the completed questionnaire was distributed a week before the second anniversary of the storm, 17 August 2000.

Data analysis

Statistical analysis was undertaken using Epi Info 6 (Centres for Disease Control 2000). Descriptive statistics were used to describe the sample characteristics. Means, standard deviations (SD) and medians were calculated for years living at residence and depth of water in home and yard. Chi square test (x^2) was used for relationships between the present level of anxiety and preparedness as well as the present level of anxiety and the perception of the likelihood of another storm. Statistical tests were considered significant if $p < 0.05$.

Results

Subjects

Two hundred and eight surveys were

Characteristic		% (number*)
Age	18-24	1.5 (3)
	25-34	8.7 (18)
	35-44	24.6 (51)
	45-54	22.7 (47)
	55-9-64	16.9 (35)
	65 and over	25.6 (53)
Sex	Male	41.9 (85)
	Female	58.1 (118)
Home building insurance	Yes	97.0 (196)
	No	3.0 (6)
Home contents insurance	Yes	89.9 (187)
	No	10.1 (21)
Home building insurance paid	Yes	67.2 (131)
	No	32.8 (64)
Home contents insurance paid	Yes	77.1 (158)
	No	22.9 (47)
Past flooding of home (prior to August 1998)	Yes	24.1 (48)
	No	75.9 (151)
Flooding of home (since August 1998)	Yes	23.4 (47)
	No	76.6 (154)

* Do not add up to n=208 as some questions unanswered

Table 1: Characteristics of sample (n=208).

Characteristic	Mean (SD)	Range, median
Number of years living at residence (at time of storm)	18.3 (13.6) years	1 - 58, 16 years
Depth of water in home (as a result of storm)	482.3 (591.2) cm	0 - 5000*, 300 cm
Depth of water in yard (as a result of storm)	982.3 (624.2) cm	0 - 5000*, 1000 cm

*5000cm depth self-reported in Fairy Meadow

Table 2: Other characteristics of sample (n=208).

	none % (n)	very little % (n)	little % (n)	some % (n)	quite a lot % (n)	a lot % (n)
Before storm						
Anxious	62.4 (121)	13.9 (27)	6.7 (13)	5.2 (10)	6.7 (13)	5.2 (10)
Angry	78.9 (142)	8.9 (16)	3.9 (7)	0.6 (1)	2.2 (4)	5.6 (10)
Unsafe	70.9 (134)	11.1 (21)	4.8 (9)	2.1 (4)	6.3 (12)	4.8 (9)
Immediately after storm						
Anxious	2.1 (4)	3.6 (7)	8.8 (17)	18.0 (35)	25.8 (50)	41.8 (81)
Angry	14.4 (25)	11.5 (20)	3.4 (6)	21.3 (37)	11.5 (20)	37.9 (66)
Unsafe	10.9 (20)	6.5 (12)	8.7 (16)	14.7 (27)	19.6 (36)	39.7 (73)
Now (2 years after storm)						
Anxious	9.2 (18)	10.7 (21)	12.8 (25)	24.0 (47)	16.8 (33)	26.5 (52)
Angry	26.9 (47)	9.7 (17)	9.7 (17)	16.6 (29)	8.6 (15)	28.6 (50)
Unsafe	19.7 (35)	12.4 (22)	12.9 (23)	18.0 (32)	12.4 (22)	24.7 (44)

* Do not add up to n=208 as some questions unanswered

Table 3: Anxiety, anger and safety before storm, immediately after storm and two years on (n=208*).

returned from 152 households representing a 51% (152/296) household response rate (296 households reached by the mail-out). Thirty-seven per cent of replying households sent back two surveys. Surveys were returned from Wombarra in the north to Dapto in the south with Figtree having the largest number of respondents (20%). *Tables 1 and 2* represent demographics of the sample.

Levels of anxiety, anger and safety

Responders were asked to rate their levels of anxiety, anger and safety during storms for three periods—before 1998 storm, immediately after and now (two years on). The 'quite a lot' and 'a lot' responses for now were combined and indicated that 43% still experience high levels of anxiety, 37% anger and 37% feeling unsafe (*Table 3*). This can be compared with the levels before the storm and immediately after the storm. Counselling was sought by only 8%.

Effect on children

The effect on children was examined with many parents reporting children still anxious in heavy rain. Out of 152 responding households, 43 households had 92 children (less than 18 years old). Eighty-six per cent (37/43) of these households with children reported that their children experienced anxiety when it rains. Some of the reported effects at the time of the storm and soon after included anxiety and panic attacks in rain, feeling unsafe, sleep disturbances including nightmares, behavioural problems, disruption to school and other studies (Higher School Certificate) and breakdown in family relationships. Fifty-eight percent (25/43) reported that they still have problems two years on.

Preparedness

Fifty-two per cent felt more prepared in the event of another storm. These residents described positive actions such as removing carpets, raising storage areas and instigating a safety plan. Forty-eight per cent felt that there was nothing that they could do to lessen the risks. Accordingly, 41% had made changes to their home and/or property and 59% had not made any changes. Responses were also sought for the frequency of monitoring their local creeks and the perception of the likelihood of another storm (*Table 4*).

Relationship between two responses

The relationship between the present level of anxiety and preparedness was significant (x^2= 14.07, p = 0.015). The relationship between the present level of anxiety and the perception of the likelihood of another storm was also tested but Chi square analysis was not valid, as expected values were less than 5.

Attitudes

The surveys found that 82% of respondents were angry with WCC. The reasons most frequently cited were the perception of not being listened to and WCC's apparent inaction. Some of the actions that respondents felt were necessary to lessen their anger with WCC were:

- better long-term planning
- limited/careful development near watercourses, on the escarpment, and in flood-prone areas
- consideration of downstream properties in upstream development.

Nineteen per cent of respondents were still angry with insurance companies. Respondents in some areas were angry at the Roads and Traffic Authority (RTA) (5%) and the State Rail Authority (SRA) (2%) for the effect of road design and railway embankments on flooding in their area.

Five per cent of respondents were angry at the Collieries' role in their flooding and property damage (*Table 5*).

Factors that increase the chance of flooding were also investigated. Ninety-two per cent of respondents nominated

Statement/response		% (number*)
Feel more prepared	Yes	52.4 (88)
	No	47.6 (80)
Changes made to home	Yes	41.4 (77)
	No	58.6 (109)
Monitor creek	Constantly	42.7 (88)
	On/off	39.8 (82)
	Never	17.5 (36)
Likelihood of another storm	Very likely	26.3 (54)
	Likely	23.9 (49)
	Not sure	33.7 (69)
	Unlikely	10.2 (21)
	Very unlikely	5.9 (12)

* Do not add up to n=208 as some questions unanswered

Table 4: Preparedness for another storm/flood (n=208*).

Party (more than one party is allowed)	% (number)
Wollongong City Council	81.7 (170)
Insurance company	18.8 (39)
Government - State/Federal	5.3 (11)
Collieries (BHP and Allied)	5.3 (11)
Roads and Traffic Authority	4.8 (10)
State Rail Authority	2.4 (5)
Developers	1.7 (3)
Environment Protection Authority	1.0 (2)
Department of Community Services	1.0 (2)
Neighbour/s	1.0 (2)
Department of Urban Affairs and Planning	0.5 (1)
Department of Land and Water Conservation	0.5 (1)
Sydney Water	0.5 (1)
State Emergency Service	0.5 (1)
Bureau of Meteorology	0.5 (1)
Media	0.5 (1)
Solicitor	0.5 (1)
Hydrologists	0.5 (1)
Others (private parties)	1.9 (4)

Table 5: Parties that you are angry at now, two years on (n=208).

Factors that increase the chance of flooding in your area (more than oneresponse allowed)	% (no.)
Creek maintenance (lack of)	92.3 (192)
Urban development	72.6 (151)
Main roads	40.9 (85)
Climatic change	26.9 (56)
Railway embankments	20.2 (42)

Table 6: Factors that increase the chance of flooding in your area (n=208).

the lack of creek maintenance while 73% chose urban development (*Table 6*).

Discussion

Anxiety

In this survey, the level of anxiety when it rains remained high two years on. Those reporting 'quite a lot' and 'a lot' of anxiety when it rains reduced from 68% immediately post storm to 43% two years later. This is not unexpected. According to past research into natural disasters, major stress and health effects diminish, but do not disappear one year after events (Clayer et al. 1985).

As the question about anxiety when it rains did not clarify intensity of rain, the reported levels may be underestimated. The number responding 'quite a lot' and 'a lot' may have been higher if the question asked about 'heavy rain'.

The relationship between anxiety and insurance status is not known. The effect of either being uninsured or having claim denied on anxiety levels was not examined. Further, the impact of flooding before and since the 1998 storm was not tested against anxiety levels. Additional analysis of available data is necessary to investigate these relationships. Furthermore, the magnitude of loss as a result of the storm was not measured and therefore its relationship with anxiety levels is also unknown.

Few residents sought formal counselling. The Department of Community Services, the University of Wollongong, church and other organisations offered counselling shortly after the storm event. It may be that affected residents were preoccupied with the clean up as well as the struggle to get paid. Many attended community meetings and demonstrations against insurance companies. This has implications for the timing of counselling services with counselling recommended for those still experiencing problems.

Further, families, friends and neighbours were an integral part of many people's emotional recovery. The importance of informal counselling and the power of community action in helping people cope and feel some sense of control cannot be understated.

The effect on children was harder to interpret as an open question was used and that brought a variety of responses. However, based on this survey's responses, further study into the effect of severe storm events on children is recommended. Again, counselling may benefit children with ongoing problems related to the storm/flood.

Preparedness

As the level of anxiety was related to preparedness, increasing and maintaining preparedness is essential. Lustig & Maher (1997) discussed declining community preparedness as one of the barriers to sustainable floodplain management plans. Around a quarter of the respondents had been flooded before and since (Wollongong was hit by another storm in October 1999, but on a smaller scale). Experts have stated that it will happen again. Further, there are ongoing examples of developments with significant flood risks still being highlighted in the media (Lustig & Irish 2000).

In addition, more community education on flood mitigation is needed. Almost half of the respondents felt that they could not lessen the risks of future flooding. At the time of writing this paper, the State Emergency Service (SES), NRMA and WCC released the 'FloodSafe in the Wollongong Area' brochure (SES 2001). This is a step in the right direction. However, more detailed information is needed. Lustig & Maher (1997) made several suggestions for sustaining community preparedness.

The relationship between the level of anxiety and the perception of the likelihood of another storm was not established in this survey. In reality, this is not a simple relationship. There are many complex issues in risk communication. However, discussion of the subject is beyond the scope of this paper.

Attitudes

Initially, both the insurance companies and WCC were the target of people's frustration. Two years on, the insurance company fight was all but over. The community turned their attention to prevention and saw the WCC in the central role. There was concern over inadequate creek and drain maintenance and inappropriate urban development. Both factors were nominated by a large number of respondents as increasing the chance of flooding in their area.

The question of responsibility for creek maintenance is raised. There appears to be confusion about this issue with most respondents nominating WCC as the sole body responsible for maintenance of creeks. A few respondents mentioned private landowners and the Department of Land and Water Conservation (DLWC).

The community should be clearly informed about the role of all relevant authorities in maintenance of their local creek. A coordinated approach is required but the reality is that coordination between government agencies is problematic (Lustig & Maher 1997).

Further, these government authorities should engage in more community consultation. The majority of respondents were angry with WCC as they felt that their concerns were not addressed. Lustig & Maher (1997) discussed the importance of representatives from the flood-prone community on floodplain management committees. By mid-2001 the WCC had commenced the appointment of community representatives on such committees. It is hoped that these Floodplain Management Committees operate permanently, not only when Floodplain Management plans are being drawn up (Lustig & Irish 2000).

WCC was also blamed for inappropriate development that has increased flood risks in many areas. Very few respondents mentioned other government bodies. In this concern, the role of departments such as the DLWC and the Land and Environment Court (L&E Court) is not clear to many residents. Lustig & Irish (2000) suggested that the DLWC and the L&E Court take more responsibility in opposing inappropriate developments in Wollongong.

In some areas, respondents were angry with RTA and SRA. The responsibility of these authorities in development issues that impact on flooding in any area is undisputed. Again, a coordinated approach with community consultation is essential.

Many respondents were still angry with insurance companies. It is unclear how many of these had their claim denied by their insurance company. While most insurance companies paid, with some making changes to their policies to cover some types of flooding, there is no guarantee for the future. The debate about wording of these policies will continue and puts at risk future coverage. In addition, flood insurance does not assist those in our community who are unable to afford insurance (Buckle & Fleming 2001). Most affected residents would agree that insurance or no insurance, they do not wish to repeat the experience.

A smaller proportion of respondents was angry at coalmines. This reflected the experience of residents in the suburbs of Keiraville and Bellambi who had tonnes of coalwash and sludge in their homes. The former BHP Kemira mine and Allied's Bellambi colliery are located along the escarpment and have coal stockpiles which were lost in the heavy downpour on 17 August 1998. Discussion of the issues surrounding these coalmines and the 1998 storm is worthy of further investigation.

Limitations

The survey was only sent to people on the SWAG mailing list. Therefore the responses cannot be generalised to the wider community who was affected by the August 1998 Wollongong storm. In addition, it is not known whether responders differed from non-responders in any significant way. Further, the survey was undertaken at the second anniversary of the storm, which may have heightened people's responses in the questionnaire.

The questionnaire was considered an appropriate measurement tool for this study. However, it is important to acknowledge some of its limitations. As this questionnaire was not piloted, some of the questions may have been misunderstood. Moreover, the problem of recall and influence of wording and ordering of questions on responses necessitated careful interpretation of the findings.

Conclusion

Based on the findings of this survey, the Wollongong storm of August 1998 had a significant impact on affected residents long after the initial clean up. This is evidenced by ongoing feelings of anxiety in rain for adults and children, many still feeling unprepared for another storm and the persistent anger toward the actions of WCC and other government bodies. To address these problems, recommendations are made for counselling, community education sessions on flood mitigation, more community consultation by local and state government agencies and a coordinated approach to storm/flood management by all relevant authorities. It is essential that the storm/flood issue stays on the public agenda and that the community continues lobbying for changes to floodplain management and urban development in the Wollongong area to lessen future flood risks.

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Acknowledgments

The author would like to thank Dr Irene Kreis (Head of Illawarra Environmental Unit, University of Wollongong) for assistance with the preparation of the survey, media releases and the use of Epi Info. In addition, the author would like to thank Jim Irish (University of Technology), Dr Terry Lustig (Environmental Management) and Richard Nederkoorn (President, SWAG) for comments on the survey.

