Local government views on addressing flood risk management on the Gold Coast

Godber, Hasings and Childs present Gold Coast local government planning officers' views on 'sustainable' floodplain management in the region

Abstract

The premise of sustainable development infers the need to integrate risk management with land-use planning and sustainable community development. To achieve 'sustainable' floodplain management, policy makers and local government officers need to have an effective knowledge of the risks considered to be 'acceptable' by the community as well as the levels of flood awareness and local experience. This knowledge then needs to be further incorporated into acceptable risk standards and floodplain land-use policy – but how can this be achieved? Research to date has identified several factors relating to government, perception, resource availability and communication which limit such integration. Based on a case study on the Gold Coast, QLD, this paper presents the views of local government officers on potential solutions to address the problems of setting and communicating flood risk standards in land-use planning.

Introduction

In studying perceptions of acceptable flood risk on the Gold Coast, Queensland, Godber (2005a; 2005b) postulated that land-use decision-makers needed to more effectively incorporate community risk perceptions when establishing 'acceptable' risk standards. In Queensland, local government has prime responsibility for the application of hazard management. This paper presents the views of local government officers on potential solutions to address the problems of setting and communicating flood risk standards in land-use planning.

The focus case study, the Guragunbah urban floodplain, is located within the lower catchment of the Nerang River system (figure 1). This region is susceptible to flood[1] but has experienced substantial population growth over the past three decades. This has resulted in significant land-use change from predominantly

Figure 1. Location of Study Area – Guragunbah on the Gold Coast, QLD

farm and swampland to urban development (Godber, 2005a). The region continues to attract new residents (approximately 15 000 per year, Gold Coast City Council, 2003; ABS, 2001)[2] many of whom may have little or no direct experience with flooding in South-East Queensland (Table 1).

Although construction associated with urban floodplain development at Guragunbah has generally conformed to regulation based on the best available flood-risk information at the time, some developments are now

1 In the latest extensive flood event, in July 2005 moderate to major flooding affected the Gold Coast region resulting in inundation of residential and commercial properties and infrastructure.

2 On the Gold Coast the number of private dwellings (houses, townhouses, etc) has increased from approximately 14 000 in the 1960s to just over 187 000 in 2000 (Gold Coast City Council, 2003; ABS, 2001). Further to this, the Queensland State Government's Regional Plan for the South-East indicates that populations within existing urban areas are set to increase in the order of 50 000 persons per year (Office of Urban Management, 2004).

The red line indicates the water level within residential areas during the extensive flood event in July 2005.

located at elevations below today's commonly accepted planning standard (i.e. the "defined flood event" – DFE) of the 1-in-100 year flood. Consequently, land-use planners and risk managers face the challenges of how to manage the potential exposure to flood hazard, and communicate the flood risks to the community. Complicating this is the fact that many in the community have inaccurate perceptions of the actual flood risk and differ in their acceptance of that flood risk, which has implications in terms of increasing community vulnerability (Godber, 2005a,b). Research has shown that risk perception and acceptance is influenced by a number of factors including: familiarity and experience with a hazard, knowledge about impacts, the way in which information is communicated/ presented, and cognitive or psychological characteristics (Fischhoff, B., S. Lichtenstein, P. Slovic, S.L. Derby, and R.L. Keeney, 1995; Tobin and Montz, 1997; Slovic, 2000a,b).

Background

Surveys conducted in 2002–2003 on the Gold Coast by Godber (2005a; 2005b) established that the level of flood risk considered to be acceptable varies among key decision-making stakeholders in the community, namely local government, the development industry and the floodplain residents. Table 1 summarises key findings of this research, based on data collected from samples of stakeholder groups within the floodplain. The research identified a number of issues concerning floodplain land-use planning, risk management and acceptable risk and concluded that more attention could be directed towards planning *with* as opposed to *for* the community when considering the *acceptability* of risks and hazard impacts. From the results this approach is argued to be more appropriate in light of the public misinterpretation of flood impacts associated with standards such as the traditional 1-in-100-year flood.

