

DO EDUCATION STRATEGIES SINK AND COMMUNITIES SWIM? EVALUATION OF THE WORONORA PREPAREDNESS STRATEGY FIVE YEARS ON.

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ABSTRACT

The need for flood awareness education has been advocated by a wide variety of emergency services, government agencies and researchers, both in Australia and overseas. To date, there has been little objective evidence of a link between pre-event education on the one hand and flood awareness, flood preparedness and damage minimisation on the other. Molino Stewart, with assistance from an Emergency Management Australia research grant, evaluated the effectiveness of a recent flood preparedness program in the Woronora Valley, a narrow coastal floodplain in the Sutherland Shire in Sydney. Program implementation began in 1999 and included a mixture of traditional and innovative communication methods.

A survey of 100 flood-affected residents assessed: whether residents were aware of flooding in their community; had received and retained the various flood messages; and were prepared for a flood.

The survey found that the strategy had increased flood awareness significantly in the community but that much more work needs to be done to increase the preparedness of residents. It found that some communication techniques were considerably more effective than others but the most effective techniques had some significant barriers to their implementation.

1 BACKGROUND

1.1 Evaluating Community Education

Community engagement and education regarding flood preparedness are often seen as paramount in reducing loss of life and property during a flood (Young and O'Neill, 1999). However there has been no report offering evidence of the effectiveness of pre-event awareness and education. Sorensen (2000) highlighted that "There is no conclusive evidence regarding whether or not a public education or information program actually makes a significant difference of increasing human response to warnings".

A national and international literature search, along with personal communication with flood preparedness researchers around the world as part of this project, confirmed a paucity of data on the effectiveness of flood education and preparedness campaigns.

The Woronora Flood Preparedness Evaluation was an attempt to evaluate the effectiveness of pre-event awareness and education in a particular location.

1.2 Flood Preparedness in the Woronora Floodplain

The Woronora River is located in southern Sydney and runs through a narrow floodplain along its final 11 kilometres. Most of the development in this area is concentrated around the suburb of Woronora. However, other development in the floodplain occurs in the suburbs of Bonnet Bay, Como, Illawong and the estates of Deepwater Estate and Shackleton Estate. In a Probable Maximum Flood it is estimated that more than 500 houses in the floodplain would experience above floor flooding.

In 1995, a Floodplain Management Study identified homes in the Woronora, Valley at risk of flooding. Later that year, a floodplain management plan was completed with the assistance of the local community. The plan included a proposal for improved flood forecasting and warning systems, community preparedness and building and planning controls.

Molino Stewart prepared a Community Preparedness Strategy for Sutherland Shire Council in November 1998. Some of the techniques to communicate the messages and the way they were integrated represented some ground-breaking ideas on flood preparedness and are detailed in Molino and Rogers (1999).

Sutherland Shire Council, with the Assistance of the State Emergency Service (SES), began implementing elements of the strategy in 1999.

1.3 The Evaluation Project

Molino Stewart, with assistance from an Emergency Management Australia research grant, evaluated the effectiveness of the Woronora Preparedness Strategy in late 2003, almost five years after its implementation began. This evaluation project involved:

- Developing a set of evaluation criteria;
- Sourcing information on pre-strategy awareness and preparedness in the Woronora Valley;
- Identifying how much of the strategy had been implemented;
- Interviewing by telephone 100 residents which represented about 20% of flood affect households;
- Using the implementation and survey data to evaluate the effectiveness of the strategy against the evaluation criteria;
- Comparing the results with pre-strategy survey information and Australian and international experience; and

- Analysing the research and survey data to identify the most and least successful measures and to identify opportunities for improving communication about floodplain management.

This paper summarises the research findings. The full report (Molino Stewart 2004) is available from Emergency Management Australia.

2 THE CONTEXT

Any community education exercise occurs with reference to a specific physical, geographical, social and historical context. Awareness of these contextual aspects is important if the effectiveness of an education campaign is to be evaluated and its lessons applied elsewhere. This section outlines the context of the Woronora Flood Preparedness Strategy.

2.1 Location and Geography

The Woronora River is in the Sutherland Shire, 20km south of the Sydney CBD (see Figure 1). Its upper reaches are largely undeveloped and managed by the Sydney Catchment Authority. Woronora Dam provides drinking water for the Sutherland Shire and some surrounding suburbs and has a catchment of about 80 square kilometres.

Downstream of the dam the river passes through sandstone gorge terrain. Much of these 95 square kilometres of catchment are covered in eucalypt forest but there is increasing urban development along the catchment's ridgelines.

There is also residential development along the banks and narrow floodplain of the final 11 kilometres of the Woronora River before it joins the Georges River near Como Bridge.

The reach of river along which floodplain development occurs is tidal. The main riverside suburbs are shown in Figure 2.