The survey was predominantly self-funded with financial assistance from the Illawarra Environmental Health Unit (photocopying and postage) and Wollongong SWAG (postage).

About the author

Anita Fletcher's family home of 20 years was one of the many Wollongong homes affected by the storm of 17 August 1998. She acted as secretary for Wollongong SWAG and continues her interest in floodplain management and urban planning in the region and insurance policy changes. This study was undertaken while she was in her final year of a Master of Public Health degree at the University of Wollongong. However, the study was done in her own time and did not form part of her Masters requirement. She works as a Physiotherapist with the Illawarra Area Health Service.

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This article has been refereed

Natural hazards mitigation in Tulsa:

the role of strategic policy innovation and social learning

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Introduction

In an ideal world, communities would learn from their experience with natural hazards and undertake actions to mitigate the risks associated with repeat events. Unfortunately, the real world is fraught with recurrent disasters, often afflicting the same communities in an insidious and destructive manner. Indeed, such was the case for Tulsa, Oklahoma (USA), a city that was subject to episodic and continuing flash-flooding hazards through the mid 1980s.

Fortunately, the city undertook a series of concerted actions to mitigate its vulnerability to flooding, and has now attained international renown for its achievements in natural hazard mitigation. Tulsa's transformation from hazard victim to hazard manager is a fairly well-known story (e.g. Patton 1993; 1994), but the specific role of the individuals who helped to design and implement the city's disaster-reduction strategy is less appreciated. Knowledge about entrepreneurial individuals who champion new public policies, or policy entrepreneurs, is important if society is to design effective approaches to mitigating natural hazards and building a more sustainable future (FEMA 2000).

In this article, we frame the issue of Tulsa's struggle with natural hazards in the context of public policy innovation, and focus attention on the role of the policy entrepreneurs whose inspiration and dedication to policy change and learning helped the city to mitigate its hazards in a more effective and enduring manner. Our focus on policy entrepreneurs mirrors growing interest in how policy innovations, particularly those innovations that advance prospects for sustainabilty, can be better understood and applied in various social contexts.

To this end we review current interest in policy innovation and illustrate the process in a brief review of Tulsa's flooding problems in its Mingo Creek watershed that illustrates what actions were taken to mitigate them. Next, we describe a recent study that identifies the strategies Tulsa's policy entrepreneurs adopted to overcome a variety of barriers to innovation, and discuss the implications of the findings for natural hazards policy and prospects for sustainability.

Policy innovation and learning

How innovation in public policy, or policy innovation, occurs has been the subject of a growing amount of scholarly interest in recent years for several reasons (Mazmanian and Kraft 1999; Stephan and Scheberle 2000). First, the federal government has been actively promoting the devolution of many of its programmatic responsibilities to the states and municipalities without concomitant resources. Moreover, municipal governments in the U.S. have been increasingly subjected to a variety of unfunded federal mandates, many of them environmental quality requirements, which obligate them to do more with less. In addition, federal funding for public programs has been precarious in recent years while urban problems have continued to mount. The growing trend toward the privatisation of public sector functions, which has ushered in the need to foster workable public-private partnerships, has also placed a premium on an improved understanding of the policy innovation process. Finally, understanding policy innovation is central to the national commitment to develop a more sustainable society.

Kingdon (1984) and Polsby (1984) were among the first researchers to examine the general patterns of policy innovation in government. Kingdon's well-known argument that the conditions for innovation are optimal when the politics, problem, and policy streams converge at a *window of opportunity* has been applied by several researchers in a variety of policy contexts (e.g. Birkland 1997; Rabe 1986). While the notion of a window of opportunity has penetrated both the policy analytic community as well as the general public's vocabulary, Kingdon's characterisation of the policy entrepreneur as a participant who motivates policy change had not received much attention by analysts until recently. Polsby's characterisation of policy innovations as either *acute* or *incubated* shed light on the distinctive difference between innovations that evolve relatively rapidly over time with limited information and few decision makers, such as the US reaction to the launch of the first Soviet satellite, Sputnik, compared to those that require a good deal more time to accommodate multiple decision makers, conduct technical studies, and become more widely accepted, such as the movement toward economic rationality (i.e. deregulation) that has become a growing trend in federal government programs.

More recently, Behn (1988) characterised his view of policy innovation as *groping along* since it best describes the trial-and-error approach that many agency managers experience in the uncharted and chaotic course of finding workable solutions to their problems. Behn suggests that managers have a clear sense of their agency's mission, but lack the time, resources, and stable environment necessary to develop comprehensive workable solutions. Rather, they grope along toward a solution, building experience, information, and momentum to attain their ultimate success one small step at a time.

In contrast, Golden (1990) found that a *policy planning* approach better addressed the experiences she examined in several human service organisations. The policy planning model differs from groping along due to the former's need for existing legislation that structures the innovation process, the existence of a clear idea and a method of implementation, a greater emphasis on time allocated to planning, and the limited amount of change expected from the innovation. Another valuable contribution is Sabatier and Jenkin-Smith's (1993) development of an advocacy coalition framework (ACF) that defines the conditions under which policy change and learning are most likely to advance. The ACF model captures the value

orientation of advocacy coalitions and describes the role that scientific and technical analysis play in policy deliberation and debate, but it tends to minimise the role of individual policy entrepreneurs in the policy innovation process.

The role of the policy entrepreneur has been addressed by several researchers, who suggest that the ultimate success of an innovation can be traced to the strategic actions that one or more entrepreneurs motivate in the course of an innovation. Deyle et al. (1994) studied the evolution of state coastal erosion policy and found that entrepreneurs were essential to the success of policy innovations in coastal management for several reasons. In the coastal setting, effective entrepreneurs understood the context of environmental issues and their policy relevance quite well. They also understood the importance of technical expertise and research that provided a sound scientific basis for assessing promising alternatives. While they acted in response to Kingdon's window of opportunity, they were also quite skillful in helping to open a window when needed. In their study of school vouchers, Roberts and King (1996) found that policy entrepreneurs were frequently drawn from a variety of occupations, interests, and backgrounds.

To advance understanding of the innovation process, Roberts and King (1996) developed a typology of entrepreneurs and applied it to their voucher study. They found that a policy entrepreneur could participate in an innovation at one or more levels of involvement, but that the degree of participation and the professional career status of the entrepreneur could be used to further define the role being performed. For example, policy intellectuals typically help to foster new ideas or alternatives. Policy advocates can help to advance new ideas but also develop them, sometimes through a prototype demonstration. Policy entrepreneurs (as Roberts and King define the term) motivate new ideas, demonstrate them, and implement them. Policy champions do the latter two steps. Policy administrators simply implement the innovation. Further specification can be assigned if the entrepreneur is employed in government (policy entrepreneur), holds a leadership position (executive or bureaucratic entrepreneur), or is publicly elected to office (political entrepreneur).

A recent review of leading policy innovations in the U.S. was reported on by Altshuler and Behn (1997) who used the Ford Foundation's annual competition in *Innovation in American Government* at Harvard's Kennedy School of Government as their database. Among other findings, the authors identified a dozen impediments to innovation that delay or prevent entrepreneurs from attaining successful implementation (see *Table 1*).

These impediments are categorised as:

- accountability dilemmas (who is responsible for innovating?)
- paradigm dilemmas (how can we be innovative thinkers?)
- analytical dilemmas (how much analysis should be done?)
- structural dilemmas (how do organisations stimulate innovation?)
- replication dilemmas (how do we transfer an innovation?)
- motivation dilemmas (who will innovate?).

Using the same database, Borins (1998) analysed the key success factors for all of the finalists in the Kennedy School database. Specifically concerning environmental innovations, he drew the following conclusions.

First, environmental programs are holistic; they increasingly involve systemic thinking about the management of entire ecosystems.

Second, environmental activists can be a valuable resource and support to policy entrepreneurs.

Third, policy entrepreneurs should rely on market mechanisms and user fees to support and enforce environmental programs.

Fourth, environmental innovations tend to involve politicians and public servants in different ways, with substantial movement across bureaucratic and political arenas.

Fifth, planning and policy analysis play an important role in the success of environmental innovations.

This list is instructive for the Tulsa case, since it suggests that environmental innovations necessitate more scientific and technical analysis than other kinds of policy innovations. It also implies that success flows from the ability of entrepreneurs to cross-organisational boundaries and to facilitate the interaction of political and nonpolitical actors.

In sum, the literature provides several insights into the conditions for successful policy innovations. Clearly, a variety of policy entrepreneur types must find ways to overcome impediments that are contextual and dynamic. In the case of environmental policy innovations, research indicates that a systems view blended with a variety of perspectives can foster useful alliances with advocates as well as strategies for program design, demonstration, and implementation. Knowledgeable policy entrepreneurs thus often behave in a strategic manner in the way they address these challenges. It is this blend of strategic actions that are observable in the innovation process that is referred to as strategic policy innovation.

Mitigating flash-flooding hazards along Mingo creek

Tulsa's history of flash-flood hazard

Accountability dilemmas—who is responsible for innovating?
Authorisation dilemma—be creative but hold yourself accountable.
Failure dilemma—who accounts for failure?
Customer dilemma—do you work for agencies or elected officials?
Paradigm dilemmas—what is the nature of the 'box' that motivates new ideas?
Routinisation dilemma—mind the rules.
Scale dilemma—how big should innovations be?
Analytical dilemma—how much analysis should be done?
Structural dilemmas—how innovative is the organisation?
Organisational-diversity dilemma—complexity of the task structure and incentive system determines the degree of innovativeness.
Federalism dilemma—institutional fragmentation impedes widespread adoption.
Replication dilemmas
Adaptation dilemma—what should be copied?
Organisational-adaptation dilemma—how can organisations adapt?
Dissemination dilemma—what are the hidden problems in an innovation?
Definitional dilemma—what aspects of an innovation can be replicated?
Motivation dilemmas
Media dilemmas—mean-spirited journalists can punish failure.
Reward dilemmas—what kinds of rewards will motivate innovations?
Elected-official dilemma—fear that failure can mean loss of job.

Table 1: Impediments to Innovation (after Altshuler and Behn 1997).

mitigation closely tracks and intersects with the national flood control experience at many different points in time. Accordingly, it has been convenient for authors to frame the city's trials and successes with its flooding problem within the specific eras of flood-hazard management that characterise the US effort in general. Flanagan (Flanagan and Associates 1994) and Patton (1993) refer to these eras as: the Structural Era of Flood Control (1928–1966); the Regulatory Era of Floodplain Management (1968–1978); and the Non-structural Era of Floodplain Management (1979–present). As it is for many federal, state, and local government policy innovations, the national context for flood control planning and management is important to understand the opportunities and constraints that confronted local policy entrepreneurs.

Expansion into the Mingo Creek drainage area began during the post-World War II suburban expansion in Tulsa. A second population boom occurred in Tulsa in the 1960s, leading to increased urbanisation of the city's floodplains. Despite repeated flooding of these floodplain areas in the late 1950s, development continued nonetheless. Arkansas River flood control was addressed upstream of Tulsa with the completion of the Keystone Dam by the U.S. Army Corps of Engineers (USACE) in 1964. The Mingo Creek drainage area was annexed into the city limits in 1966. During the 1960s, the Mingo Creek watershed experienced one flood event every two to four years. Increasing urbanisation of the watershed caused each flood to be worse than its predecessor due to greater volumes of runoff.

At the national level, concern about the limitations of structural flood control techniques led to legislation (1960 Flood Control Act) and an Executive Order on Floodplain Management (EO 11296) that encouraged floodplain planning, technical assistance, and mapping.

In 1968, the passage of the National Flood Insurance Act ushered in a new era of floodplain management. That year in Tulsa, the noted landscape architect Ian McHarg pointed out to the city's leadership that it was locating its parks on high ground and its homes in the floodplains. McHarg suggested that the city adopt an approach that echoed its own 1924 plan by creating a network of linear parks that would serve the dual function of abating flood hazards and providing for a community trail system. This advice was not heeded.

The City of Tulsa experienced a series of severe floods along Mingo Creek in the 1970s. The first of these floods occurred on Mother's Day, 1970. Flooding along Mingo and Joe Creeks caused $163,000 in damages. Tulsa joined the emergency program of the National Flood Insurance Program (NFIP) later this same year. The following year, Tulsa joined the regular NFIP program. Tulsa promised, as a condition of joining these programs, to adopt a new standard based on a 100-year flood and new land-use regulations. The next major flood occurred four years later. Flooding in April and May 1974 resulted in damages totaling $744,000.

The City of Tulsa and the USACE realised that a comprehensive, regional, long-term strategy was required. The goal of the strategy was to prevent flood events through a combination of structural and non-structural measures.

A storm on June 8 that year resulted in flooding along Mingo, Joe, Fry, and Haikey Creeks and $18 million in damages. Mingo flooded for a third time in 1974 on September 19.

The devastation wrought by this series of events catalysed citizen action. Carol Williams, a Mingo Creek flood victim, formed a lobbying group with other flooded residents named Tulsans for a Better Community. Despite their growing numbers, the lobby met stubborn resistance from the city's leadership. The city had no flood management plan and little interest in developing one.

After the September flood, Bob Miller, a flooded homeowner and Tulsans for a Better Community member, travelled to Rapid City, South Dakota to study that city's floodplain acquisition program. Upon his return, he presented a slide show to the mayor that illustrated the feasibility of relocating homes (Patton 1993). By 1975, the city had designed and begun the Mingo Creek Improvement Project, a limited channel project that included a right-of-way clearance of 33 houses designed to protect 700 homes from floods comparable to those experienced the previous year.

The Memorial Day flood of 1976 was the most severe flood to that date. Ten inches of rain fell in three hours causing floods along Mingo, Joe, and Haikey Creeks. This flood led to three deaths and $40 million in damages. More than 3,000 buildings were damaged. Once again, Carol Williams pressed the city to take action, including a more aggressive floodplain acquisition program.

With the help of U.S. Congressman Jim Jones, funds for acquisition were secured through monies from Section 1362 of the flood insurance law. This approach later became national policy. Tulsans for a Better Community merged with the citywide Homeowners Coalition that was a more powerful advocate for change. After this flood, the USACE began working with the City of Tulsa to find a solution to the flooding problem that included 10 miles of channels and 23 upstream detention basins. In sum, the City of Tulsa implemented several innovations:

- a moratorium on building in the floodplain was enacted
- the first full-time hydrologist, Charles Hardt, was hired—Stan Williams was directed to draft city policies with regard to floodplains and development.
- the city was allowed credit or reimbursement by the federal government for Mingo Creek construction work undertaken since 1974.