These results imply that policy makers need to more effectively incorporate community risk perceptions when establishing 'acceptable' risk standards. The question becomes: *What can be done at the local government level to realign acceptable risks*? The present paper identifies potential management strategies to address these issues, particularly from a local government perspective, and explores their efficacy in the case study region. Views from council officers on four potential strategies to address the problems of setting and communicating risk standards in relation to flood hazard and land-use planning reveal some limitations and possibilities.

Table 1. Key Findings from Godber (2005b)

The stakeholders considered risks from different perspectives
• The floodplain residents in terms of the impacts that are likely to occur to their homes;
• The local government and the development industry in terms of the management responsibility and regulatory and legal obligations for sites.
Current planning standards were misinterpreted by the public and generally considered to be unacceptable.
• The floodplain residents were generally unaware of the land-use planning measures that had been implemented to address flooding (for example minimum development standards or acceptable risks);
• The floodplain residents did not believe the local governments would permit residential land-use within areas that may be flooded, if only by events greater than the current minimum acceptable standard (the 1-in-100 year flood);
• When the potential impacts associated with the 1-in-100 year flood were illustrated graphically, the floodplain residents considered the consequences to be unacceptable.
Flood risk could be 'removed' through land-use planning.
• Many floodplain residents and some development industry representatives did not consider land which had been developed, (particularly to heights above previous flood events or the planning standards) to be "floodplain";
• The planning standards were often seen by the some of the residents and members of the development industry as having removed all flood risk.
Differences exist between actual and perceived responsibilities for education and flood mitigation.
• The floodplain residents considered local government to be responsible for informing the community about flooding and then mitigating the risk;
• The majority of development industry representatives also considered community education to be the responsibility of the local government;
• The developers did acknowledge the role played by their industry in mitigating flood risks; however, the representatives did suggest that local governments needed to ensure that land-owners actually undertook the mitigation required for their sites;
• The Local Government considers education and mitigation to be 'whole-of-community' issues.

The Four Strategies

Policy makers and local government officers need to have an effective knowledge of the risks considered to be '*acceptable*' by the community as *well* as the levels of flood awareness and local experience. This knowledge then needs to be further incorporated into acceptable risk standards and floodplain land-use policy – but how can this be achieved?

The Godber studies (2005a; 2005b) identified stages at which decisions about flooding and acceptable flood risk were made at the local government level, and by whom. This was achieved through a modelling process, describing the planning and risk management processes existing within the Gold Coast City Council. The derived model was also analysed in terms of frameworks and processes recommended within the literature (Holway and Burby, 1993; Smith *et al.*, 1996; Smith, 1998; Penning-Rowsell *et al*, 1998; Burby *et al.*, 2000) and existing policy and guidelines (Queensland Government, IDAS 1997; Standards Association of Australia, 1995; SCARM, 2000; EMA, 2002). From this analysis opportunities were identified to further integrate flood risk management and land-use planning, including closer consideration of acceptable risks.

1. Change the planning approach

The first strategy involves changing the planning approach and the way in which planning schemes are constructed, from the current top-down approach, where local government makes the decisions, to a bottom-up approach based on what risks the community considers to be acceptable. For example, within QLD, local governments already seek public comments and feedback on particular developments and proposed land-use, as well as drafts of new planning schemes. This community consultation, however, does not appear to drive the setting of acceptable flood risk standards. Rather local government adopts a standard incorporating a level of risk which it believes is acceptable within the community. This results in potential mismatches between imposed risk standards and community preferences.

2. Change the planning process to allow flexibility in standards

The second strategy involves modifying the existing planning process to allow the community to select the risk standards it considers to be acceptable for any given land-use i.e., flexible decision-making. At present there are different standards of flood risk exposure considered acceptable for different land-uses (i.e., 1-in-100 for residential homes; 1-in-20 for parkland areas), but these have traditionally been adopted from pre-existing policy and technical assessments of risk, rather than being based on community perceptions of flooding.
It is possible for local governments to adopt flood risk standards that differ from those specified within the existing legislation and guidelines (i.e., within QLD the State Planning Policy (SPP) 1/03), if the new level can be justified through flood studies that reflect the community's understanding and acceptance of flood risk impacts.