Figure 1: Location of Woronora River

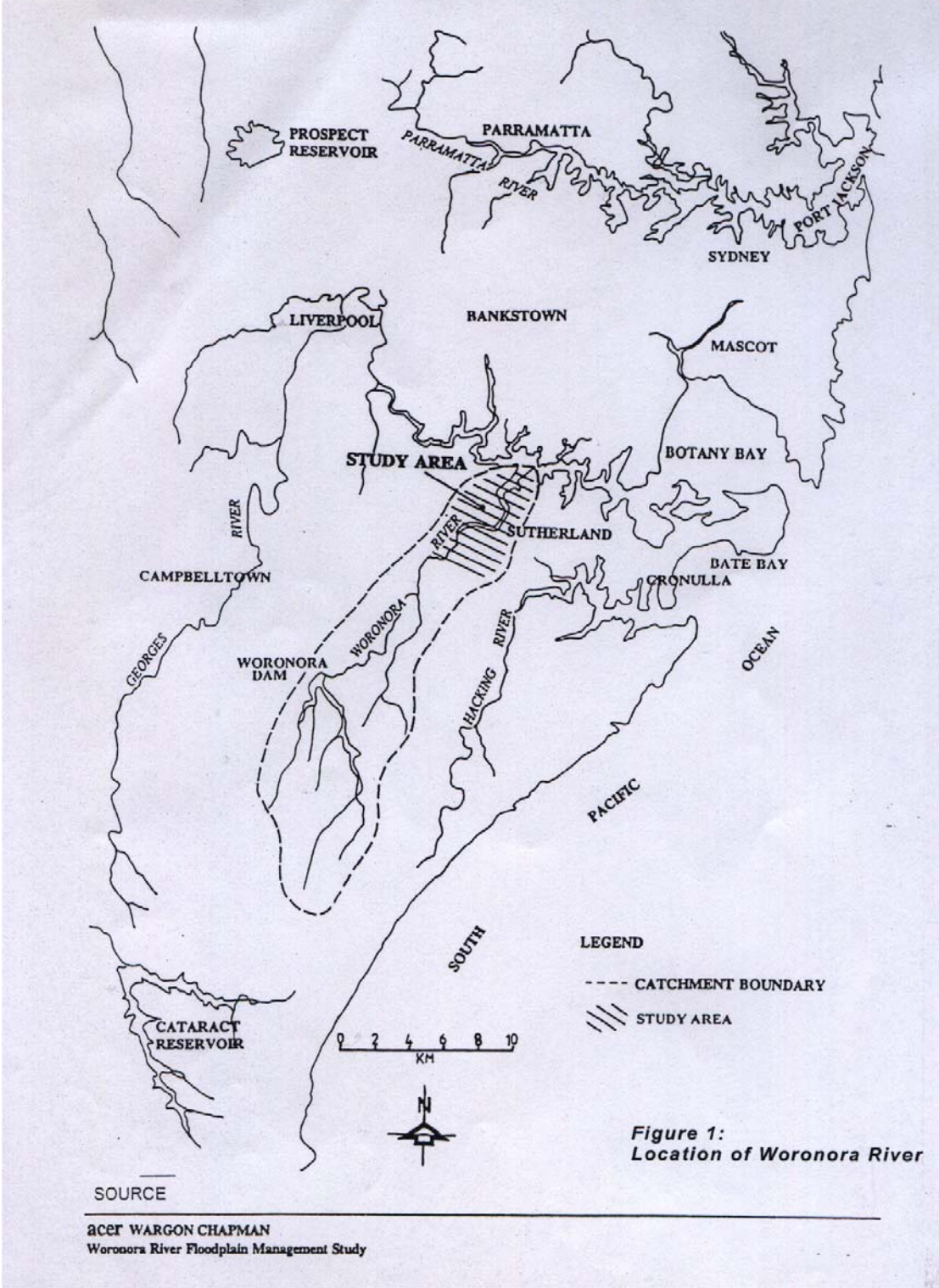


Figure 2: Main Woronora River Suburbs



2.2 Development

There are more than 500 houses in the study area which was defined by the limits of the probable maximum flood. Nearly 80 per cent of these houses (approximately 400) are in the suburb of Woronora, a suburb which nestles around a narrow floodplain on either side of the river. The two halves of the suburb are linked by the old Woronora Bridge. Many of the houses in this suburb do not have direct vehicular access.

Downstream of Woronora is Bonnet Bay. This suburb was substantially developed in the 1970s and only a fraction of this suburb is within the PMF zone. Nevertheless approximately 120 homes could be flooded. Further downstream, scattered houses are built along the riverbank at Como and Illawong. These homes have boat access as well as pedestrian access from ridgeline roads. The levels of these houses vary but some are built very close to the high water mark.

2.3 Community Profile

Statistics were obtained from the 2001 census on community demographics. The statistics were obtained for entire suburbs rather than only for the flood-affected area. It was assumed that the suburbs were representative of the flood-affected areas.

The 2001 census indicated that 69% of the Woronora population had been there for more than five years. If it were assumed that a similar turn over rate has occurred for the last 34 years, then less than 10% of the population which was at Woronora during the 1969 flood (the most recent significant flood) would still be living there. This was confirmed in the telephone surveys with seven per cent of the population indicating they lived in their current home in 1969.

None of the flood-affected areas at Bonnet Bay were developed in 1969 so those residents have no significant flood experience. In fact floods higher than the 1933 flood would be needed before homes in this area are flooded.

The census data suggest that between 90 and 95 per cent of homes are owner occupied. The average household size is about three persons and more than 90 per cent of the population speak only English and a high proportion of the remaining population speak it well or very well. These statistics were confirmed in the telephone surveys.

Ninety three per cent of the population had been educated to year 10 or above. This means that information communicated in written and spoken English should be understood by most of the community.

2.4 Flood Hazard

A flood study was undertaken in 1991 and the results are summarised in Table 1 for each of the main residential areas. The mean high water level is about 0.5m AHD.

Table 1: Design Flood Levels (m AHD)

Suburb	Flood Probability			
	5%	2%	1%	PMF
Como/Illawong	1.5	1.6	1.9	4.2
Bonnet Bay	2.5	2.8	3.1	6.6
Woronora	3.0	3.3	3.6	7.4
Bridge				
Woronora	3.0-3.6	3.3-3.9	3.6-4.2	7.4-8.3
Deepwater Estate	3.5-3.7	3.8-4.0	4.1-4.3	8.1-8.4
Shackles Estate	3.5-3.9	3.9-4.3	4.2-4.6	8.4-8.8

Source: Acer Wargon Chapman (1995)

As can be seen from the table, there can be up to 4.6 metres variation in flood level along the river for the same event and up to 4.9 metres variation at the same location for different events.

In terms of flood damages, Table 2 summarises the number of properties and the number of houses affected by the various design flood levels.

Table 2: Flooded Properties

Design Flood	Number of houses with flooded yards	Number of houses with flooded yards and above floor flooding
5%	246	200
2%	283	254
1%	323	289
PMF	503	497

Source: Acer Wargon Chapman (1995)

As is apparent from the table, most houses with flooded yards would have above floor flooding in the same events.

The study did not calculate design flood levels for events smaller than the 5% event. Floor levels in a property database suggest that as many as a dozen homes could experience above floor flooding in an event which was only 1.5m AHD at Woronora Bridge and up to 60 homes would flood in an event which reached 1.8m AHD at the same location.

The two main access roads out of Woronora would be flooded at about 1.5m AHD.