The following year, 1977, saw the implementation of a series of flood control innovations:

- comprehensive floodplain management policies, regulations, and drainage criteria were developed
- stormwater detention regulations were enacted for new development
- an early alert and warning system was initiated
- master drainage planning for all major creeks was begun
- an earth change ordinance was enacted in 1978, giving the city control over alterations made to Tulsa's landscape.

The next major flood did not occur until eight years later. The Memorial Day flood in 1984 was the most devastating flood in Tulsa history. Fifteen inches of rain fell during the night. The flood accounted for 14 deaths, 288 injured, 7,000 buildings damaged or destroyed, and $184 million in damages. Damages along Mingo Creek accounted for 69 percent of the total monetary damage.

In the hours following the flood, newly

elected Mayor Terry Young organised a team comprised of himself, City Commissioner J. D. Metcalfe, Ron Flanagan, Charles Hardt, Ann Patton, and Stan Williams to assume the leadership of the city's largest and most innovative floodplain clearance and mitigation program. A paradigm shift in the city's understanding of how best to reduce flood hazards was now clearly underway.

The work of this initial Flood Hazard Mitigation Team led to the following results:

- three hundred flooded homes and a 228 pad mobile-home park were relocated
- a joint City of Tulsa and USACE detainment basin project was begun
- the Department of Stormwater Management was created in 1985 centralising responsibility for stormwater programs
- a maintenance program that cleared silt and debris from major creeks and tributaries was started in 1985
- a stormwater utility fee was established in 1986.

The City of Tulsa and the USACE realised that a comprehensive, regional, long-term strategy was required. The goal of the strategy was to prevent flood events through a combination of structural and non-structural measures. Partnerships with local, state, and federal agencies were part of the regional flood control strategy enacted by the City of Tulsa. The Mingo Creek Local Flood Control Project was completed in 1999. These policy innovations transformed Tulsa from one of the most frequently flooded cities in the nation into one of the least.

Policy entrepreneurs

The story of Tulsa's struggle with flooding documents the presence of a large number of policy entrepreneurs, each of whom made an important contribution to the ultimate success of the Mingo Creek project. The nascent strategy that the entrepreneurs developed was designed to draw several policy themes together in order to produce a more coherent and compelling flood control program. Over the course of time, the entrepreneurs learned much from the city's painful experiences with flooding and began to deploy more ambitious strategies that necessitated the development of an effective partnership with the USACE, access to more federal resources, increased flexibility in existing city ordinances and enactment of new ones that would address the system-wide aspects of the problem, and greater organisational capabilities and technical expertise to deal with the flood hazard in an effective and responsible manner. To illustrate more clearly how the different elements of this strategic approach worked together, Roberts and King's (1996) typology of policy entrepreneurs can be used to identify the types of policy entrepreneurs who were engaged in finding innovative policies to resolve Tulsa's flood hazard dilemma.

Two individuals who played a pivotal role as policy intellectuals for Tulsa were Ian McHarg and Gilbert White. McHarg, whose nontraditional views on the relationship between the natural environment and the design of built systems are known worldwide, was invited to Tulsa to educate the city's leadership about alternative ways to reduce flashflood hazards. Gilbert White, who has been the leading intellectual in the national movement toward non-structural solutions to flooding hazards for several decades, provided the necessary encouragement and information that helped to guide the policy entrepreneurs' overall strategy. Attendance by Tulsa policy entrepreneurs at the annual Workshop on Hazards Research and Applications organised by White in Boulder, CO, also proved quite beneficial.

Since the context in which the policy entrepreneurs operated was fairly fluid, it is not unreasonable that many policy entrepreneurs would change their jobs and even their careers in the period under discussion. Therefore, the classification of the entrepreneurs is divided into two periods associated with the most significant flood events: the 1976 and 1984 floods.

Post-1976 flood policy innovations

Several people qualify as political entrepreneurs due to their actions in this period. The first of these is U.S. Congressman James Jones. Jones was one of the key people working for Tulsa on a national front by ensuring the passage of the Water Resources Development Act. This had the far-reaching impact of allowing actions that Tulsa had previously undertaken locally towards flood prevention to count towards its share of federal flood control projects. This act would become very important in 1984 when the USACE received authorisation to work on Mingo Creek. Other political entrepreneurs included Norma Eagleton, Patty Eaton, and Robert Frandon, who built upon the work of former commissioners Bill Morris and Sid Patterson. Eaton and Frandon, who were elected in 1976, influenced several innovations including: declaring a moratorium on building in the floodplain; establishing stormwater detention regulations for new development; establishing new floodplain policies and drainage criteria; and hiring Stan Williams and the first city hydrologist, Charles Hardt (Patton 1994). They also encouraged the implementation of a rudimentary alert and warning system.

Three people qualify as bureaucratic entrepreneurs because they held formal, but not leadership, positions with the state or the federal government. Dell Greer became involved in the 1970s as a representative of the Federal Insurance Administration (which later became part of FEMA). He worked with Tulsa residents who were committed to solving the flooding problem. Greer worked with Tulsans, including Ann Patton and Carol Williams, to address the cause of the floods, which in some cases meant removing houses from the floodplain (Greer 1999). He became involved in 1974 and remained involved until the mid 1980s. Stan Williams and Charles Hardt were hired shortly after the flood. For the next few years, they were heavily involved in working on flood issues. Stan Williams worked on ordinances regarding the floodplains and development with Hardt (Hardt 1998).

Several people can be classified as policy entrepreneurs due to their involvement with the flooding issues and the fact that none held a position in government at the time. Ron Flanagan, a former city employee and planning consultant, offered his services to the flooded residents. Before 1974, Flanagan worked on zoning and planning issues with developers (Flanagan 1998). Beginning in 1974, Flanagan became intimately involved in the flooding problem along Mingo Creek. Flanagan, who helped educate the flooded residents about floodplains, was one of the people calling for a new method of flood control in the Mingo Creek watershed. Ann Patton was an activist, who as a newspaper reporter, covered flood stories and addressed the causes of the floods and the possible alternative solutions that could be employed to mitigate them. The articles she wrote encouraged new ways of approaching the flooding problem and placed pressure on the city government to act. Carol Williams was also involved with the citizens' movement demanding that something be done. Williams' house had been flooded three times in the mid-1970s, which motivated her to become very active in citizen groups, including Tulsans for a Better Community. She played an important role in organising these groups and in educating them about flood issues. Finally, J. D. Metcalfe, president

of Standard Industries, was responsible for helping organise the Floodplain Symposium in 1976 and inviting Ian McHarg to lecture at this presentation. Metcalfe took an active role in the flooding issues.

Post-1984 flood policy innovations

Several of the people identified as entrepreneurs in the post-1976 flood innovations also qualified as entrepreneurs in the post-1984 flood innovations. Their classifications, however, have been changed due to the different roles they played in 1984 and afterward.

Terry Young and J. D. Metcalfe were both political entrepreneurs. Young and Metcalfe were newly elected as Mayor and Street Commissioner, respectively. They assumed office only 19 days before the 1984 Memorial Day flood and were responsible for several of the more significant innovations that were implemented during that time. Mayor Young called Metcalfe the night of the flood and assembled the first Flood Hazard Mitigation Team, which was responsible for developing the mitigation measures put in place following the flood. Mayor Young decided to move those houses that had flooded repeatedly out of the floodplain. He also played a critical role in getting approval to use federal flood insurance money, combined with City of Tulsa monies, in the home buyouts.

In the aftermath of the flood, Young and Metcalfe continued their flood-prevention activities. Together, they were able to sell the public on the joint City of Tulsa-USACE plan for detainment basins. Young and Metcalfe were responsible for the creation of the Department of Stormwater Management. In 1985, they started a maintenance program that would clear debris out of major creeks. They also created the Stormwater Drainage Advisory Board (SDAB), a citizens' advisory board.

Four people qualify as executive entrepreneurs: Stan Williams, Neal McNeill, Charles Hardt and Michael Buchert because they occupied agency leadership positions. Stan Williams was hired as an assistant city attorney as part of the Flood Hazard Mitigation Team in 1984. He worked with City Attorney Neal McNeill on figuring out ways for Tulsa to legally accomplish the goals that Mayor Young had set forward. Williams worked closely with Hardt and Flanagan on the detention projects as well as securing funds for homeowner buyouts.

McNeill's biggest contribution was the legal support for a $2 per month stormwater utility fee, which was implemented in 1986 and assessed on every house and business in Tulsa. McNeill arranged the billing method so that the fee was taken out first; people were forced to pay the stormwater fee or else their water supply would be curtailed (McNeill 1999). Charles Hardt, who had been working in Denver, was hired by the City of Tulsa as a consultant after the 1984 flood as part of the Flood Hazard Mitigation Team (Hardt 1998). He brought the engineering experience he gained in Denver to bear on the Mingo Creek problem to provide a measure of legitimacy to the various projects. Michael Buchert started working for the Tulsa District USACE office in 1977 on possible flood control measures for Mingo Creek, specifically detention basins (Buchert 1998). This work played a large role in the USACE's offer to conduct a joint project with the City of Tulsa.

Two people qualified as bureaucratic entrepreneurs, having formal, but not leadership, positions with the government: Ann Patton and Carol Williams. Patton played a number of roles in the Mingo Creek saga. In 1984, she became an assistant to Street Commissioner Metcalfe and served as a motivating force for other entrepreneurs. Patton's most important role was with the media. It was because of Ann's writings and contacts with the media that much of the public became educated about proposed changes (Flanagan 1998). Patton subsequently took a formal administrative position with the Department of Public Works. Carol Williams also became employed by the City of Tulsa, where she worked on natural hazard mitigation and neighborhood development activities for the remainder of her career.

Ron Flanagan, a policy entrepreneur, began working with flood victims in the early 1970s. He left Tulsa in 1978 to work in Denver for a water engineering firm. Returning to Tulsa in 1984, he worked on the Mingo Creek project and was a member of the Flood Hazard Mitigation Team. His plans and designs played critical roles in the Mingo Creek project. Many people were involved with the project who did not qualify as entrepreneurs. This should not suggest that their actions and accomplishments were not important, it is just that they were not involved with as many aspects of the project.

Policy entrepreneur survey

In order to identify a more general pattern in policy entrepreneurs' behavior over time, additional case study research was conducted in related Tulsa policy innovations that occurred after the flooding events of Mingo Creek transpired. Two important environmental innovations include the development of the Metropolitan Environmental Trust (MET), beginning in the 1970s, which is responsible for promoting municipal solid waste recycling, and the development of the Ozone Alert! program, beginning in the 1980s, which utilises short-term behavioral changes among the city's constituencies to reduce emissions of tropospheric ozone precursor gases. For each of these two cases, as well as for the Mingo Creek case, as many of the key policy entrepreneurs were identified as possible, interviewed, and sent a survey questionnaire to fill out and return (Ziebro 2000).

Several variables have been identified in the literature as important in the innovation and associated social learning processes. The policy entrepreneur survey was developed to capture the degree to which variables identified in the literature as key to the innovation and social learning processes, were evidenced in the three separate cases. The questionnaire consisted of 15 closed-ended questions in which participants rated the importance of different variables. The first four questions focused on specific innovations. In these questions, the respondent was asked to choose just one of the three policy innovation cases under study and then identify three specific innovations that occurred within the selected case. They were then presented with lists of possible information sources utilised and difficulties encountered, and asked to rank each according to their relative importance.

The last set of questions was aimed at the overall process of innovation that the entrepreneurs experienced. These questions did not refer to specific innovations, but to the innovation process as a whole. Again, the respondent was generally presented with lists of a varying number of possible information sources and/or difficulties and asked to rank each according to its relative importance.

Surveys were mailed to the 28 policy entrepreneurs identified as part of the research and previously interviewed during the case study analyses; 24 responses were received. As surveys were returned to the authors, each respondent's answers were numerically coded and entered into a spreadsheet that was then directly imported into Statistical Package for the Social Sciences (SPSS) software for analysis.

The literature suggests that the variables about which survey questions were asked

were important in the innovation and social learning processes; however, there were no *a priori* assumptions regarding the relationship among the variables for any given question. Thus, a method of exploratory factor analysis, called principal component analysis (PCA), was used for this study. A separate PCA was carried out for the six questions on the survey pertaining to the variables identified in the literature.

For each question analysed, the results of the PCA are a series of factors that are constructed of the 'most important' variables for that particular question. The goal in constructing factors is to explain the most variance possible with the smallest number of factors.

These factors were then subjected to a reliability analysis to eliminate statistically suspect factors. Finally, new variables were constructed from the PCA factors remaining after the reliability analysis. These new variables were assumed to be standardised linear combinations of the variables contained within each remaining factor. The new variables constructed from the PCA analysis were then used in a linear regression to determine if these variables could predict entrepreneur response to certain survey questions.

Question 1 asked the respondents to rank the relative importance of different information sources in determining the nature of the problem (i.e. in problem definition). The statistical analysis resulted in one multivariable factor (problem definition factor), which was a combination of the following variables: academic journals; magazine articles; books; and specialised workshops. Relative to the other sources of information listed in the question, these four sources were regarded as the most important in defining the problem. It is interesting to note that 'discussions with experts' was not retained in the PCA analysis, given the important role of experts indicated in the literature. It would appear that expertise, while important in the overall innovation process, is not imperative in the problem definition phase, but that it becomes more important in the later phases such as seeking of solutions.

Question 4, which asked respondents to rank the importance of several barriers to innovation, resulted in a new barrier factor. This factor indicated the following variables as important barriers to the innovation process: lack of understanding of scientific/technical information (STI); solution required 'thinking outside of the box'; not enough time to adequately analyse STI; lack of organisational diversity; lack of media support; lack of recognition; and fear of not being re-elected.

Four of the six variables found to be important barriers to innovation dealt with institutional structure. Two variables address the ability of the decision-making system to incorporate STI.

Research suggests that the ability to effectively incorporate STI is important for innovation and social learning to occur. The final two variables address more general institutional structure issues (diversity and 'thinking outside the box'). The literature suggests that entrepreneurs play a key role in altering the institutional structure such that these barriers to innovation are effectively removed.

Question 5, which asked entrepreneurs to rank the importance of several information sources in the search for new solutions, resulted in two new factors. The first factor consisted of the following variables: personal interviews with agency personnel; federal government sources; and expert opinions/guidance. This factor can be interpreted as indicative of the importance to the entrepreneurs of technical expertise. These findings affirm existing studies that explicitly address how technical expertise is incorporated into the innovation and social learning process.