3. Mitigate the Existing Risk

The third strategy involves using structural engineering methods (such as raising dam walls or constructing levees) to mitigate the existing flood risks. Instead of changing the planning standards, the actual risk that exists on the ground would be altered to levels considered to be 'acceptable' by the community.
For example this could be achieved through raising the walls of the existing dams; constructing additional dams to increase storage capacity; and/or constructing levee banks around weak points in the river banks or near highly populated/developed locations. Traditionally, levees and other forms of structural engineering have been identified as one of the most feasible options for mitigating the risk to existing land-uses, e.g., Lismore and Grafton, NSW. This mitigation, however, has been based on technical assessments of risk as opposed to community perceptions of acceptable (or unacceptable) flood impacts.

4. Communicate the risk better

The fourth strategy involves communicating flood risks and associated impacts to stakeholders in a way that the community can understand and relate to their own location or situation. For example this could be achieved through the use of photos, scenarios or flood markers instead of only technical expressions such as 1%AEP or 1-in-100-year flood. At present, some local government areas (e.g. Rolleston in QLD and Raymond Terrace in NSW) have flood markers on telephone/telegraph poles around their towns, illustrating the water levels of previous flood events.

Local government responses to the four strategies

Interviews were conducted in October 2003 with representatives (hereafter referred to as council officers) from the risk management and land-use planning units of the Gold Coast Local Government. The council officers, and their roles within the floodplain land-use planning process, included:

- A representative from the Flood Strategies Section, a unit responsible for developing floodplain management and land-use planning policy and consulting with the community about flood risk;
- A representative from the Strategic Environmental Planning and Transport Directorate, a unit responsible for developing land-use planning guidelines and assessing the suitability of proposed land-use; and
- A representative from the Planning (South) Committee, comprising Local Area representatives and responsible for making the final decision about the suitability of land-use on behalf of the local government.

The four strategies described above and the assessment of their feasibility by council officers (working within the constraints of legislation and local government policy) are presented below.

1. Change the Planning Approach

The council officers suggested that changing from the current top-down to a bottom up planning process would not be practical at the local government level, because any envisaged changes to the actual legislated processes would be the responsibility of the State Government. There were also suggestions that the State Government had not provided enough resources or guidelines for local governments to consult with the community about risk, and specifically, acceptable risk. While community consultation does occur, risk acceptability is not covered. As a result, there were concerns that the community could not be sufficiently informed about the range of issues that had to be considered when designing planning schemes. Furthermore, changes to the actual legislated process would need to be initiated and undertaken at the State Government level to ensure an equitable process would be adopted across the State's floodplains. The SPP 1/03 however, does address some of these issues, but at the time of interviews the legislation had only been enacted for one month.

2. Change the planning process to allow flexibility in standards

While this strategy was not entirely dismissed, the council officers did indicate that it would be impractical to change the minimum planning standards for several reasons. Firstly, local governments do not want to initiate changes that may have negative impacts on other local government authorities and development interests that might reduce land availability and affordability. Secondly, there were also concerns about which stakeholders should be consulted, particularly with a mobile population. Thirdly, there was debate as to whose interpretation of acceptable risk is most 'appropriate'. The representatives also noted that Local Governments have a 'duty of care' to all landholders and permitting one landholder to develop below a standard has the potential to increase or alter the physical risk of surrounding residents, to levels they may not agree to accept/ consider acceptable.

3. Mitigate the existing risk

The council officers indicated that while it would be possible to mitigate the existing risk via engineering solutions, these would be difficult to implement for a number of reasons. Firstly, identifying and consulting with stakeholders is difficult, particularly with uncertainties surrounding the following issues: choice of effective and legally sound risk communication method; and the extent to which residents would be affected by flooding. Secondly, prioritisation over funding and resources for competing projects (that might offer social/ economic benefits that, to some, outweigh the potential flood risk) and the day-to-day duties and services that local governments must also provide, would be a source of debate. Thirdly, the distribution of costs – should only those who directly benefit pay or should the whole community contribute? Finally, the rapid growth and development occurring in the geographical area present challenges for floodplain managers including regular updating of existing flood models in order to accurately predict potential flooding.