2.5 Flood History

Over the last 100 years the Woronora River has not experienced as many large floods as one would statistically expect.

There have been just over 20 recorded floods on the Woronora River since 1898. A flood in that year is thought to have reached the level of a 2% event but since then the highest flood has been a 5% event which occurred in 1926. The last flood of any note was in 1969 which was about half a metre lower than the 1926 flood. The 1933 and 1961 events were between the levels of the 1969 and 1926 event. Events in 1949 and 1956 reached the same levels as the 1969 flood. The most recent flood was in 1988 but it only reached about 1.7m AHD at Woronora Bridge.

2.6 Flood Communication History

As far as we have been able to ascertain, community consultation undertaken as part of the 1995 Floodplain Management Study was the first real attempt to communicate flood risks and hazards to the Woronora River communities. Discussions with those involved in its preparation indicate that the Woronora River communities were not only inexperienced in flooding but also sceptical that the estimated floods could occur (Bruce Ginn, formerly Acer Wargon Chapman, pers comm).

No further significant flood communication occurred until the flood preparedness strategy was launched. The only communication from Sutherland Shire Council to property owners in respect of flood risk was by way of notification on Section 149 certificates issued at the time of a sale or transfer of title of a property. Pre and post strategy surveys indicate that few, if any, residents have become aware of flood risks through the Section 149 certificates.

2.7 The Flood Preparedness Strategy

Molino Stewart, in association with Professional Public Relations, prepared a flood preparedness strategy for the residents of the Woronora Valley in 1998 on behalf of the Woronora Flood Alert Network Working Party. This strategy was part of a package of measures to reduce flood risks to people and property in the Valley.

The strategy was based on an agreed colour categorisation of flooding which will be used in all flood warnings for the river (Table 3).

Table 3: Woronora Flood Categories

Flood Category Descriptor	Range at Woronora Bridge (m AHD)	Comments
Green Category	1.5 - 2.3	Onset of flooding with roads cut and some houses flooded through to many homes flooded
Blue Category	2.3 - 3.1	Hundreds of homes flooded. Upper end of category floods low level bridge and corresponds to flood on record
Yellow Category	3.1 - 3.9	Hundreds more homes flooded. Upper end of category is current planning level ¹ .
Red Category	Above 3.9	Up to 500 homes flooded. Flooding of homes which would not have received notification of flood risk on 149 certificate.

¹ Planning level is the level above which the habitable rooms of any development must be built. On the Woronora River this is 0.5m above the 1% flood level.

Where applicable, throughout the campaign, the various strategies were identified by the same colour coding for simplicity and consistency. The Strategy proposed a set of messages for flood awareness, preparedness, warning, response and recovery modes which were to be delivered via diverse media. More detail on the proposed strategy can be found in Molino and Rogers (1999).

The Working Party recommended implementation of most components of the preparedness strategy and Sutherland Council and the SES commenced this in 1999.

3 STRATEGY EVALUATION

While there have been an increasing number of flood education strategies implemented in recent years, formal evaluation of the effectiveness of these community education campaigns appears scarce.

Ideally, evaluation needs to be outcomes focussed, not only measuring the extent to which residents have retained the information delivered to them but also whether they have responded with appropriate behaviours.

The SES defines flood ready communities as “communities whose people are capable of responding appropriately and in timely fashion to warnings” (Pfister and Rutledge, 2002). In order for the Woronora flood preparedness strategy to be considered effective, increasing levels of flood awareness and knowledge are not enough unless appropriate behaviours before, during and after a flood are an outcome.

It is difficult to measure the ultimate effectiveness of a strategy in the absence of a flood but there are other outcomes which can be measured in the interim which give some measure of the strategy’s effectiveness and identify its strengths and weaknesses.

This project evaluated whether the Woronora Strategy had achieved its aims of raising the level of flood awareness in the targeted communities and whether they were better prepared for a flood.

Table 4 summarises the criteria recommended for evaluating the effectiveness of the Woronora Flood Preparedness Strategy. Only the first four outcomes could be evaluated as part of this project.

Evaluation also requires a degree of comparison: Firstly, a comparison before and after strategy implementation and then a comparison with what has been achieved elsewhere.

Table 4: Strategy Evaluation Criteria

Outcome	Message	Performance Indicator
Information has been delivered to residents	They live in a flood prone area	All messages were delivered to residents (number of kits distributed, house labels attached to electricity box etc).
	There are different categories of flooding	
	There is a plan to help them	
	The plan includes action by them	
Information has been received by residents	They live in a flood prone area	Proportion of residents who received the information.
	There are different categories of flooding	
	There is a plan to help them	
	The plan includes action by them	
Information has been understood and retained by residents	I live in a flood prone area	Proportion of residents who are aware that the Woronora floods and proportion who are aware that their property may be at risk from flooding.
	There are different categories of flooding	Proportion of residents who know the four categories of flooding. Proportion of residents who know what category of flooding affects them.
	There is a plan to help me	Proportion of residents who are aware of the Woronora plan.
	The plan includes actions by me	Proportion of residents who know what to do before/during/after flood.
Residents are prepared	Not applicable	Proportion of residents who are planning to take action to reduce the impact of flooding. Proportion of residents who have taken action to reduced the impact of flooding for example emergency kit handy (brochure, radio, torch), magnet on fridge.

Outcome	Message	Performance Indicator
Residents have been warned	A “colour” category flood is expected Tune to local radio station for regular updates Check electricity meter box if not sure what colour category flood enters your house Refer to your Woronora Flood Preparedness booklet or tune to the local radio station for details on how to respond SES contact number for enquiries	Proportion of residents who received warning messages (sirens, door knocks, radio etc) and time taken to reach them.
Residents have responded	Not applicable	Proportion of residents who responded by doing what was recommended before/during/after a flood. Proportion of residents who have evacuated in time.
Residents have recovered	Not applicable	Outcomes in terms of life saved and property loss avoided following a flood. Satisfaction with warnings by those at risk. Proportion of residents confident in the warning system.

Some base level information was available for the Woronora Valley from a survey which was commissioned by the SES (Centre for Social Marketing, 1999). Its usefulness for comparative purposes was limited by the high proportion of subjective self-assessment questions which it contained.