A second search factor resulting from responses to *Question 5* was a combination of the following variables: private contract service and independent field reports. This factor consists of variables that are representative of outside expertise. As mentioned previously, it appears that the importance of outside experts lies in their ability to aid the entrepreneurs in their search for new solutions.

Question 6 asked the entrepreneurs to rank the importance of several factors in the process of adapting 'borrowed' solutions to Tulsa's situation, and resulted in an adapt factor composed of the following variables: personal interviews with agency personnel; personal experience and opinions; expert opinions/guidance; and private contract service. Once again, these variables reflect the contribution of outside expertise to the innovation and social learning processes. Not only do experts serve as an aid to the entrepreneur's search for new solutions, but they are also important in helping them to adapt these solutions to their unique circumstances.

In *Question 8*, the entrepreneurs were asked if they felt the City of Tulsa had learned from its experience with environmental policy innovation. If they answered 'yes', they were then asked to rate the relative importance of several variables relative to the city's ability to learn. A learning factor composed of the following variables: information analysis; information flow; and information use was constructed. This factor clearly shows the importance of STI in the innovation and social learning processes as discussed above. The entrepreneurs serve an invaluable role in the process of information flow and analysis.

Question 17 asked respondents to indicate the importance of several techniques that they learned during the innovation process and are currently applying to environmental policy initiatives and activities.

A factor consisting of the following variables was constructed:

- organisational flexibility; development of task forces
- public participation/support
- use of volunteers
- community involvement.

The variables retained in this factor are all reflective of the type of institutional environment and structure that the entrepreneurs believe is important in the innovation and social learning processes. Institutional structures should remain flexible, perhaps through the use of task forces developed to address specific concerns (such task forces would facilitate the inclusion of outside expertise). They also feel that it is important to build public support and community involvement, perhaps through the use of volunteers.

Regression analysis was performed to determine if the new variables could predict responses to specific survey questions. For example, *Question 2* asked respondents to indicate how quickly they became familiar with a problem (i.e. how quickly the problem was defined). Interesting questions to ask regarding this particular survey item are whether the type of information found to be important in problem definition or the barriers encountered are indicative of entrepreneur's response to this question. Only the barrier factor was statistically significant at the 0.05 level (significance = 0.013), indicating that the more important the barriers were considered to be, the longer it took the entrepreneurs to become familiar with the problem.

Question 3 asked the entrepreneurs to rate the ease with which solutions were found and adopted. The analysis suggested that the more important the entrepreneurs found the information used in problem

definition, the more difficult they found the adoption of solutions. Perhaps this is due to the fact that the more informed the entrepreneurs were regarding nature of the problem, the more they were aware of limitations regarding any particular solution.

The first portion of *Question 8* asked the entrepreneurs whether or not they felt the City of Tulsa had learned from its past experiences with environmental policy innovations. Interestingly, both the factors that the entrepreneurs felt were important in the city's ability to learn and those that they continued to apply in new policy-making situations were not indicative of whether the entrepreneurs believed the city had learned. While these are not the results one would initially expect to encounter, perhaps this is because of a discrepancy between the entrepreneurs' and the researchers' definitions of 'learning'.

Table 2 summarises the variables that the entrepreneurs found important to the innovation and social learning processes. These results support several tentative conclusions. First, the PCA underscored the importance of scientific/technical information (STI) and outside expertise in the innovation and social learning processes. Not only must the entrepreneurs have access to STI, but it must be of a certain quality (i.e. it needs to be credible).

Expertise was seen as particularly important in the identification and adoption of new solutions, once the problem was well defined. The information used in problem definition was indicative of the difficulty the entrepreneurs encountered adopting new solutions. Also, barriers to innovation were indicative of the amount of time it took entrepreneurs to think they had clearly defined their problem.

Slight differences were seen between the three cases (Mingo Creek, municipal solid waste recycling, and ozone) for both the types of information used to define the problem and for the nature of the information used in the search for new solutions.

Discussion

The flood hazard case well illustrates the fundamental difference between environmental policy innovations and other kinds of innovations. The Tulsa case affirms Borin's (1998) general conclusions about environmental policy innovations and reinforces Deyle's (1994) suggestions that environmental innovations necessitate a good deal more planning and policy analysis to reduce the relatively high degree of uncertainty that is systemic to environmental issues. The key to successful flash-flood hazard mitigation lies in its holistic, or drainage basin, approach that incorporates the essential administrative and managerial components needed to sustain the system.

In view of this finding, it is not surprising that the city opted to develop a new organisational structure to address its perennial flooding and related environmental issues. Also, the entrepreneurs worked quite well with environmental activists, several of whom were actively recruited by the city to implement the innovations

In addition, the stormwater utility fee was adopted by the city as a key user fee to support the effective management of the flood control program. Fourth, the case illustrates the significant degree to which politicians and public servants were involved, and the frequent, if not continuous, transboundary movements that they undertook within the city's administrative bureaucracy to get their innovations adopted and implemented.

While political leadership was uneven and inconsistent over a lengthy time period, several political entrepreneurs recognised the important role that executive entrepreneurs played in the adoption and implementation of effective solutions, and elected to work closely with them, both in the short and longer term planning horizons. Finally, the level of planning and policy analysis undertaken by the city, the USACE, and numerous consulting firms underscores the need for effective scientific and technical information to guide the design, development, and adoption of environmental policy innovations.

As a result of these attributes, a strategic approach, even one that is network-oriented, would appear to make a good deal more sense to policy entrepreneurs than to *grope along* in an attempt to motivate marginal changes that might ultimately prove to be ineffective. A strategic orientation also enables policy entrepreneurs to develop effective ways to address many of the impediments that would be expected to thwart an innovation. A review of the Tulsa story shows how most, if not all, of Altshuler and Behn's (1997) dozen impediments to innovation were successfully overcome. Lastly, the Tulsa story reinforces more general frameworks for understanding policy innovation while it illustrates the important contribution

Process	Important variables
Problem definition	academic journals magazine articles books specialised workshops
Barriers to innovation	lack of understanding of STI solution required 'thinking outside the box' inadequate time to analyse STI lack of organisational diversity lack of media support lack of recognition fear of not being re-elected
Search for new solutions	personal interviews with agency personnel Federal Government sources expert opinions/guidance private contract service independent field reports
Adapting borrowed solutions	personal interviews with agency personnel personal experience and opinions expert opinions/guidance private contract service
Ability to learn	information analysis information flow information use
Characteristics of learning environment	organisational flexibility development of task forces public participation/support use of volunteers community involvement accessing external information systems/holistic thinking

Table 2: Summary of Important Variables for Policy Entrepreneurs

that strategic entrepreneurship makes to our comprehension of the overall process, particularly in regard to environmental policy and our future prospects for attaining a more sustainable society.

The survey analysis of policy entrepreneurs underscores the importance of both STI and outside expertise in policy innovation. Entrepreneurs indicated that access to STI of sufficient quality allowed them to perform the more detailed planning indicative of the strategic innovation process. One manner in which STI can be obtained is through the cultivation of relationships with experts. The entrepreneurs who actively engaged in policy innovation have made it a point to seek out and nurture these relationships.

In light of its history of policy entrepreneurship, Tulsa's recent success with the Federal Emergency Management Agency's *Project Impact* is reflective of the lessons that the city's entrepreneurs and political leadership have learned from their struggles with natural hazard mitigation. The keys to Tulsa's success likely result from Mayor Savage's assignment of *Project Impact* to the Department of Public Works and the subsequent recruitment of seasoned policy entrepreneurs, such as J. D. Metcalfe, Charles Hardt, and Mike Buchert, to assist the local *Project Impact* coordinator, Ann Patton. Other entrepreneurs such as Ron Flanagan and former mayor Terry Young have signed on as project partners. Nevertheless, we also recognise that Tulsa's continuing success in policy innovation depends on community support and participation. The large number of partnerships the city has crafted underscore this point.

In regard to our understanding of the policy innovation process in Tulsa, there's much that needs to be better understood. While this article focuses primarily on the actions of individual policy entrepreneurs, it failed to investigate their organisational environments and the influence that policy-oriented learning might have on their structure and performance in regard to innovation. In addition, the rich social capital resources from which the city draws its support is an important, but understudied aspect of the city's ability to make continued progress toward sustainability. We would expect that future studies could examine the role of social capital (Putnam 2000) to community resilience and receptivity to innovation and change. This and related efforts in collaborative planning (Wondolleck and Yaffee 2000), for example, should improve our ability to manage our local urban economies and the environment more effectively in the future.

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Acknowledgements

We thank Catherine Blaha, Ann Patton, Karl Pepple, Mark Sharfman, and Tulsa's community of policy entrepreneurs for their help. The research from which this paper is based was supported by the National Science Foundation Grant SBR-9618003.

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This article has been refereed

Reduction of stress and trauma in the delivery of disaster recovery services:

The users decide—an exploratory study of the effects of delivering disaster recovery services

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The paper was presented to the Australian Critical Incident Stress Association Conference Trauma Across Cultures in Brisbane on August 4, 2001.

Background

Storms and flooding which occurred suddenly and without warning on the night of 9th March 2001 affected a number of locations in south east Queensland including parts of Brisbane, Sunshine Coast, Gold Coast, Caboolture and Logan, and disrupted the lives of many people. It resulted in the deaths of two people. More than 500 individuals and families sought help from the Department of Families, and many more approached other agencies. There is little evidence in the literature of consumer feedback on the quality of disaster recovery services, in particular how promptly services are delivered and how appropriate these services are following such events.

Therefore it was decided to focus an exploratory research project on those people who had received financial relief assistance paid under the Natural Disaster Relief Assistance scheme (NDRA), and had interacted on a personal level with Department of Families staff following the above storm. As NDRA relief payments are means tested and have specific eligibility criteria, the group selected was in effect a sub-group of the total of those sustaining material loss as a result of the storm.

Introduction

The idea for this research emanated from three sources.

Firstly, a desire to obtain feedback from consumers as to the effectiveness and efficiency of the disaster recovery services they received from the Department of Families during the 9 March 2001 storms and floods. This is in keeping with the Department's policy of continuous service improvement. It also reflects a commitment to the development of a strong evidence base for policy and practice, and acknowledges that consumer evaluation is essential to both.

Secondly, a need to establish a valid and reliable instrument that could be used following disaster events to regularly monitor the quality of service provision, as well as a need to learn more about the research issues confronting any future work in this area.

Finally, to begin examining disaster recovery experiences from the perspective of what actually helps people affected by the disaster event to develop resilience, and how this knowledge can lead to ensuring better prepared communities with increased capacities to deal with possible disaster events. Overall, the study arose from a commitment to build the knowledge base in disaster recovery to ensure best practice.

From a brief review of literature, there is little reported on support given to individuals following a disaster, and in particular their response to the event in terms of lifestyle changes and personal reaction. Specifically in this context, Buckle's work (1998, 1999, 2000) is the most geographically relevant and recent contribution. In particular, his work on redefining the concepts of 'community' and 'vulnerability' offers much in helping us to change the current welfare orientation of some of our service delivery strategies. The present approach traditionally sees the recipient of a service as 'dependent' and of limited 'functioning ability', and reliant on external 'specialist' service providers who are the experts in determining what is best for the recipient. That another perspective can be entertained in developing changes in service strategies to offset this approach is supported by McMillen & Fisher (1998). In developing a scale to measure beneficial life changes after negative life events, they draw on a body of literature which shows that negative disasters '...natural, technological and criminal...' (McMillen & Fisher, 1998 p. 173) sometimes generate positive psychosocial life style benefits. Two examples of these benefits are '...more faith in people...' and '...a sense of of neighborhood closeness...'.

If this is the case, then it is important to learn when, and to whom this occurs, since it may well be valuable in the development of intervention training for disaster recovery staff. It could help us to reassess our concept of how services are delivered: more positive skill enhancement based on self-learning principles (as opposed to didactic instructional material), which could be made available with other information before and immediately after a disaster.

It is therefore important that we learn ways of how to best research the provision of assistance following a disaster. The people affected are not a homogenous group, they may be only temporary incapacitated by the 'event', but it may be traumatic enough to affect memory of what services were provided, by whom and when. These are all-important factors in evaluating service delivery and the planning and provision of future services.

Methodology

In undertaking the study it was decided, using a sampling method, to examine the perceptions of some of the people affected in relation to their experience of service provision. In addition an attempt was made to assess if, after the event, problems still persisted. It was also planned to gather individuals' recollections of the event and the impact the storm had had on them. Because of the differential nature of the damage to property and the varied intensity of the storm within the geographical area, it was decided to

obtain a purposive sample taking these factors into account.

Instrument

A personally administered questionnaire was used, since it was recognised that respondents would probably need to ventilate their experiences relating to the storm and its consequences. Also, since this was an exploratory pilot study in order to develop a more comprehensive data collection instrument for future use, it was felt this approach was more appropriate. Open-ended questions were designed, pre-tested and modified. These related to the service requested, when received and from whom. Overall measures of satisfaction were gained and opinions sought as to what changes to service provision would be advantageous, including the kind and form of information needed before and after similar disaster events.

In addition to basic socio-economic data, including country of birth etc, two additional sections were included. These related to psychological and physical behaviours before and after the storm, and the extent to which the incident had changed the respondent's experiences concerning personal and social contacts.

The first section was explored with a simple questionnaire used in the Chamberlain et al (1974) study after the Darwin Cyclone. This asked whether certain physical and psychological behaviours existed before the storm and whether these persisted after. A scoring system of 1-6, with 1 indicating no evidence of behaviour and 6 indicating a very strong positive change of the behaviour since the storm, was used.

The second set of questions arose from the work of McMillen & Fisher (1998) into the perceived positive life changes experienced after negative events. Their work, based on literature which indicates that people often report benefits from negative events they have experienced, developed a scale with 8 sub-scales, which explores the effect a nominated event has had on a person's life. For example, its effect on the persons perception of their 'faith in people', 'lifestyle changes' or 'increased community closeness'. It was decided to test a small number of the subscales and four were subsequently chosen. These were 'increased community closeness', 'family closeness', 'lifestyle changes' and 'faith in people'. The questions attempted to ascertain the strength of agreement or disagreement with statements relating to the respondent's feelings since the storm e.g. 'I feel more a part of the community'; 'I have learned how good people can be'.