4. Communicate the risk better

The council officers indicated that this would be the most practical solution to address the problem, but again there were issues that would have an impact on how risk could be communicated – funding to purchase educational material; state guidance in terms of a standard presentation format for flood risks; the possibility of communicating the 'wrong' information and the potential legal consequences as a result; and inadequate resources to actually assess flood risk. The representatives further acknowledged that the community does not understand the technical language currently used to communicate flood risks, with debates within council over which format should be used to present flood risk information to whom the information should be provided. The risk management and land-use planning representatives also suggested that the placement of visible flood markers within suburbs is not an option the local government would consider. The implication was that there would be the potential for litigation from landholders trying to sell their properties and calls for the identification of other potentially contentious land-uses, such as public housing. Recent research has questioned the validity of this argument, observing that a flood-event rather than the designation of land as flood-affected or floodplain will have more of a negative long-term impact on property values (Babcock and Mitchell, 1980; Muckleston *et al*, 1981; Muckleston, 1983; Schaefer, 1990; Tobin and Montz, 1988, 1990, 1994; Schrubsole, D., M., Green, and J., Scherer, 1997; Yeo, 2003). While the representatives also acknowledged the limited ability of maps to communicate detailed flood information, the consensus from the council officers is that maps illustrating general areas that may be flood-affected (but not specific heights), could be useful to the community as reference point.

Summary: limitations of the four strategies

The premise of sustainable development infers the need to integrate risk management with land-use planning and sustainable community development (e.g. Berke, 1995:373). Research to date has identified several factors relating to government, perception and resource availability which limit such integration. These include:

1. the acknowledgement (and prioritising) of the hazard by the relevant authorities and local communities;

2. the resource potential of the hazardous environment; and
3. the coordination of the jurisdictions responsible for planning and management.

(Smith and Handmer, 1984; Lambley, 1990; Handmer, 1996; Smith *et al*., 1996; Penning-Rowsell and Tunstall, 1996; Lustig and Maher, 1997; May, 1997; Berke, 1998; Burby 1998a,b; Burby *et al*., 1998, 1999, 2000). The results of the current study generally support the inhibiting factors identified by the above sources. In particular this identifies issues that potentially limit the realignment of standards to levels considered acceptable by them community and integration of risk management and land-use planning.

1. Resource availability and prioritisation

Local Governments have only a limited internal resource base from which to directly fund or request funding required for mitigation projects and the associated preliminary studies. This is a significant barrier also identified by Smith *et al*., (1996). Mitigation projects (education as well as structural engineering) must also compete against both the day-to-day operations of local governments (such as waste management) and projects that often address contradictory issues, for example, during times of drought, the management of limited water resources. The potential flood risk must also be balanced against the projected social economic and environmental benefits offered by the location and prospective land-use, an issue identified by Handmer (1995) and Penning-Rowsell *et al*., (1996).

2. Lack of political will

The political will needed to initiate changes to levels of acceptable risk and the processes through which standards are established does not appear to exist at the local government level (at present), supporting the findings of Smith *et al*., (1996). The results suggest that the local governments do not want to deviate too drastically from the traditional standards and initiate changes for fear of retribution from other local governments as well as the State and Federal Government and development interests. The lack of political will to initiate change further demonstrated the tussle between managing the flood risk and utilising a valuable land resource, identified by Burby *et al*., (1998, 1999, 2000) as a significant inhibiting factor. Further, local governments do not want to reduce the available land for development or force other local governments to change their planning processes. This presents a management dilemma – will it take a major flood, impacting on the results of current land-use decisions, to initiate the political will to change?