With regard to what has been achieved elsewhere, a national and international literature search failed to identify any significant comparable studies against which the Woronora Strategy could be benchmarked.

Performance against the selected indicators was evaluated by:

- Reviewing the measures implemented by Council and other floodplain information available to residents; and
- Undertaking a survey of 100 residents within the floodplain to determine the extent of awareness, comprehension and action regarding floodplain management issues.

Section 4 outlines how the strategy was implemented and how components performed against the delivery criteria. Section 5 summarises the performance of the strategy against the other evaluation criteria.

4 STRATEGY IMPLEMENTATION

Table 5 summarises all elements of the original strategy and whether or not they were implemented. This section details when, where and how aspects of the Strategy were implemented and how many of the target audience were reached with the messages.

Various elements of the strategy delivered some or all of the following messages to flood affected residents in the Woronora Valley:

- They live in a flood prone area;
- There are different categories of flooding;
- There is a plan to help them; and
- The plan includes actions by them.

Table 5: Flood Preparedness Strategy

PROPOSED	IMPLEMENTED	YEAR
Flood Signs on western approach to low level Woronora Bridge and in Lakewood City Reserve	Flood sign on western approach to low level Woronora Bridge and in Lakewood City Reserve.	Mid 1999
Coloured bands corresponding to flood categories painted on 50 street name sign posts	17 Colour strips on metal street sign poles	End 1999
Individually printed labels showing floor level in relation to the four flood categories placed in electrical fuse box	Printed stickers indicating flood category placed in the electricity meter box by SES volunteers.	Early 2000 – mid 2003 - ongoing
Household Kit containing a booklet, children’s colouring sheet, fridge magnet and brochure	Household kit containing booklet (Woronora Flood – Are you ready), children’s colouring sheet and After the Flood Booklet distributed in 2000-01.	Early 2000 – mid 2003 - ongoing
	New Fridge magnet and new brochure distributed in July/August 2002.	July/August 2002
Public meeting organised following householder kit distribution	Public meeting organised before the distribution of kit	November 1999
Use of standard emergency warning signal	Standard emergency signal operational	1999
Hot stamping wheelie bins with short flood message	Not implemented	NA
Organising events to launch strategy	Not implemented	NA
Media releases	Published in local newspapers <i>The Leader</i> and <i>Our Voice</i>	September and November 1999
PC COPS – a computer based, automated telephone dial out system	Three month trial of the PC Cop System in late 1998 not adopted due to lack of resources	Late 1998
Display materials	Not implemented	NA
Flood Awareness Week	Not implemented	NA

4.1 Flood Signs

4.1.1 Implementation

Flood signs were erected in Woronora and Bonnet Bay in mid 1999. These show the actual level of historic floods relative to the coloured flood categories and also carry the message “The Woronora Floods. Are You Ready?” and directs people to tune to the local radio station for flood warning information (Figure 3).

A double-sided sign was installed mid-1999 on the footpath on the western side of the old Woronora River Bridge. It was originally erected perpendicular to the direction of traffic flow to maximise visibility but following complaints from residents the sign was turned to be parallel to the traffic flow.

At the time the sign was installed, a large proportion of the target audience passed it almost daily because the old bridge was the only means of crossing the Woronora River. A new high level Woronora Bridge was opened in 2001 and the old Woronora Bridge is now only used for access to the suburb of Woronora.

Residents from Bonnet Bay, Shackles Estate, Illawong and Como would use the new Bridge to cross the Woronora River and would not pass in front of the sign unless they were visiting Woronora itself. The sign is now delivering the flood messages to only 75 per cent of the target population.

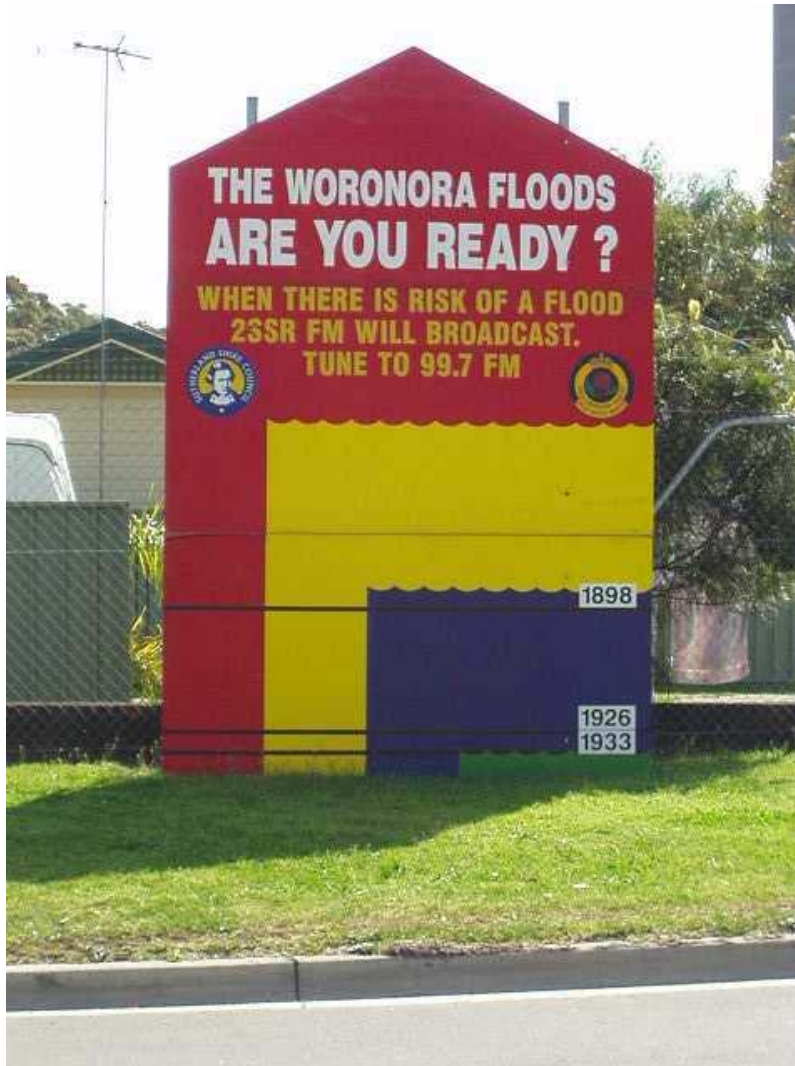
The sign in Bonnet Bay was placed on the wall of a building in Lakewood City Reserve so that it was visible to passing traffic. However, after objections from two residents, the sign was moved and is now only visible to some of the park users.