Sample

The sample was taken from those people who had been visited by staff of the Department of Families and paid emergent, household contents or structural repair relief assistance. To qualify for such payment, these applicants had been assets and means tested, and were not covered by insurance. At the time the study was commenced, there had been payments made to 272 individuals/families who had experienced some material losses in the areas affected by the flooding.

Initially it was decided to undertake a 20% random sample covering all storm-affected areas, however, a number of considerations changed this decision. As it was decided to attempt to obtain respondents from different ethnic and cultural groups, and as this distinction was not immediately obvious from the source data to hand, it was decided that a purposive sample would be needed.

Secondly, because of the geographical pattern of the storm's path and the consequence that some areas were more adversely affected than others, it was recognised that socio-economic factors in those affected areas indicated the possibility of potential significant social difficulties for those involved which warranted further examination/analysis.

Thirdly, because of the range of premises affected by the storm, it was decided that it was necessary to include a sample of houses, flats and caravans. From this, a sample framework was drawn up to include the above factors, with the original aim to sample 60 people.

Following design of the data collection instrument and its pre-study testing, it was recognised that time restraints would limit sample size, since it was decided that the nature of the study required personal interviews. It was estimated it would take at least 40 minutes to engage and debrief the respondent and administer the questionnaire. It was also found that tracing and contacting respondents, obtaining agreement and visiting to interview further complicated the data collection process.

In fact, 140 telephone calls were needed to obtain the final number of 40 respondents. A number of people in the population from which the sample was drawn had no telephone, several had moved away, and 25 numbers were disconnected. As calls were made during the day, many potential interviewees were at work, and thus not contactable: this factor would have influenced the high proportion of those sampled who were recipients of Centrelink benefits. There was only one refusal to cooperate with the study.

One staff member conducted the majority of interviews over a three-week period.

Results

The 40 respondents had endured flood damage and the sample covered 15 different suburbs. *Table 1* shows the characteristics of the sample.

The range of requests for help per respondent was between 0 and 7 with a mean of 2.95. *Table 2* gives the breakdown according to the type of assistance requested.

It can be seen that the largest category was for financial assistance. This was

Summary of Sample Characteristics (Sample N=40)		
Respondents	Male	45.0%
	Female	55.0%
Dwelling	House	80%
	Flat	15%
	Caravan	5%
Moved from premises as a result of the damage	permanent	10%
	temporary	27.5 %
Place of birth	Australia	60%
	UK & NZ born	17.5%
	Aboriginal	2.5%
	Remainder	15.0%
First Language	non-English	15%
Half of the respondents lived in a family setting with some member disabled		
Age range 23-80 years with mean age of 47.5 and median age of 43		
Single, or single with dependents		57.5%
Over 57% of the sample were receiving some form of pension		

Table 1: Summary of sample characteristics.

Item	F	%
Clothing	6	5.2
Food	7	6.1
Furniture/household goods	16	13.9
Help with cleaning up	15	13.0
Elec check	12	10.4
Health needs	4	3.5
Personal counselling	4	3.5
Information	10	8.7
Financial help	37	32.2
Other	4	3.5
Total	115	100.0

(Based on multiple number of responses, not respondents)

Table 2: Number of requests for help.

followed by requests for furniture and household goods and then help with cleaning up after the storm. 48.8% of respondents received more help than requested, while fewer than 25% received just the help they had requested. For the remainder, it should be noted that NDRA guidelines enable the Department of Families to provide financial help, rather than actual material goods. Although people may have requested material goods e.g. clothing or furniture, the Department provided financial help to purchase these items through other sources such as non-government agencies, or they received such help from family and friends.

From their answers to the questions, 85% of respondents said they were visited by Department of Families staff and applied for assistance within a week of the storm, with 25% of those being visited and requesting assistance within two days of the storm.

In all, 95% of the sample had requested assistance within 10 days of the storm, with 85% having received financial assistance within 10 days of their request. The median time for respondents requesting assistance was 4 days after the storm, and the median time to receive assistance was 2 days after the request.

Generally respondents were unsure where the assistance they received was from, but could provide details with prompting. Likewise, they had difficulty in recalling who had had actually visited them, other than staff from the Department of Families. This was not influenced by age, since the range was from 23 to 80 years, with a mean of 47.5 years. Almost exclusively and spontaneously, the response regarding the Department of Families was positive, and respondents saw the workers as 'caring' 'understanding' and 'warm', giving 'practical help'. They tended to view the Department as the preferred agency for future problems, irrespective of the problem.

Positive comments were made regarding Members of Parliament and Local Authority Councillors who had visited the area, although the perceived range of help offered by the different Councils varied, often within the one local Council area.

Concern was raised over situations that give rise to flooding, for example the building of houses on flood plains, construction of busways, the construction of golf courses across streams and the ongoing work on creek channelling. Real Estate Agents and landlords were criticised for not advising that rented property was in flood prone areas, and the Weather Bureau received widespread criticism for its failure to provide adequate warnings of heavy rain and likely consequent flooding.

Interviewees were mostly unable to distinguish between information that needed to be provided before an event and help required immediately after it. Most had no idea of available services in the community and they were unable to provide any clear ideas as to what assistance might help them. Some made suggestions regarding the form that information could take, for example the provision of fridge magnets, a brochure distributed with electricity bills, a brochure hand delivered after the event, and details of relevant assisting agencies in local newspapers, and on radio/TV advertisements. Most respondents saw avenues of help as the 'big picture' approach e.g. changes to channelling, curbing, drains etc rather than at an individual level, such as preparation for evacuation, awareness of helping agencies, list of phone numbers near the phone.

For many this was another crisis in their lives that set them back financially and 3.5 months later they were still struggling. Many people from the sample were also coping with other major problems at this time e.g. marital breakdown, serious illness. Most are still traumatised at times of heavy clouds and forecast of rain. Actual rainstorms make many people extremely anxious. Some parents reported children having sleep problems or nightmares, which they attribute directly to experiences during the storm.

Many of the subjects in this study spoke of experiencing high levels of individual trauma and were very frightened throughout the time of the flooding. None initiated personal counselling, nor did they largely perceive a need to do so. Many related stories of emotional debilitation and some indicated a deterioration in their level of daily functioning, which they directly attributed to the emotional effects of the storm.

In order to see if there were differences in reaction to the effects on the families, that might be influenced by cultural or ethnic factors, the responses of those not born in Australia and the respondent with an Aboriginal background, were compared with those who identified as being Australian born. Since the total number of respondents was only 40, and this is the least possible number tolerated in some statistical procedures, it was decided to make general observations regarding this comparison rather than analysing it statistically.

Overall, in examining the data, there were no obvious differences that could be explained specifically by ethnic and cultural factors. The only difference that was identified related to temporary moves after the flood, with more non-Australian born taking this step.

When responses to the 20 questions forming the questionnaire from the Darwin Cyclone study were analysed using cluster analysis, five distinct and coherent clusters emerged. These related to relationships e.g. with family, children spouse etc.; indicators of a gastro-somatic origin e.g. troubled by indigestion, bowel complaints; psycho-endogenous e.g. nervous and depressed, restless, lacking in confidence; psycho-exogenous e.g. skin complaint, asthmatic; and finally Alcohol Related.

When the questions were examined by averaging responses according to the above groups, overall 60-62% reported no changes before or after the storm. That is, the phenomenon was not present before

or after the storm, or if it was present before the storm there had been no change in severity after the event. A small number (2-3%) indicated the signs were present before the storm and were worse now. Between 25-30% indicated the presence of symptoms before the storm with slight improvements in the symptoms now. This was marked in those symptoms which could be grouped as Psycho endogenous in origin.

However, when examining the data according to individual responses across all the questions, forty five percent (17) marked between 1 to 9 of the questions indicating deterioration, while 22.5% reported an improvement. Of those indicating deterioration, this was in regard to being now more worried about the future (*Question 2*) and now being more nervous and depressed (*Question 4*).

When the results were examined in relation to ethnic or cultural origins there were no significant differences, although there was a trend for more non-Australian born respondents to report symptoms that were grouped in the psycho exogenous cluster.

With regard to the Perceived Benefit Scale, the results of this small pilot study showed that between 75% and 85% of respondents felt there had been no change in relation to 'lifestyle changes', 'community closeness' or 'family closeness'. However, with regard to the sub-scale referring to 'increased faith in people', 70% agreed or strongly agreed with an increase in this indicator. Bearing in mind the general reports earlier that respondents appreciated the care and attention of workers from Family Services, this result is a possible reflection of that.

When the results were examined for possible differences according to ethnicity or culture, no differences were found.

Discussion

Discussion of these findings will be dealt with briefly in two parts: firstly the actual results, and secondly matters relating to further research into this area.

In view of the apparent scant attention paid to this particular aspect of disaster recovery in Australia, this was essentially an exploratory exercise. It has revealed a clear picture of satisfaction with the services provided by the Department of Families and their timing. From the sample, there does not appear to be any specific area which is influenced by ethnicity or culture, and there are no apparent indicators for a revision of services along ethnic/cultural lines.

A picture has emerged, however, of people who are often in the midst of crisis at the time of sustaining a disaster event. Whilst from a service provision perspective, the disaster is the principal focus, for some recipients it is one more difficulty at this time in their life to deal with. For some, an attitude of fortitude, inevitability, resignation and an ability to fight back assist them to deal with this. A focus on the 'whole situation' rather than the restitution of material goods might provide a useful 'starting point' in the initiation of community disaster recovery. Disasters are no respecter of persons or type of property, and geographical and environmental factors are seen by the respondents to be of major concern to them. Policy makers in the area of flood mitigation need to ensure they provide open access to residents such that their experiences can influence decisions made regarding environmental changes in flood prone areas.

There is some evidence emerging which indicates that some positive aspects can arise from a disaster, such as a stronger faith in people and a stronger sense of community. These are factors that should be remembered and implemented in staff training programs.

The service offered to respondents by the Department of Families concentrated primarily on financial assistance to replace material losses. Whilst most respondents were extremely positive about the services provided, this study has indicated a need for attention to an holistic approach in service delivery, and refinement of referral to and coordination of assistance offered by other community agencies.

With regards to feedback, people are generally interested in being asked about their experiences and have the right to see the results of their endeavours in feedback about the research. At this stage, the manner whereby those interviewed will be provided with feedback is yet to be determined; however, it is envisaged that all will be contacted by mail shortly and provided with a succinct outline of the questionnaire analysis.

The process of researching this area brought the following matters to light.

Firstly, while it is desirable to ensure a probability sample of sufficient size to be able to draw strong inferences, this may not be possible in populations affected by disaster events. Temporary or permanent moves, property destruction and damage to telephone services or disconnection may prevent access to those people affected. In addition, because of the random nature of the effects of a disaster, not all people are necessarily seriously affected by the event, and may not identify with the aims of a research project.

In addition, since the focus is on the adequacy of 'service provision', only those people eligible to receive this service, in this case monetary assistance, were identifiable for inclusion in the study. Many useful ideas regarding service provision in community recovery may have been proffered by those similarly affected by the event, but not targeted, given the exclusivity (on general financial grounds) of the chosen sample. Furthermore, an alternative sample might have highlighted individual aspects of resilience peculiar to this latter group. Such information could assist us in the provision of resources to those already facing other difficulties in their lives, where coping with the effects of a natural disaster is one more hurdle to overcome. Work is now in process planning to compare the results from this study with those from a group who did not qualify for the NDRA assistance, but who live in the same geographical areas.

Secondly, timing of these kinds of studies is important. If undertaken too soon after the event, respondents may still be in a state of shock and focused on solving associated problems. If undertaken too long after the event, memory may play a part in confusing recall, or minimise the effect of certain factors. In either case, what is important is to undertake studies that allow respondents to answer in their own terms. This not only allows them to ventilate their feelings about the event, but also focuses them on the topic being researched. It also allows them to contribute additional anecdotal material which may, through analysis, prove of interest and importance to the research undertaken.

It is recognised that the questions used in this study need refining, and, given the background details of the respondents, many had difficulty in understanding what was required. As this was in fact a pilot study to further research, it is felt the questions were adequate for the purpose and, as primarily one interviewer was used, any variation from the written questions was consistent, and did not influence the data results.

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This article has been refereed

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Bells and whistles, belts and braces: designing an integrated flood warning system for the Hawkesbury Nepean Valley

Part 1: bells and whistles—available technologies

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Background

The Nepean Catchment includes the Southern Highlands, the Blue Mountains and Western Sydney and covers 12,000 square kilometres upstream of Windsor. The river runs along the foot of the Blue Mountains between Penrith and Windsor and changes its name to the Hawkesbury River between these two urban centres. At Windsor the river is virtually at sea level but winds through steep sandstone gorges for another 100 kilometres before reaching the ocean at Broken Bay. It picks up another 10,000 square kilometres of catchment along the way.

There is a 400 square kilometre floodplain between Penrith and Windsor which is home to more than 60,000 people living in urban centres, rural townships and villages, rural residential developments and farms. Further downstream in the gorge area the population is smaller and more scattered with farms, weekenders and mobile homes being the common forms of accommodation. In the urban areas there are also nearly 4,000 commercial and industrial premises as well as schools, hospitals, nursing homes and prisons that may all need evacuation during floods.

In 1997, the NSW State Government formed the Hawkesbury-Nepean Floodplain Management Advisory Committee to undertake investigations and make recommendations to the Government regarding management of the flood risks faced by the Hawkesbury-Nepean Valley communities.

A key recommendation of the Committee's 'Achieving a Hawkesbury-Nepean Floodplain Strategy' was:

'That the funding provision for flood warning sirens... be applied to the installation of a cost effective flood warning network comprising a combination of sirens and other appropriate technology' (HNFMAC 1997, p13).

Molino Stewart was engaged to identify and evaluate a range of potential flood warning dissemination technologies that could have an application in the Hawkesbury Nepean. This paper summarises the findings into available technologies. A second paper explains how they were evaluated and an integrated warning system devised.

Bells and whistles

According to Rogers and Sorensen (1988a), warning people of impending danger encompasses two conceptually distinct aspects—alerting and notification. Alerting deals with the ability of emergency officials to make people aware of an imminent hazard. Alerting frequently involves the technical ability to break routine acoustic environments to cue people to seek additional information. In contrast, notification focuses on how people interpret the warning message. It is the process by which people are provided with a warning message and information. Dual systems incorporate both the alert and notification functions.

To these three categories (alert, notification and dual) can be added 'unofficial warning systems', whereby people warn those within their personal networks. These four categories form the basis for the following discussion of warning dissemination technologies. A fuller description of the technologies can be found in Molino, Begg and Opper (2001).