3. Issues concerning stakeholder identification and knowledge levels

A mobile population and a limited resource base, leads to debates over which stakeholders should be consulted regarding land-use standards (previous, current or future residents)? The representatives acknowledged that the community does not understand the way in which flood risk information is currently presented. In response there are problems for local governments in attempting to address the community's misinterpretation of technical terms.

4. Uncertainties about community consultation

The dilemma over whose perceptions of risk the community consulted etc. should be considered the 'standard' was raised as a supporting argument for the continuation of current arrangements. The results also identified the contentious issues of which stakeholders will benefit from mitigation, whether that benefit is direct or indirect, and how the associated costs should be distributed.

Concerns regarding which level of government is, and should be responsible for providing the community with flood risk information were evident, supporting Burby *et al's* (1998, 1999, 2000) and Lustig and Maher's (1997) finding that jurisdiction conflicts have the potential to significantly interfere with effective hazard mitigation. The QLD State government could play a more active role and, following NSW, legislate that information regarding flood risk must be provided when purchasing property. However, the level of flood information available to local governments differs across the state and such legislation may see many local governments disadvantaged without considerable state assistance. In line with the provision of flood information, there would need to be a follow-up program to ensure the recipients correctly interpreted and appropriately used the information they received. Such a program, however, would need to compete against other local and state government projects for resources.

5. The uncertain and irregular nature of flooding

Local governments have been reluctant to provide too much specific information about potential flood impacts, due to the uncertainty that surrounds flooding and the unique characteristics of each flood event, a barrier to mitigation identified by Smith *et al*., (1996). At present, the varying ability of local governments to accurately model flood risk is also a significant issue, linked to resource availability, issues over management jurisdiction and perceived inadequacies at the state government level, again supporting the findings of Smith *et al*., (1996) and Burby *et al*., (1998, 1999, 2000).

6. Limited guidance from the State Government regarding the communication of flood risk.
Similar to the key inhibitors identified by Lambley (1990), May *et al*., (1996a,1996b), Smith *et al*., (1996), Berke, (1998) and Burby *et al*., (1998, 1999, 2000), the results of the present study indicate that the confusion surrounding which level of government (local or state) is and should be responsible for floodplain management/ mitigation might be preventing local governments from initiating change. At present, the issue is largely transferred onto the State Government, and it is here that changes (such as state-wide standards for communicating flood risk and consulting the community about the acceptability of risks and impacts) may need to be made.

Opportunities for change

These issues do not imply that local governments are *unable* to integrate perceptions of risk into planning, rather that they are *inhibited* from initiating change. There were two solutions identified by the council officers as potential *opportunities* for change – education and engineered structural mitigation. Berke (1998) and Burby *et al*., (2000) have also identified structural mitigation and education as key flood risk management options for local governments to integrate into floodplain land-use planning. Such measures, however, remain surrounded by obstacles including resource availability and debates over stakeholder consultation and contribution (identified by above and e.g. Burby 1998a,b; Burby *et al*., 1998, 1999, 2000). There still exists a fear of legal repercussions surrounding the provision of flood risk information within the community, either preventing or limiting the release of flood risk information and modifying the format in which such information is delivered. A solution to reduce this problem is ensuring that communication is mandated between local government and community stakeholders. This should lead to stakeholders making *informed decisions* regarding their potential exposure to flood risks when selecting a residence and give the community more control over their level of vulnerability.

In an ideal situation, planning schemes would be based on the land-use and hazard risks considered 'acceptable' by an informed community. From the local government perspective, however, there are a number of issues raised that inhibit changes to the planning processes, standard setting and the realignment of acceptable risks.

Acknowledgements

The authors wish to thank the Gold Coast City Council for their cooperation and Ms Carly Hall for her work in generating the map used in this article.

References

Australian Bureau of Statistics. (2001). *Census of Population and Housing – Usual Residents Community Profile* (Catalogue No: 2901.0). Australian Bureau of Statistics, Canberra.

Babcock, M. and B. Mitchell. 1980. Impact of Flood hazard on Residential Property Values in Gault, Ontario. *Water Resources Bulletin* 16(3): 532–537.