4.1.2 Delivery Effectiveness

The flood signs carry each of the flood messages although the message is brief and sometimes it is implied. The signs deliver their messages on a daily basis to at least 75% of flood affected residents but the placement of the sign in relation to travel routes is critical to their effectiveness in delivering messages.

For example the Woronora Bridge sign delivers the messages to 100% of Woronora residents because of its prominent and strategic location. The Lakeside Reserve sign on the other hand was moved from its prominent location and now is only seen by a small proportion of Bonnet Bay residents. Neither sign is likely to be seen by flood affected Como, Illawong or Shackles Estate residents.

Figure 3: Flood Sign, Woronora Bridge



4.2 Flood Totems

4.2.1 Implementation

The Strategy suggested that coloured bands corresponding to flood categories be painted on 50 street name signposts. They were meant to be reference marks for residents to look at in the event of a flood to get an idea of how high it might rise when a colour coded warning was issued.

Council's Stormwater Manager used strips of coloured heavy-duty plastic adhesive tape instead (Figure 4), which worked well and this method was easier to implement than paint.

Seventeen totems were placed on the metal street name sign posts in the streets in the Woronora and Bonnet Bay areas.

4.2.2 Delivery Effectiveness

The totems on street signs do not deliver any explicit message but are there mainly for reference during a flood. Only 17 out of 50 recommended locations were marked and therefore these would not be visible to the majority of residents during a flood however they have been located in the most at the locations with greatest risk. About half of the flood affected population are likely to pass the totems.

Figure 4: Flood Totem

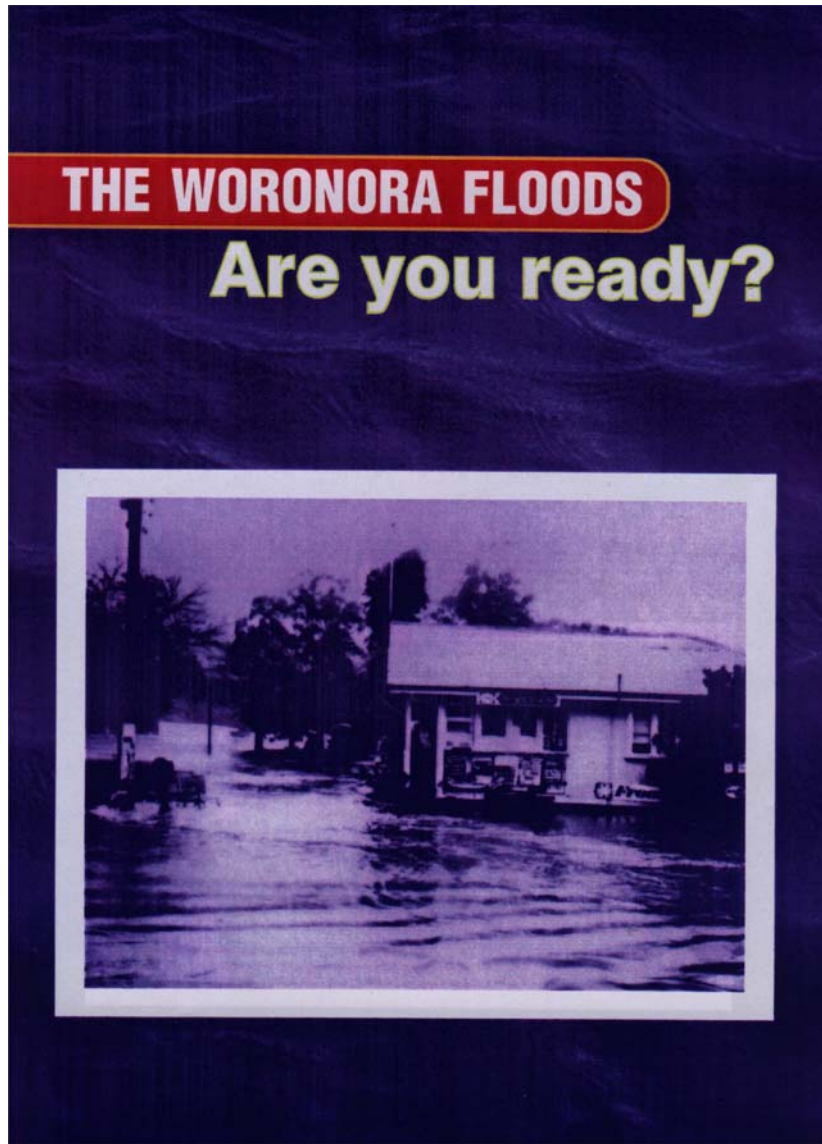


4.3 Household Kits

4.3.1 Implementation

Household kits containing an 8 page B5 colour brochure '*The Woronora Floods – Are you ready*' (Figure 5), children's sheet, DL sized card with magnet and the Emergency Management Australia booklet *What to do Before, During and After the Flood* were distributed by SES volunteers.

Figure 5: First Brochure



A flood label (see Section 4.4) was produced for every flood-affected property on the database and they were available for distribution at the same time as the household kits. SES volunteers in their orange overalls delivered the kits and labels personally to residents over a number of weekends starting in early October 2000 and ending around July 2001. The volunteers explained what the kit and labels meant and the role of Council and the SES in case of a flood etc. Occupants were then asked to sign a sheet recording that they had received the household kit. Copies of these signed sheets were used to assess how many properties had been delivered the household kit.