Alerting technologies

Alerting deals with the ability of emergency officials to make people aware of an imminent hazard. Following is an outline of siren/alarm systems, aircraft, modulated and coded power supplies and visual cues as means of alerting populations to impending danger.

Sirens/alarms

Sirens are designed to provide a very rapid alert to potentially threatened populations. They are currently the only reliable means of alerting outdoor populations. Traditionally, sirens have only been used as an alerting technology, limited in their utility by the lack of instructional messages. At best they have told people to seek further information unless an intensive program of public education is used to instruct people what to do when the signal sounds. However, some of today's sirens can provide high-power voice messages as well as traditional warning tones, taking them closer to a dual alert/notification classification (Moore 2000).

Aircraft

In special cases airplanes and helicopters can be used as part of the warning process. Sirens or bull-horns can be carried by low-flying aircraft to provide an alert or warning message. In addition, they can drop prepared leaflets containing a warning message. This type of warning channel is useful in reaching remote populations or populations that cannot be reached by normal communication channels. Disadvantages include access to aircraft, maintenance and cost. A further problem is obtaining sound systems that can broadcast a message that can be heard over the noise of the aircraft itself (Rogers and Sorensen 1988b).

Modulating electrical voltage

Most electricity distribution authorities have a SCADA system which controls the functionality of all components of the network down to zone substation level. Such systems have the capability to control voltage on the transformer at the substation. Large increases in voltage

could result in damage to electrical appliances, but most can withstand significant voltage drops.

This capability could be used in one of two ways. Firstly, it could be used to reduce electrical voltage in a periodic manner in the form of a morse code letter or fluctuating signal (Moore 2000). Alternatively, it could be possible to set the system to fluctuate the voltage to around 15% and place a device in people's homes that would be triggered by the reduction in voltage and emit a warning tone or flashing light. Such a device would be relatively inexpensive.

Either system would be able to operate down to a granularity of zone substation level only. However, devices would only need to be placed in the homes concerned, making the second option more targeted. Neither system can be used if electrical systems fail, and any other causes of voltage drop could generate false alarms.

Modulating electrical frequency

Existing electrical power distribution technology enables specialised warning systems that use data signals transmitted over the power lines to activate an alarm system. When the system frequency is altered, devices linked to electrical circuits (similar to smoke detector alarms), can be activated.

A slight variation on this arrangement would involve the use of a 'ripple control signal' which can be sent down the electricity wires to activate the device, without endangering other electrical appliances. This mechanism is used to activate off-peak hot water systems. Advantages of this type of warning device include quick dissemination time and 24 hour availability. However, it cannot be used if electrical systems fail.

Coded visual signs

Visual cues can be used to alert populations of impending danger. In the far north Queensland town of Weipa, cyclone alerts are colour-coded. Road signs featuring the colour codes are displayed when there is a cyclone threat (Doherty 2000).

The advantage of using visual cues is that they can be a simple and effective means of warning the population. The disadvantages are that people need to be educated about the meaning of the symbols, and visibility may be compromised at night-time.

The use of signs with variable message signs (VMS) technology was also investigated. This warning mechanism falls into the dual alert/notification category and is explored later.

Laser lights

Lasers can be used to project a thin beam of light some considerable distance. The idea of setting up lasers at the beginning of a flood warning to project the expected flood level onto houses was explored.

Apart from the cost of $3,000 or more for each laser, this idea would have a number of disadvantages. Firstly, the cheapest lasers are those that cast a red beam of light. These are not very visible outdoors in daylight and therefore would only really be suitable for night-time use. Furthermore, they can only project a beam about 50 metres, so a very large number of them would be needed. To get a better projection or visibility it would be necessary to increase the strength of the laser but this carries with it the risk of causing eye damage to anyone who looks into the beam.

The chief advantage of personal contact is that people are more willing to respond to a warning because they are more likely to believe that a danger exists.

Green light lasers can be used to get greater projection and daytime visibility without increasing power, but these cost about three to four times as much as a red laser. Lasers also run the risk of being tampered with, stolen or lost in the flood.

Dual alert and notification technologies

Dual systems incorporate both the alert and notification functions. An outline of dual technologies, from low technology personal notification, through to use of PA, tone alert and dial-out systems follows.

Personal notification

Personal notification, as defined in this study, involves using emergency personnel to go door-to-door or to groups of people to deliver a personal warning message. The chief advantage of personal contact is that people are more willing to respond to a warning because they are more likely to believe that a danger exists. The disadvantage is that it is time consuming to implement this method and it may require the commitment of many vehicles and personnel (Rogers and Sorensen 1988b).

Military experience gained during the wartime use of warden systems suggests that it takes six minutes to doorknock each house. Using two person teams, which must be done for safety, ten teams (20 personnel) plus control personnel will be required to doorknock 100 homes in one hour. To doorknock 20,000 homes in 12 hours will require 167 teams (334 personnel) in the field at any time plus control personnel (Opper 2000). This assumption was used when evaluating this technology.

A field exercise was carried out in McGraths Hill in the Hawkesbury Nepean subsequent to Molino Stewart completing the investigation to which this paper relates. It found that pairs of volunteers were able to doorknock the whole suburb at a rate of between two and three minutes per house.

Fixed and mobile public address systems

Dedicated PA systems can be installed specifically for the purposes of warning populations. As noted in the sirens/alarms section, some of the latest sirens incorporate a voice message function.

Portable loudspeakers can be used from vehicles to warn nearby populations. Often these are used in conjunction with personal notification procedures. Portable loudspeakers increase the speed of warning populations without other means to receive the warning. Their chief disadvantages are that it is often difficult for people to hear a warning broadcast from a moving vehicle and it is difficult for people to confirm the warning, particularly if they only heard a part of it (Rogers and Sorensen 1988b).

Component costs for installation and operation of dedicated PA systems are less than those for sirens, however as PA systems have a lower effective coverage radius than sirens, up to 50% more installations could be required.

Tone alert radios

Tone alert radios are a specialised warning device that can be remotely activated. They provide a warning signal and some types can subsequently broadcast a verbal warning message. The radio operates in a standby condition. Upon receipt of a code the radio emits a tone and broadcasts a pre-recorded or read message. The code and message are broadcast from a radio transmitter. The radio receivers operate on normal electrical power and some have battery back-ups.

The advantages of tone-alert systems include a quick dissemination time, the combination of an alerting signal with specialised messages, their-around-the-clock availability, and the fact that they can be heard inside buildings that may be insulated from the sounds of outdoor sirens. Disadvantages include maintenance problems, availability during power failures, limited broadcast range, and difficulty for using outdoors (Rogers and Sorensen 1988b).

Dial-out systems and related technologies

Dial-out systems work by having a computer database of pre-selected telephone numbers for the areas in which the warning has to be disseminated. When the system is activated the computer dials each number on the database. If the recipient answers the phone they are instructed to press the keypad to receive further details of the warning. The system can dial as many numbers simultaneously as there are dedicated phone lines connected to the system.

It rings the numbers in succession until all numbers have been rung. If the number is unanswered then it is rung again after all numbers on the database have been rung once. The system is programmed to keep ringing the unanswered numbers on rotation indefinitely or for a set number of times.

The chief advantage of telephone warning systems is the ability to quickly disseminate a message. This can be an efficient way to warn people because most people hear and answer phones when they ring. Furthermore, nearly all will listen to the message, particularly if the message makes it clear that 'this is an emergency'. The telephone system also offers the recipient two-way communication via information numbers, further reducing uncertainty by providing additional information (Rogers and Sorensen 1988a).

Problems with dial-out systems include the fact that people who are not near a phone will not receive a message, a database of numbers must be constantly updated and people with silent numbers will need to give permission to be included on the database. Furthermore, cordless telephones are becoming increasingly popular. These phones rely on the supply of electricity to function, and would not work in a black-out situation.

Finally, there is a likelihood that in an emergency situation, the telephone network very quickly experiences service level quality problems (ie, lines are 'clogged' by people making calls). The effectiveness of a dial-out system would therefore be significantly downgraded as the event unfolded. It is even conceivable that it would 'melt-down' and prove an ineffective form of communication (Cronan 2000).

Enhanced dial-out system

Telcordia Technologies' Community Notification Solution (CNS), developed in the USA is an enhancement to dial-out systems in that it operates over the existing telephone network, but is designed to impose far less of a burden on the network while delivering far more alerts within a given period. A patent for CNS was recently issued in Australia.

Unlike dial-out systems, the warning is not sent by phone message, but is delivered by a choice of devices including:

- standalone device (about US$10) with or without Caller ID that will plug into a normal phone jack
- display or advanced screen-display phones (offered by a local telecommunications company)
- computer modems
- home security systems
- set-top boxes.

Alerts are sent as a data burst in less than one second compared with 30-60 second calls. The system notifies people of an emergency by creating a time stamped text message (limit of 60 characters + 10 digits), activating a corresponding light (red, yellow) and if instructed, one of seven alarm sequences. The system will send whatever message is entered into the message create application (including other languages).

The Telcordia system has yet to be used in an emergency situation (Telcordia website).

Paging and mobile phones

There are a number of pager or mobile phone alerting applications on the market. Some stand-alone dial out systems have the capability to alert all selected personnel carrying pagers or mobiles. At this time it would be difficult to offer a solution where every person in the affected zones would be provided with a portable device to be used only in emergencies without them being a subscriber to a particular network.

However, in the USA, technologies are being investigated that can locate and reach citizens with pagers or mobile phones who are in the path of a disaster or inclement weather. In Australia, it is theoretically possible to locate the cell that a particular mobile phone user is in and send a text message to those phones with SMS (short message service) receive capability. In 1999, 42% of Australian households, and 69% of small businesses either owned or had access to a mobile phone.

Most GSM (Global System for Mobile—most phones have this type of connection) and CDMA (Telstra's new digital network—Code Division Multiple Access) phones have an SMS receive function. Newer technology phones that support GPRS services will also support SMS. However, as well as SMS capability, the service also needs to be activated, e.g. Telstra subscribers must have an active MobileNet Memo service to receive SMS.

The phone would also need to be turned on to receive the message, and it would have to be retrieved by a key sequence entered by the phone user. In Australia there are as many as 60 different mobile phone carriers and re-sellers.

A single mobile phone carrier does not have visibility of mobile phones not registered on its network. In other words, to reach all mobiles within a given area it would be necessary to have each carrier send the message to its registered subscribers.

Variable message signs

Variable message signs are electronic programmable signs generally used as a traffic management tools. These signs could be programmed with warning messages and simple instructions in the event of a flood. These signs generally use flashing lights to catch people's attention. Signs can either use mains power or if not available, solar power.

Variable message signs allow messages to be updated. Messages can be scrolled, but not for moving traffic as this is considered too distracting and would probably not be allowed by the RTA.

In general, a library of messages is stored in the sign and remote commands simply reference the message identification number. Warnings can be broadcast to all signs, taking around 30 seconds. Alternatively, signs can be addressed individually or in groups, with each contact taking around 15 seconds.

Notification technologies

Notification focuses on how people interpret the warning message. It is the process by which people are provided with a warning message and information. The principal notification mechanism used to warn of emergencies is the mass media, with internet technology increasingly considered as a potential additional communication mechanism.

Mass media

The general pros and cons of using the mass media to disseminate warnings are neatly summarised in Handmer and Parker 1998. They can distil the most important information to a large audience even if the audience is poorly prepared. Following is an outline of technologies used to disseminate warnings via the electronic media of radio and television. Print media is not discussed as this mechanism would be too slow to be effective in the context of the Hawkesbury-Nepean River Valley.

Radio

Radio is often a major channel for disseminating warning information because it can quickly reach a large number of people during non-sleeping hours. The use of radio as a warning channel will continue to be a major practice in emergencies. Often pre-arranged plans for notification and use of standardised messages accelerate the speed in which a warning can be issued over radio. One disadvantage of radio is that often a broad area is covered by the broadcast including areas not at risk. Second, all information must be conveyed verbally which excludes the use of graphic materials.

Third, radio reaches only a small portion of the population during certain hours. Fourth, due to the private operations of stations, problems can arise in priorities regarding warning broadcasts although this can be largely eliminated with formal agreements and exercises (Rogers and Sorensen 1988b).

Television

Warnings can also be broadcast over commercial television. This can be done by interrupting normal programming with a bulletin, or by displaying scrolled text on the bottom of the screen. TV reaches a large number of people, particularly in the evening hours. Like radio, it is a poor channel during sleeping hours. TV is a particularly good channel for warning of slowly developing events. One major advantage of TV is the ability to use graphic information such as maps or diagrams in the warning (Rogers and Sorensen 1988b).

In Sydney, the average weekly reach of television is 94%, with 71% of people able to be reached between 6pm and 10.30pm any day Monday to Friday. The average person watches just over three hours of television per day with peak viewing between and 8pm and 9pm (AC Nielsen 2000).

As with radio, information can be broadcast at the station's discretion, or pursuant to formalised agreements.

Internet

With the increasing numbers of individuals and workplaces having Internet access, it may be worth considering internet technology as a supplementary means for rapidly and widely disseminating warning messages. In Australia, as of January 1999, 1.7 million people (approximately 11% of the population) accessed the Internet on a regular basis (Australian Communications Authority 2000).

In the past, the internet has not been seriously considered, since recipients must be logged in to their email service to receive messages. In other words, the Internet has been mainly a 'pull' technology, where users needed to actively seek and access information. The problem has been that unless one knew that a warning existed, one wouldn't know to go and look for it.

> It was apparent that the Hawkesbury-Nepean flood warning system has to use several technologies if most of the population is to be reached and contingencies such as loss of power or telephone systems can be accommodated.

Internet PUSH+ technology will solve this problem, as a person need only be connected to their Internet service to have warnings 'pushed' right onto the monitor screen. The '+' part of 'PUSH+' would cause some sort of audio or visual alert to show up. This could be a flashing icon on the recipient's monitor screen, or an audible tone, or both. This would allow the recipient to become aware of the warning immediately, thus giving him or her more time to take appropriate action.

Unofficial warning systems

Although the main focus of this research project was to consider technologies used in the official warning dissemination system, it is important not to forget that an unofficial warning system will be present at the same time as the official one. According to Handmer and Parker (1998), overall warning system performance is enhanced by integrating official and unofficial flood warning mechanisms.

Unofficial warning systems are those whereby people warn those within their personal networks, e.g. passing on official warnings, seeking information, personal observation. People tend to employ their personal networks to assist with interpreting messages and decision-making.