Berke, P. R.. (1998). Reducing Natural Hazard Risks through State Growth Management. *The Journal of the American Planning Association*, 64(1), 76–86.

Burby, R.J. (1998a). Cooperating With Nature: *Confronting Natural Hazards With Land Use Planning for Sustainable Communities*. United States: Joseph Henry Press.

Burby, R.J. (1998b). Natural Hazards and Land Use: An Introduction. Pp. 1–28 in *Cooperating With Nature: Confronting Natural Hazards With Land Use Planning for Sustainable Communities*, edited by R.J. Burby, United States: Joseph Henry Press.

Burby, R.J., T. Beatley, P.R. Berke, R.E. Deyle, S.P. French, D.R. Godschalk, E.J. Kaiser, J.D. Kartez, P.J. May, R. Olshansky, R.G. Paterson, and R.H. Platt. (1999). Unleashing the power of planning to create disaster-resistant communities. *The Journal of the American Planning Association* 65(3): 247–258.

Burby, R.J., R.E. Deyle, D.R. Godschalk, and R.B. Olshansky. (2000). Creating Hazard Resilient Communities through Land-Use Planning. *Natural Hazards Review*, May: 99–106.

Burby, R.J., P.J. May, and R.G. Paterson. (1998). Improving Compliance with Regulations: Choices and Outcomes for Local Government. *The Journal of the American Planning Association* 64(3): 324–334.

Emergency Management Australia. (2002). *Planning Safer Communities – Land use planning for natural hazards*. Canberra: Emergency Management Australia.

Fischhoff, B., S. Lichtenstein, P. Slovic, S.L. Derby, and R.L. Keeney. 1995. Risk Perception and Communication Unplugged: Twenty Years of Process. *Risk Analysis* 15(2):137–145.

Godber, A.M. (2005a). *Urban Floodplain Land-use – Acceptable Risk? A Case Study of Flood Risk Perception on the Guragunbah Floodplain*. Unpublished Ph.D Thesis, Queensland University of Technology: Brisbane.

Godber, A.M. (2005b). *Urban Floodplain Land-use – Acceptable Risk.* The Australian Journal of Emergency Management, Vol. 20 No. 3. pp. 22–26.

Gold Coast City Council Social Research Section. (2003). *Our Community: A Social Profile of Gold Coast City.* Gold Coast: Gold Coast City Council.

Handmer, J.W. (1996). Policy Design and Local Attributes for Flood Risk Management. *Journal of Contingencies and Crisis Management* 4(4):189–197.

Handmer, J.W. (1995). Managing Vulnerability in Sydney: Planning or Providence? *Geojournal* 37(3):355–368.

Holway, J.M. and R.J. Burby. (1993). Reducing Flood Losses: Local Planning and Land Use Controls. *The Journal of the American Planning Association* 59(5):205–216.

Lambley, D.B. (1990). Jurisdictions as Impediments to Floodplain Planning and Management. *Australian Journal of Public Administration* 49(4):431–441.

Lustig, T. and M. Maher. (1997). Sustainable Floodplain Management Plans. *The Australian Journal of Emergency Management* 12(3):10–17.

May, P.J. (1997). Addressing Natural Hazards: Challenges and Lessons for Public Policy. *The Australian Journal of Emergency Management* 12(1):30–37.

May, P.J., R.J. Burby, N.J. Erickson, J.W. Handmer, J.E. Dixon, S. Michaels, and D.I. Smith. (1996a). The Commitment Conundrum. Pp. 196–212 in *Environmental Management and Governance: Intergovernmental Approaches to Hazards and Sustainability*, edited by P.J. May, R.J. Burby, N.J. Erickson, J.W. Handmer, J.E. Dixon, S. Michaels, and D.I. Smith. New York: Routledge Press.

May, P.J., R.J. Burby, N.J. Erickson, J.W. Handmer, J.E. Dixon, S. Michaels, and D.I. Smith. (1996b). *Environmental Management and Governance: Intergovernmental Approaches to Hazards and Sustainability*. New York: Routledge.