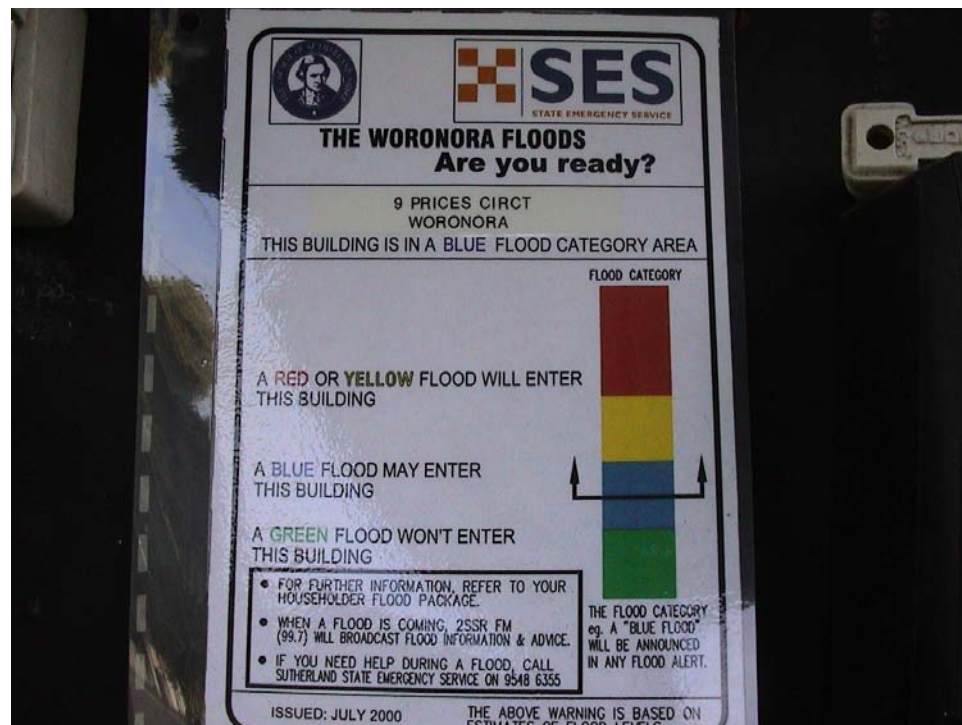
As of October 2003 the SES had not managed to contact every residence as some people weren't home and the kits were to be given personally to home occupants. The SES still has to deliver the kits to around 95 properties in Bonnet Bay and 80 properties in Woronora.

4.4 Flood Labels

4.4.1 Implementation

Flood labels were individually printed to show the dwelling's floor level in relation to the four flood categories (Figure 6). It was optional for occupants to accept a label but if they did it was mandatory that the SES volunteers install the labels in the electricity box.

Figure 6: Flood Label



About 90 per cent of residents were happy to have the labels installed (David Monk, SES, pers comm.). The majority of those who objected did not want a label with the Council logo in their electricity box and were very negative about Council.

4.4.2 Delivery Effectiveness

Delivery of the flood labels not only required the SES to be available to deliver them and a resident to be home but the resident also had to give the SES explicit permission to install the label. Although 90 per cent of residents accepted the label, the low delivery rate of household kits mentioned above means that only about 60 per cent of flood affected homes have the labels.

4.5 Public Meetings

4.5.1 Implementation

The Strategy recommended that public meetings be held to explain the preparedness strategy to residents and answer their questions.

A two-hour public meeting was held in November 1999. The meeting was advertised by two notices in *The Leader* on 16 November 1999 and 23 November 1999. Fliers were letterbox dropped to affected residents early on the week of the meeting. Twenty four residents attended the meeting.

4.5.2 Delivery Effectiveness

The public meeting not only provided significant detail regarding the four messages but also allowed residents to ask questions and get clarification or more specific information. The 24 people attending represented delivery to less than four per cent of the flood affected properties when it is considered that some households had two representatives.

4.6 Media Releases

4.6.1 Implementation

Two articles were published in *The Leader* which is the local newspaper for the Sutherland Shire. One was published in September 1999 and the other in November 1999.

Another small release was published in *Shape the Shire*, Sutherland Shire Council's official newsletter.

4.6.2 Delivery Effectiveness

These would have been delivered to virtually all residents and they contained all four messages .

4.7 Second Brochure and Fridge Magnet

4.7.1 Implementation

In 2002, a second brochure and fridge magnet were created and built on key messages contained in previous flood awareness materials. The brochure comprised four A4 pages, in full colour. The brochures and magnet were distributed in July/August 2002 either by post or by hand delivery to letterboxes.

4.7.2 Delivery Effectiveness

All households within the flood affected area had a brochure delivered but there was no face-to-face contact between the person who delivered the brochures/magnets and the residents. The four detailed messages were delivered to all households.

5 AWARENESS AND PREPAREDNESS EFFECTIVENESS

This section discusses the effectiveness of the elements of the Woronora Flood Preparedness Strategy in relation to the receipt, retention and preparedness evaluation criteria introduced in Section 3 and other lessons learned from flood preparedness communication in the Woronora Valley. It then provides an overall evaluation of each element and the strategy as a whole.

5.1 The Survey

In late 2003, 100 telephone surveys within the study area were conducted. Twenty five residents were surveyed in each of the four flood colour categories. Seventy seven households (77 percent) were surveyed in Woronora, 19 in Bonnet Bay (19 percent) and four in Como (four percent). This is close to the distribution of flood affected properties between these suburbs.

Information on the questionnaire, survey methodology and a detailed analysis of responses can be found in Molino Stewart (2004). Below is a summary of some of the responses in regarded to community perceptions of flood threat.

5.2 Community Perception

Respondents had lived an average of 15 years in their current home. The minimum length of time spent in their current residence was three months and the longest 60 years with a median of 12 years.

Fires were regarded as the biggest threat to their property by 52 percent of respondents, theft by 13 percent and storms by 10 percent. Floods were seen as the biggest threat by 24 percent of respondents. This proportion rose to 40 percent amongst the blue category and 32 percent amongst the green category. Although not statistically significantly different from the overall results, these results still seem to highlight that residents from the two categories most likely to be affected by floods are more likely to regard flood as a threat to their house.

Ninety one percent of respondents declared that they lived in a flood prone area. This proportion was as high as a 100 percent amongst respondents in the green category, 96 percent in the blue category and 92 percent in the yellow category. Only 76 percent of respondents in the red category believed they lived in a flood prone area.