One warning mechanism that could be classified as unofficial as it is community driven, is the system of asking flood wardens to warn their local communities. The use of flood wardens has been pioneered in the Thames Region of the UK. There are over 50 wardens in place across the Thames region with plans to expand this even further in the next few years.

According to Haggett (1998), flood warden schemes have a number of advantages:

- they get local people involved in their flood warning scheme
- recipients are more likely to believe in a warning issued by a local warden who they know
- local wardens can take over the maintenance of contact details and can be used to distribute flood warning literature
- it is easier for emergency management agencies to provide quality information to a relatively small number of wardens rather than everyone at risk
- flood wardens can also supply emergency management agencies with local information during flood events.

Disadvantages listed by Haggett include:

- reliance on members of the public to issue warnings can sometimes be prone to failure — it is important to establish deputy wardens in case of absence
- warning schemes need maintaining
- in low risk areas it is often difficult to get volunteers and maintain commitment
- in some urban areas community spirit is lower and people do not want to get involved.

Outcomes

A preliminary evaluation of the technologies eliminated the following for practical reasons:

- aircraft — weather and noise limitations
- modulated electrical voltage — frequent false alarms
- laser lights — health risks and potential loss of equipment

- pagers and mobile phones—too many service providers and limited effectiveness
- internet—PUSH+ technology not sufficiently developed.

For each remaining technology a conceptual option was developed for its implementation in the Hawkesbury Nepean Valley. These options accounted for the distribution and density of settlements, topography and infrastructure capacities. For some options there were sub-options to allow comparisons between different configurations of the same technologies but which trade off different performance criteria such as cost and speed of notification.

A methodology called multi-criteria analysis was used to compare these conceptual options. This allowed options with different performance characteristics to be compared objectively while making provision for subjective judgements to be made about the importance of the criteria used to compare options.

The SES and Department of Land and Water Conservation identified 28 criteria for evaluating the performance of the options. They also provided a range of weightings for these criteria depending on their opinions as to how important each criterion is in making a decision.

The analysis included some sensitivity analysis to see how sensitive the ranking of options was to assumptions about option performance and criteria weightings.

What emerged was that the traditional lower technology options such as door knocking and public media broadcasts are extremely valuable. It was also clear that these cannot be relied upon to alert and notify all 60,000 people in the floodplain. In fact no single technology can.

It was apparent that the Hawkesbury-Nepean flood warning system has to use several technologies if most of the population is to be reached and contingencies such as loss of power or telephone systems can be accommodated.

The next step was to determine what combination of technologies would be the most affordable, effective and reliable. Details of the multi criteria analysis and the methodologies for developing an integrated warning system are the subject of a second paper.

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About the authors

Steven Molino is a Principal of Molino Stewart who has considerable experience in a wide range of water cycle projects and has spent a considerable part of the last decade investigating flood damages, mitigation and preparedness. He was the project manager for the Warragamba Flood Mitigation Dam EIS and the Warragamba Auxiliary Spillway EIS and has advised the Hawkesbury-Nepean Inter Departmental Committee and the Hawkesbury Nepean Flood Management Advisory Committee. He recently prepared a flood preparedness strategy for the Woronora River in southern Sydney which is now being implemented. He has also used multi-criteria analysis and other techniques to evaluate options and facilitate conceptual development of sewerage schemes, water supply schemes, waste management strategies and eco-tourism developments. Steve can be contacted at:

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Graham Begg was a senior consultant with Molino Stewart and has had a long involvement in the water industry. He has developed methodologies for estimating agricultural flood damages and has investigated flooding induced by mine subsidence. Before joining Molino Stewart, Graham was the General Manager of a company whose services included installation and maintenance of remotely operated metering, information technology and communication systems utilising new technologies. Graham is now a strategic and business planner with the Sydney Catchment Authority. He is helping it identify its risk management, including flood risk, responsibilities and is preparing a report on these for the regulator.

Lyndall Stewart has spent the last five years working in public relations and communications and is currently a senior communications consultant with Molino Stewart. She has prepared a community education and communication strategy for flood preparedness on the Woronora River in Southern Sydney and has designed and implemented community education strategies for stormwater pollution in several NSW catchments. Lyndall's strong research skills were used in this project to undertake an international literature search to identify technologies, case studies and suppliers.

Steve Opper has 27 years experience in emergency management, and for the last 15 years he has been as a full time officer of the NSW SES. He has been involved in the management of floods at the local field level, and in both regional and state operation centres. He holds the Disaster Services Administration Certificate from Emergency Management Australia (EMA) and has completed a number of specific emergency management training courses offered by that organisation (EMA). Steve also holds a Graduate Certificate in Applied Management from the Australian Institute of Police Management and has been awarded the National Medal for emergency service to the community. He is the project manager for the Hawkesbury-Nepean project within the SES.

Part two of this article will be in the next (Winter) edition of the Journal.

This article has been refereed

The development of a web-based algorithm for the prediction of patient presentation rates at mass gatherings

by Dr Paul Arbon PhD, FRCNA, MAIES, Chief Superintendent–St John Ambulance Australia, Senior Lecturer–School of Nursing and Midwifery, University of South Australia

Introduction

Large public events are often referred to as mass gatherings. Many large public gatherings, including fairs, sporting events and concerts are held in Australia. In the research literature mass gatherings are usually defined as events attended by more than 25,000 people (De Lorenzo 1997) though some authors include events attended by more than 1000 spectators. There is renewed interest in mass gathering medicine research because epidemiological data has not been used extensively to guide planners and providers in the first aid management of mass gatherings (De Lorenzo 1997) and, generally, research has focused on a single event or venue and has not provided data that can be transferred to other events and venues. Much of the existing data is descriptive and does not consider the influence of features of the crowd, venue, weather or event and their effect on patient presentation rates (Bowdish et al. 1992). As a result service providers tend to rely on historical precedents when making decisions about providing health care at these large events and there is limited understanding of the factors which might influence the number and type of patients presenting to health care services.

It is estimated that mass gatherings in Australia attract a combined spectator audience of approximately 14 million people each year. Several of these events generate a patient load of more tan 1 000 patients per day and health services at these events must be carefully planned and appropriately resourced to manage the number and type of patients expected.

This paper provides a summary and discusses the implications of research undertaken by St John Ambulance Australia and the University of South Australia that focused on the factors influencing rate and type of patient problem presenting to health care providers at major public events. The research developed regression models for the prediction of patient presentation rate (PPR) and transport to hospital rate (TTHR).

Background to the research

The provision of emergency medical care and first aid for spectators and participants at large public events is a growing area of interest. This interest has been generated in part as a response to catastrophic events such as the Hillsborough stadium fire (April 1989) and recognition of the need for an effective and pre-planned response to emergencies of this kind. For providers of emergency patient care, however, the day-to-day provision of patient services at large public gatherings also requires careful planning. Larger public events present an array of difficulties and issues that must be considered if an effective response is to be provided to patients requiring emergency care. Planning for these events is complex and requires an understanding of typical patient presentation rates per thousand spectators (PPR) typical patient problems (associated with the event and audience) and other influences on the demand for services such as variation in the ambient temperature and humidity on the day of the event.

A number of issues associated with mass gatherings have been identified in the literature. There exists a high degree of variability in the medical and first aid provisions at such events (Saunders et al.1986; Franaszek 1986) and there is very limited information about services within Australia. General standards have been proposed (Emergency Management Australia 1999; Great Britain Health and Safety Commission 1993) but no uniform standards are accepted and widely used (Donagen 2000). The most commonly reported structure has the medical and first aid resources centred around fixed aid-stations, the number depending on the size and topography of the event. The planning required to support these services is extensive and time consuming. Hnatow and Gordon (1991) identified the following nine elements of health planning for mass gatherings: attendance (crowd size); personnel; medical triage and facilities; communications; transportation; medical records; public information and education; mutual aid; data collection. Additional elements identified in the literature have included public access, disaster planning and the operating environment (e.g. weather, terrain and duration).

Within Australia relatively few investigations have been undertaken in the area of mass gathering first aid (Flabouris and Bridgewater 1996; Fulde et al. 1992; Richards et al. 1984). The most useful of these has been the work of Flabouris and Bridgewater (1996) because it provided a beginning analysis of the relationship between the demand for first aid care and features of the operating environment such as the temperature and crowd size.

An important example of the effect of planned emergency patient care strategies at major events has been provided by a recent study of the impact of cardiac defibrillation on survival from cardiac arrest at the Melbourne Cricket Ground. In addition to providing support for the introduction of automatic defibrillators in public venues, this study emphasises the effect of establishing response arrangements that allow basic and advanced life support to access patients in a timely manner. The research, undertaken by St John Ambulance Australia, (Wassertheil 2000) indicates that a coordinated, planned and appropriately resourced emergency response can significantly reduce deaths from cardiac arrest at major public events. During the period of the research the incidence of cardiac arrest at the Melbourne Cricket Ground was 1:500,000 attendances. Of the 28 cardiac arrest patients in the sample, 24 (86%) left the venue alive and 20 (71%)

were discharged home from hospital. Twenty-one cases were managed with almost immediate cardiopulmonary resuscitation (CPR), early rapid response defibrillation and delayed Advanced Emergency Life Support. Of these, 19 (91%) were 'at scene' survivors and 15 (71%) survived to 'hospital discharge'. CPR was performed on 26 patients (92.9%) within two minutes from the time of collapse. The two cases where CPR was delayed occurred outside the venue in the car park.

This research shows that typical survival rates for life threatening illness can be significantly improved where a planned response is available; in this case the survival rate from cardiac arrest was an extraordinary 85.7%.

Emergency patient care response where large crowds gather relies on a multi-level response capacity. Given the size of both venues and crowds it is usual to rely on first aid trained personnel to provide first line basic life support for spectators. The presence of a large cohort of first aid trained personnel will reduce the time lapse between collapse of the patient and the provision of initial care significantly.

The second line response requires more highly trained first aid personnel able to provide elements of advanced life support (such as cardiac defibrillation) and finally, timely response and transport by ambulance services. Often medical, nursing and ambulance personnel will be in attendance as part of the first aid service at the event.

Each of these layers of the patient care service can operate effectively where good planning and coordination are present. The provision of an effective response requires a number of things: an effective communication system; appropriate placement and response times from first aid teams; adequate support from other public safety agencies (for example police) and adequate human and material resources to meet the demand for patient care. Each of these resource elements relies on good information about probable patient presentations (i.e. type and number of patients expected at the event).

Research findings

The research reported here arose from concern about the lack of epidemiological data suitable for the prediction of patient numbers and types across different public events and venues. Over a period of 12 months 201 mass gatherings (attended by more than 25,000 people) were surveyed throughout Australia. The survey was undertaken by St John Ambulance Australia personnel and the researchers, and collected data on the incidence and type of patient presenting for treatment and the environmental factors that may influence these presentations. Environmental factors included, weather, crowd size, mobility of the crowd, access to first aid, and type of event. A standard reporting format and definition of event geography was employed to overcome the event specific nature of many previous surveys.

The total number of spectators attending events in the research sample was 12,046,436. The total number of patients was 11,956 and of these 330 required subsequent transport to hospital for further treatment (see *Table 1*). The patient presentation rate per thousand spectators (PPR) was, on average, 0.992 compared with between 0.5 and 2.0 for mass gatherings reported in the literature. The highest PPR for a single event in the sample (26.85) was recorded for an outdoor rock festival held during the summer months, and the lowest rate (0.0) at a motor vehicle rally. The transportation rate (TTHR -transport to hospital per thousand in attendance) for all events was 0.027. TTHR's previously reported in the literature ranged between 0.01 and 0.55. Ambulances were in attendance at 63.2% of the mass gatherings in the sample; they were not in attendance at 28.4% of the events, and it was not known if ambulances were in attendance at 8.4% of the events.

Events in the research sample were defined as 'focused' or 'extended' and 'bounded' or 'unbounded'. This classification of events in terms of their geographical characteristics was a strategy to assist in the comparison of data across similar venue types. Events that were held in a clearly defined venue/location were described as 'focused'.

Events that were not focused on a single location, such as marathons and parades, were described as 'extended'. An event contained within a boundary, often fenced, was described as 'bounded'. Events that were not contained in this way were described as 'unbounded'. The most common event categories in the sample were bounded/focused and unbounded/extended. Patient presentation and transportation rates between these two categories differed significantly.

Bounded/focused events had a PPR of 1.26 and patients were transported to hospital at a rate of 0.03/1000. Typically, events included in this category were stadium-based sporting events including various football codes, concerts and fairs. Unbounded/extended events had a PPR of 0.26 and a TTHR of 0.02. These events were typically parades, fun runs and other races.

There are several features of the event categories that may account for the difference in PPR between bounded/focused events and unbounded/extended events. The most significant may be the availability of first aid and other patient care services at bounded/focused events. Patient care is more readily accessible and there may be less 'leakage' of patients to surrounding health care agencies at fenced events. This conclusion is however speculative, and further research will be required to evaluate the difference in risk of injury and illness between these two categories.

The research data demonstrates the effect of the event type on patient presentation rates. Events where the audience is predominantly seated and not

Patient category	Patient number	Percent of total patients	Transported number	Percent of total trans
cardiac (non arrest)	77	0.64	46	13.94
cardiac arrest	6	0.05	6	1.82
respiratory (non asthma)	88	0.74	12	3.64
asthma	353	2.95	18	5.45
heat related illness	126	1.05	9	2.73
laceration	763	6.38	15	4.55
fracture	121	1.01	54	16.36
drug/alcohol related	126	1.05	38	11.52
minor injury	3084	25.79	18	5.45
minor problem	6460	54.03	9	2.73
other	752	6.29	105	31.82
Totals	11956	100	330	100

Table 1: The relative number of patient presentations in each category.

mobile generally demonstrate a significantly lower presentation rate. Typically these are large stadium events. At shows and fairs spectators tend to be more mobile and this seems to be associated with a higher incidence of injury.

The expected attendance at an event is a relatively strong predictor of the number of patients who may require treatment (Bowdish et al. 1992), although the PPR may reduce slightly in larger crowds. Crowd size, in the research sample, ranged between 25,000 and 600,000.

The prevailing weather conditions during an event have been cited as an important influence on the number and type of casualties presenting for treatment (Bowdish et al. 1992). Temperature and humidity are positively correlated to PPR though this effect is complex and relative humidity has the most consistent effect on the number of patient presentations. There is a positive linear relationship between relative humidity and PPR in most circumstances.