Muckleston, K.W. 1983. The Impact of Floodplain Regulations on Residential Land Valuations in Oregon. *Water Resources Bulletin* 19(1):1–7.

Muckleston, K.W., M.F. Turner, and R.T. Brainerd. 1981. *Floodplain Regulations and Residential Land Values in Oregon*. Corvallis, Oregon: Office of Water Resources Technology, Water Resources Research Institute, Oregon State University.

Office of Urban Management. (2004). *Draft South East Queensland Regional Plan*. Queensland State Government: Brisbane.

Penning-Roswell, E.C. and S.M. Tunstall. 1996. Risks and Resources: Defining and Managing the Floodplain. Pp. 493–533 in *Floodplain Processes*, edited by M.G. Anderson, D.E. Walling, and P.D. Bates. Chichester: Wiley Press.

Penning-Rowsell, E.C., P. Winchester, and J. Gardiner. (1998). New Approaches to Sustainable Risk management for Venice. *The Geographical Journal* 164(1):1–18.

Queensland State Government, Integrated Development Assessment System (IDAS) (1997). *The Integrated Planning Act*. Brisbane: Queensland Government Press.

Queensland Government. (2003). State Planning Policy (SPP 1/03) *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*. Brisbane: Queensland Government.

SCARM. (2000). *Floodplain Management in Australia: Best Practise Principles and Guidelines*. Collingwood: CSIRO.

Schaefer, K.A. 1990. The Effect of Floodplain Designation/ Regulations on Residential Property Values: A Case Study in North York, Ontario. *Canadian Water Resources Journal* 15(4):319–332.

Schrubsole, D., M., Green, and J., Scherer. 1997. The Actual and Perceived Effects of Floodplain Land-use Regulations on Residential Property Values in London, Ontario. *Canadian Geographer* 41(2):166–178

Slovic, P. 2000a. *The Perception of Risk*. London: Earthscan Publications ltd.

Slovic, P. 2000b. The Perception of Risk. in *Risk, Society and Policy,* edited by R.E. Lofstedt. London: Earthscan Publications, Ltd.

Smith, D.I. 1998. *Urban Flooding in Qld: A Review.* Brisbane: Department of Natural Resources.

Smith, D.I. and J.W. Handmer. 1984. Urban Flooding in Australia: Policy Development and Implementation. *Disasters* 8(2):105–117.

Smith, D.I., J.W. Handmer, J.M. McKay, M.A.D. Switzer, and B.J. Williams. (1996). Non-Destructive Measures in Australian Urban Floodplain Management: Barriers and Recommendations. *The Australian Journal of Emergency Management* 11(2):51–56.

Standards Association of Australia. 1995. *Risk Management Standards – Standards Australia/ Standards New Zealand*. Strathfield: Standards Association of Australia.

Tobin, G.A. and B.E. Montz. 1997. *Natural Hazards: Explanation and Integration*. New York: Guilford Press.

Tobin, G.A. and B.E. Montz. 1994. The Flood Hazard and Dynamics of the Urban Residential Land Market. *Water Resources Bulletin* 30(4):673–685.

Tobin, G.A. and B.E. Montz. 1990. Catastrophic Flooding and the Response of the Real Estate Market. *The Social Science Journal* 25(2):167–177

Tobin, G.A. and B.E. Montz. 1988. Response of the Real Estate Market to Frequent Flooding: The Case of Des Plaines, Illinois. Bulletin – *Illinois Geographical Society* Fall: 11–21.

Yeo, S. 2003. Effects of disclosure of flood-liability on residential property values. *The Australian Journal of Emergency Management* 18(1):35–44.

About the Authors

Allison Godber is a geographer and Post Doctoral Research Fellow with the Centre for Social Change Research, Queensland University of Technology. She has a background in natural hazard risk perception and has focused on the way in which risk management and land-use planning policy can better reflect community perceptions of risk. Doctors Hastings and Childs teach and research Hazard Geography as academic staff in the School of Humanities and Human Services and at the Centre for Social Change Research, Queensland University of Technology, Brisbane.
Email: a.godber@qut.edu.au