Forty five percent of respondents declared that their house itself was at risk of being flooded. This proportion rose to 56 percent amongst respondents in the green category, 52 percent in the blue category and 48 percent in the yellow category. The proportion went down to 24 percent in the red category.

Thirty six percent of respondents answered that they had experienced a flood in the Woronora Valley. Sixty percent of respondents in the green category had experienced a flood.

5.3 Information Received by Residents

While there was significant variation in the effectiveness of different media to deliver the key messages to residents, a high delivery rate did not necessarily mean that a high proportion of residents received the information and vice versa.

For example, while less than four per cent of households were represented at the public meeting, it is almost certain that 100 per cent of those in attendance received the messages. Conversely, while close to 100 per cent of households had the media releases and newsletter delivered, a significantly smaller number would have read the articles and actually received the messages.

The post-strategy survey questions provided some indication of how effective the various means of communication were and the pre-strategy survey provided something of a benchmark to gauge this effectiveness against.

5.3.1 Any Flood Information

A pre-strategy survey found 20 per cent of respondents said they had received information about flooding. The survey undertaken as part of this study suggests that now 95 per cent of residents recall having received information about flooding in the Woronora Valley. This is a significant increase and suggests that the strategy has been effective in people receiving flood information.

There is little research elsewhere which can be used for comparison although it is noted that a UK study (BMRB, 2001) found that after two years of a nation wide social marketing campaign only 34 per cent recalled seeing flood awareness advertisements even after prompting. Even where specific information had been sent to high risk residents only 39 per cent recalled having received the information after prompting. This suggests that the Woronora strategy has been very effective to the extent of people receiving the flood preparedness messages. An analysis of the effectiveness of each element in the Woronora strategy follows.

5.3.2 Flood Signs

Unprompted, 64 per cent said they had seen flood signs (including totems). This is slightly lower than the 75 per cent who are exposed to the signs. However, when asked if they had seen signs, ninety per cent said that they had and 90 per cent of those who had, said they had seen the one near Woronora Bridge.

These results suggest that the flood sign near Woronora Bridge has been highly effective in not only delivering the flood awareness messages but also ensuring that they are received. It is also clear that the location of the Bonnet Bay sign is reducing its effectiveness.

5.3.3 Household Kits and Brochures

Fifty one per cent nominated brochures and four per cent nominated fridge magnets unprompted as flood information they had seen. These were contained in the household kits delivered by the SES and also in the later mail out by Sutherland Council. Subsequent prompted questions revealed that 75 per cent of those who had received a kit from the SES recalled receiving it. This compares to 40 per cent who recalled receiving the second brochure even though that had been delivered more recently.

When the proportion to whom the original household kit was delivered is multiplied by the proportion who recall receiving it then it has effectively been received by about 50 per cent of the residents which is still more effective than the proportion who recalled receiving the brochures through the letterbox.

5.3.4 Flood Labels

While only eight per cent of residents mentioned meter box labels unprompted when asked what flood information they had received, 37 per cent knew they had a meter box label when asked specifically. When only those who had received a meter box label are considered, then 58 per cent of those people with a label in their meter box were aware that they had one.

This high awareness rate may be attributed to one or more of the following factors:

- They were personally delivered by the SES;
- The resident had to give explicit approval for the label to be installed; and
- The labels are seen every time the meter box is opened which is something most residents would do from time to time.

5.3.5 Public Meeting and Media Releases

Four per cent of respondents recalled the public meeting unprompted which is similar to the proportion that attended which suggests that a public meeting makes a significant impression on those who attend.

Only one respondent made reference to information in newspapers but their response could be interpreted as the ad for the public meeting rather than one of the media releases.

5.4 information Understood and Retained

The preceding section showed that only a proportion of those who had the flood messages delivered to them actually received it. The proportion that understood and retained the information is a smaller proportion again. Some people have retained the information mentally and were able to recall it either unprompted or prompted during the surveys. Others have retained the information physically (eg the magnet is on the fridge or they kept the information brochures). This section looks at those retention rates.

5.4.1 Flood Signs

While 90 per cent of respondents recalled seeing the signs, 27 per cent of those who saw the signs did not recall the messages. This means that only 66 per cent of the population is understanding and retaining messages from the signs.

The message which is understood by most people is that the Woronora floods. Overall 56 per cent of all respondents nominated explicitly or implicitly that the Woronora floods.

Eleven per cent of the population remember unprompted that there are different coloured flood categories, seven per cent that they need to be prepared and six per cent that they need to tune into the local radio station for flood warnings.

The signs have therefore been significantly more effective at raising community awareness than they have in increasing community preparedness.

5.4.2 Flood Labels

Despite only eleven per cent of respondents remembering unprompted that the flood signs indicated different colour codes for flooding, 62 per cent of all respondents said they knew there were colour codes for flooding when asked. This means that some elements of the strategy are effective in residents retaining the message that there are colour codes for flooding but 38 per cent have still not understood or retained the colour code message.

The flood labels were the only element which gave specific information on the colour code for each house. The survey revealed that 41 per cent of the whole population know there are colour codes but do not know the colour code of their house. The remaining 21 per cent know the colour code for their house.

A random field sample showed that every house which had a meter box label installed by the SES still had the label in place. This suggests the labels may have a 100% retention rate.

If only those who have received a meter box sticker are considered, then almost 60 per cent of them know, or know where to find, the colour code for their house.

Only nine respondents were able to correctly articulate what the colour codes meant. This further suggests that there remains a low retention of the message “there is a plan to help them”. This low comprehension rate suggests that any warning messages which use the colour codes will need to include a brief explanation of what the colour means. It is noted that the flood labels themselves include an explanation which could be read when people go to their meter box to check their colour code.

5.4.3 Household Kits

The EMA flood booklet and the Woronora Flood brochure were the two kit elements which made the biggest impact with about 32 per cent of the population who received the kit remembering both of these elements. About 24 per cent of those who received the kit said they have kept both documents and 10 per cent have kept the fridge magnet. This means that 17 per cent of the total population has received and retained the most detailed flood preparedness messages via these kits.