At temperatures in excess of 30 degrees celsius, in Australia, crowd awareness and behaviour appear to have reduced the effect of ambient temperature on the PPR. These results highlight the complex interrelationship between factors that influence the number and type of patient presentations with other variables such as the availability of alcohol and the mobility and activity of the crowd having an effect. Nonetheless there is cause for increased preparedness at events where high humidity (and temperature) is expected.

Further research utilising measurements of wind chill and heat index may provide a better understanding of the influence of weather because these parameters combine ambient temperature and relative humidity.

It is likely that an increase in the number and visibility of personnel at a venue results in a slight increase in the PPR because spectators are more likely to seek assistance for minor complaints that might not be treated if first aid personnel were not so readily available. Events included in the research were attended by St John personnel and the usual qualification profile for an event included first-aiders (basic first aid 45.3%) (advanced first aid 43.5%), nurses (7.2%), ambulance officers (2.7%) and medical officers (1.3%). The research identified a positive relationship between the number of health care personnel at an event and the recorded patient presentation rate. The average number of health care personnel on duty at events in the sample was 0.60/1000 in attendance.

Patient presentations were recorded using illness and injury categories that reflect those commonly used in the mass gathering literature. *Table 1* lists the relative number of presentations in each category.

Minor injuries (cuts, abrasions, sprains) and minor problems (headache, sunburn, blisters) account for 80% of patient presentations.

Asthma is the most prevalent of the potentially life threatening medical emergencies. The category 'other' includes several patient problems that are of concern though the incidence of each of these conditions is low. The most prevalent problems in the 'other' category are (752 patients in all) burns (13.4%), nausea (12.9%), epilepsy/fitting (8.7%), syncope (6.7%) and eye injury (6.2%).

The most prevalent form of injury requiring prompt management is laceration.

The dominance of minor injury and minor problems in the data underscores the importance of first aid personnel at mass gathering events. A large cohort of first aid trained personnel will provide a visible and accessible point of contact for patients requiring minor treatment. More severe conditions may then be referred on to medical, ambulance and nursing staff.

Predicting patient presentation rates

There is considerable support in the literature for the view that patient presentations at mass gatherings are influenced by several factors; thus simple analyses of mass gathering data that establish correlation between, for example, crowd size and PPR do not provide a sufficiently sophisticated tool for predicting patient presentations. The research reported here has focused on the development of predictive models that can be applied across different venues and types of event.

Regression analysis was used to develop models that predict within reasonable statistical limits the PPR and TTHR for mass gatherings. These models are complex but underpin an internet-based algorithm that appears simple and has been made available for use by event organisers, emergency services and health care providers to assist in planning for mass gatherings.

The model for prediction of PPR accounts for 64 percent of the variance in the research data and the TTHR model accounts for 31 percent of the variance in the data at the 95 percent level of confidence.

Models for the prediction of PPR and TTHR

Because there are several factors influencing the number and type of patients presenting at mass gatherings the models developed incorporate several of the environmental factors that are considered to be significant influences on PPR and TTHR.

Using the data three regression models were obtained. Univariate analysis and two-way plots were used to identify outliers and possible linear relationships with the dependent variables (total number of patient presentations), (total number transported to hospital), and (predicted number of patient presentations).

Single variable regression models were run to test the ability of each variable to account for the variance in the dependent variable and then a backward stepwise regression procedure was used to identify the best model for each. The first model predicts the number of patient presentations at a mass gathering (*figure 2*). Using the same modeling procedures outlined in *figure 2*, two models were identified for predicting the number of patients transported to hospital. One of these models has been incorporated into the web-based algorithm and can be used when the predicted number of presentations is known (based on the PPR model above). In the interest of brevity the model is not presented here though details can be accessed through the web-site.

The algorithm

The mass gathering algorithm for the prediction of PPR and TTHR, developed as an outcome of this research, can be accessed in the mass gathering section of the Emergency Management Research Page at: www.unisa.edu.au/nur/ESRIG/emr.htm. The algorithm can also be accessed from the St John Ambulance homepages at: www.stjohn.org.au

Conclusions

This paper reports on research into the influence of environmental factors (including crowd size, temperature, humidity and venue type) on the number of patients and the patient problems presenting to first aid services at large public events in Australia. Regression models were developed to predict patient presentation rates and transportation to hospital rates at future mass gatherings and these models have provided the basis

Model to predict the number of patient presentations at a mass gathering

The estimation equation is as follows:

Y = b0+ b1 C1 + b2 C2 + b3 C3 + b4 C4 + b5 C5 + b6 C6 + b7 C7 + b8 C8 + b9 C9
Where Y = the predicted number of presentations and:

b0 = -78.184699	b5 = -20.390940	b0 = INTERCEPT	C5 = SPORT
b1 = -31.488567	b6 = -0.616134	C1 = SEATS	C6 = HUMID
b2 = 84.556898	b7 = -0.000456	C2 = BOUNDED	C7 = ATTEND
b3 = 42.370240	b8 = 0.000016246	C3 = INDOOR	C8 = ATTHUMID
b4 = 81.319501	b9 = 20.067439	C4 = OUTDOOR	C9 = DAY_NGHT

The model is used in the following way:

- the value of SEATS is 1 when the event has a non-mobile population (i.e. attendees are seated), and zero when the population is mobile.
- the value of BOUNDED is 1 when the event is fenced/bound and zero when the event is unbound.
- the value of INDOOR is 1 when the event is indoors and zero when the event is outdoors.
- the value of OUTDOOR is 1 when the event is outdoors and zero when the event is indoors.
  events which are *both* indoor and outdoor record a 1 for INDOOR *and* a 1 for OUTDOOR.
- the value of SPORT is 1 for all sporting events and zero for all non-sporting events.
- HUMID is the level of humidity expected for the day of the event.
- ATTEND is the number of persons expected to attend the event that day.
- ATTHUMID is the result of multiplying expected humidity by expected attendance.
- the value of DAY_NGHT is 1 for events which are both day and night and zero for events which are only day or only night.

An example of the calculation is provided below:

For a seated, bounded, outdoor, day only, sporting event to be held on a 25 degree day with a humidity of 50% and an expected attendance of 40,000, the predicted number of presentations would be calculated as follows:

Y = -78.184699 + -31.488567*SEATS + 84.556898*BOUNDED + 42.370240*INDOOR + 81.319501*OUTDOOR + -20.390940*SPORT + -0.616134*HUMID + -0.000456*ATTEND + 0.000016246*ATTHUMID + 20.067439*DAY_NGHT

Y = -78.184699 + -31.488567*1 + 84.556898*1 + 42.370240*0 + 81.319501*1 + -20.390940*1 + -0.616134*50 + -0.000456*40000 + 0.000016246*(40000*50) + 20.067439*0

Y = -78.184699 -31.488567 + 84.556898 + 0 + 81.319501 -20.390940 -30.8067 -18.24 + 32.492 + 0

Y = 19.25 presentations

Figure 2: Model to predict the number of patient presentations at a mass gathering.

for an algorithm designed to assist emergency management agencies and venues in the prediction of PPR and TTHR.

Further work is being undertaken to replicate the project across a broader range of event types and environmental variables. This work will have two important outcomes. It will serve to strengthen the reliability of each model and expand the size of the research database. This later outcome will allow work to be undertaken on the prediction of patient illness and injury profiles for individual events.

The current models are limited to the prediction of overall patient presentation rates and the relationship between variables such as heat stress and cardiac presentations cannot be identified at present.

The models developed in this research provide a means to quantify the level of resource required to meet health care needs during large public gatherings. Mass gathering events generate health care resource demands at the event itself, and for ambulance and hospital authorities in the provision of transport and hospital resources suited to the scale of the event. For example, hospitals need to reserve sufficient emergency beds to manage the predicted influx of patients from an event in their vicinity. In the past, agencies have adopted a philosophy designed to ensure that more than adequate resources are available and this provides a form of insurance and reduces the likelihood that health care agencies will be overwhelmed. The models developed here provide an opportunity, in a resource deficient system, for resourcing to be related more closely to actual (predicted) need.

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Acknowledgements
St John Ambulance Australia and the Australian Rotary Health Research Fund provided funding to support this project. The Australian Bureau of Statistics assisted with statistical modeling.

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This article has been refereed

Disaster Events Calendar

June 9-13 2002 Reykjavik, Iceland
Emergency medicine between continents
The program features the state of the art in emergency medicine in four focus areas:
ABCDs of life-threatening emergencies, 'Bread and Butter' emergency medicine Kinder and gentler (and faster) ED systems, International EM and injury prevention with concurrent scientific symposium (lower level).
Register on-line:
www.landspitali.is/congress/emergency2002,
or contact: Organizing agent Inga Sólnes
email: inga@your host.is
or Organizing Committee Co-chair
Mary Palmer MD at mpalmer@landspitali.is.

June 18-22, 2002 Rome, Italy
Global Disaster Information Network Conference
Hosted by: the Italian National Institute of Health.
In keeping with the theme, 'Taking Off: GDIN's Contribution to Human Health, Survival, and Well-Being', this conference will provide opportunities for learning about and discussing such diverse topics as modeling large-scale disaster management; information problems of nongovernmental organisations in disasters; political and legal issues in sharing geographic information system data; disaster web sites; information problems in complex humanitarian emergencies; and networks for monitoring volcanic activity, landslides, and seismic activity.
To post messages on the GDIN2002 Interactive Forum, go to: www.gdin.org/forum/gdin2002.
For the preliminary agenda and other information, see www.gdin.org or contact:
GDIN Secretariat, c/o AmTech
497 Seaport Court
Suite 102A, Redwood City, CA 94063 USA.

June 24-25, 2002 New York, New York
Lessons from the World Trade Center Terrorist Attack: Management of Complex Civil Emergencies and Terrorism-Resistant Civil Engineering Design.
Sponsors: Multidisciplinary Center for Earthquake Engineering Research (MCEER), National Academy of Sciences (NAS), and the Institute for Civil Infrastructure Systems (ICIS).
Contact: MCEER
Red Jacket Quadrangle
State University of New York at Buffalo
Buffalo NY, 14261
phone: 716 645 3391; fax: 716 645 3399
email: mceer@acsu.buffalo.edu
http://mceer.buffalo.edu/

July 7-12, 2002 Brisbane, Australia
XV International Sociological Association (ISA) World Congress of Sociology
The ISA's International Research Committee on Disasters will host several sessions on disasters.
Contact: Program Coordinator, Dr. Maureen Fordham, Geography Department
Anglia Polytechnic University
East Road, Cambridge, CB1 1PT
phone: 01223 363 271 ext 2177
fax: 01223 417 726
email: m.h.fordham@anglia.ac.uk
www.ucm.es/info/isa/congress2002/

July 8-26, 2002 Norwich, UK
Disasters and Development: Hazard, Risk, and Vulnerability Assessment.
New course directed by risk management consultants Charles van Oppen and Rob Gilchrist.
Sponsored by: Oversees Development Group.
Unsustainable development practices contribute to many kinds of disasters, and these disasters, in turn, increase poverty and vulnerability to future disasters. This new training course is aimed at arming development professionals and others with the knowledge and ability to plan and execute interventions in the form of disaster preparedness and mitigation planning. The course will present background information on the link between disasters and development as well as the concepts and terminology of hazards, risk management, and vulnerability. The role of risk perception in human behaviour will be examined with an eye toward how it affects local decision-making. Finally, participants will learn about a process for assessing and managing risk and help construct a 'toolbox' of techniques that can be applied to any risk or disaster scenario. The course will culminate in a disaster simulation exercise.
Contact: Overseas Development Group
University of East Anglia
Norwich NR4 7TJ, United Kingdom
phone: +44 01603 456410
fax: +44 0 1603 505262
email: odg.train@uea.ac.uk
www.uea.ac.uk/dev/ODG/pages/course_disaster.html.

14-18 August, 2002 Melbourne Australia
Stress, Trauma and coping in Emergency Services and Allied Professions. CISM: A Continuum of Care.
The Critical Incident Stress Management Foundation Australia.
Contact: CISMFA
PO Box 173
North Carlton VIC 3054, Australia
phone: 61 03 9347 9313; fax: 61 03 9347 7127
www.cismfa.org.au

August 14-15, 2002 Wellington, New Zealand
5th New Zealand Natural Hazards Management Conference.
The integration of hazard information into effective risk management will be the focus of this meeting, expected to attract planners, risk assessors, emergency managers, and natural hazards researchers and scientists. Among the specific issues considered will be natural hazard mitigation for business and industry, creation of resilient communities by integrating science and practice, and the application of new technologies.
Contact: Diane Tilyard
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Registration and program details will be sent out late May 2002. To receive registration and program details, visit www.gns.cri.nz/news/conferences/hazconf2002.htm and pre-register on-line or via the form in the on-line brochure.

September 2-11, 2002 Johannesburg, South Africa
2002 World Summit on Sustainable Development (Rio +10)
The World Summit is the largest and most prominent conference on sustainable development. The meeting will have hundreds of sessions, many of interest to the Natural Hazards community, such as Oceans and Coasts.
Contact: Johannesburg Summit Secretariat
Division for Sustainable Development
United Nations Department of Economic and Social Affairs
Two United Nations Plaza, DC2-2220
New York, NY 10017
email: dsd@un.org
www.johannesburgsummit.org

September 27-28, 2002 London, Ontario, Canada
Dealing with Disasters
Sponsor: Institute for Catastrophic Loss Reduction (ICLR)
This 'workshop in extreme events and the assessment of risk', will examine how risk from natural disasters is evaluated as well as the steps that can be taken to reduce the losses that result from them. Attention will be given to the tools that mitigate the risk, including land use planning, warnings, insurance, construction standards, building codes, and new technologies.
Contact: Sandra Doyle
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1389 Western Road
London, Ontario
Canada N6A 5B9
phone: 519 661 3234
fax: 519 661 4273
email: ssdoyle@uwo.ca
www.iclr.org

October 15-18, 2002 Shanghai, China
Fifth International Conference of Local Authorities Confronting Disasters and Emergencies - LACDE 5.
Sponsor: Local Authorities Confronting Disasters and Emergencies.
The mission of LACDE is to increase the effectiveness of local authorities to prepare for and confront natural and technological disasters and emergencies, and mitigate damage from them. It does this by promoting the study of disaster management and prevention, organising international conferences and training, and fostering international relations among local emergency practitioners and officials. This conference will focus on systems to reduce urban disasters (fire, earthquake, coastal storms, and others), preparedness, regulation, and management; safer buildings; and emergency rescue technology and equipment
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