5.4.4 Second Brochure

Seventy five per cent of those who recalled that they had received a second brochure said that they had read it and 50 per cent of them have kept it. This means that 30 per cent of the population remember reading the second brochure and 20 per cent have kept it which is a similar proportion to those who kept the first brochure and booklet.

When the two brochures and the EMA booklet are considered, then 36 per cent of all respondents say they have kept one or more of these documents.

5.4.5 Combined Media

While it has been possible from some of the survey questions to determine whether specific information has been retained and understood from specific media, some of the messages are delivered by a combination of media and such a distinction is not possible.

The overall strategy has been responsible for the following messages being understood and retained by the following proportions of the population.

a) They live in a flood prone area

Forty five per cent of the population understands that their house is at risk of being flooded. This varies depending on the flood risk. Only a little more than 50 per cent of those whose floor levels are below the 5% flood level (green and blue categories) believe their house can be flooded and less than 25 per cent above the 1% flood level (red category) believe they can be flooded.

A 5% flood would enter 246 houses in the green and blue categories. Such a flood was last experienced in 1969 when many of the current houses did not exist and few of the current residents were there.

b) There are different categories of flooding

Sixty two per cent have retained this message.

c) There is a plan to help them

There is little direct evidence from the survey questions that anyone has retained this message. However, the fact that 37 per cent of the population know they have flood labels and between 20 and 25 per cent of people who have received brochures have kept them, suggests that between 20 and 37 per cent of the population have understood there is a plan to help them

d) The plan includes action by them

Sixty two per cent of the respondents believed being prepared for a flood would reduce property losses and 80 per cent that it would improve personal safety. This means that these messages have been understood and retained by the majority of the population. When these proportions are compared to the number who appear to be aware of the 'plan', it would seem that while a significant proportion of the population understands they need to take actions, they don't necessarily see this as part of a planned response but rather a spontaneous one on their part. The potential ramifications of this are discussed in the next section.

5.5 Residents Are Prepared

Although many people understanding that being prepared for a flood would be worthwhile, this needs to translate into appropriate preparedness responses.

5.5.1 Prepared for a Warning

Sixty per cent of respondents made no reference to expecting official flood warnings but indicated that they would rely upon their own observations of rainfall and river heights to determine if the river was about to flood. Fifty two per cent also indicated their own observations would tell them if their home was going to be flooded and a further 10 per cent were adamant that their home would not flood. Being alert to official warnings would be an appropriate preparedness action and it would appear that as many as 62 per cent of the population are not prepared in this way.

The above statistics reinforce the impression given by responses to some of the other survey questions that there may be a generally low understanding in the community that there is a plan to help them. While it is important that residents know what actions to take, they need to take them as soon as the SES warns them rather than wait until they themselves think it is appropriate to do so.

5.5.2 Prepared to Get Further Information

Knowing where to get further information in the event of a flood warning is another preparedness action which can be taken now. Fifty one per cent of residents correctly nominated calling the SES or tuning into the local radio station. A further 26 per cent are expecting to get such information from Sutherland Shire Council or the Rural Fire Service. This can be compared with the pre strategy survey which found 50 per cent expecting to get additional information from Sutherland Council and 11 per cent from the Rural Fire Service.

While the preparedness strategy has clearly helped this aspect of preparedness, there is still a significant proportion of the population who will look to organisations other than the SES for flood information. It may therefore be effective for Sutherland Shire Council and the Rural Fire Service to have their own preparedness strategies so that they can direct callers to the SES or radio in the event of a flood.

5.5.3 Prepared to Act

Eighty two per cent of respondents nominated at least one appropriate flood response action when asked the open question "What would you do in the event of a flood?"

Fifty six per cent said they would self evacuate and 44 per cent that they would raise their furniture and possessions. While this preparedness is encouraging, if they rely upon their own observations to determine if they are going to be flooded then they may have insufficient time to do either.

Eleven per cent who said they would get in their boat which may be dangerous if they wait until water is entering their property and they are swept towards the old low level Woronora Bridge. Another six per cent nominated inappropriate actions.

Only five per cent of respondents claim to have an emergency kit for floods but none of them made mention of it unprompted when asked what they would do in the event of a flood. On more detailed questioning it would appear that four per cent of respondents have a kit which is adequate.

Four per cent of people said they didn't know what to do. Six per cent said they would do nothing. This means that around 10 per cent of respondents are likely to not take action to reduce the impact of flooding.

5.6 Overall Evaluation

5.6.1 Signs

The signs have clearly been a very effective element in raising community awareness of flooding, with 90 per cent of the population noticing them and two thirds understanding and retaining a flood awareness message. They have not been effective in providing detailed messages or encouraging preparedness. The effectiveness of the signs is very dependent on their location.

5.6.2 Totems

These have been a useful adjunct to the signs in raising awareness but have been significantly less noticed or understood (about 20%). The real value of these could only be effectively evaluated after an actual flood as they are meant to be used as references during an event.

5.6.3 Brochures

These are the most effective means of detailing awareness and preparedness messages but that information is not necessarily received and retained. The way in which the brochure is delivered is important with delivery to the post box being the most effective means of delivering to all households over a short period of time but hand delivery by the SES over a long period gives better results overall in terms of residents recalling receiving the information. These outcomes also need to be weighed up against the delivery costs and the other benefits of hand delivery such as improved community relations, SES training and delivery of flood labels.

It would appear that about 30 per cent of those who have received brochures by any means recall having read them and about 20-25 per cent have kept them for future reference.

Despite the low percentage of households which have kept the brochures, over 80 per cent of residents know at least one appropriate flood response action which was detailed in the brochures and magnets. It is not possible to know, from the information available, how many of these people knew to take these actions before the strategy was launched.

5.6.4 Magnets

These have only been retained by about ten per cent of the population and since they have less information than the brochures it would seem that the brochures have been a more effective communication tool.

5.6.5 Labels

Where people have accepted flood labels it would appear that 100 per cent of them remain in the meter boxes and 60 per cent of the residents either know the flood colour category of their house or know to go to the label to find out.

The label contains additional information which makes it clear what the implications of flooding are for the house and where residents can get additional information. The greatest shortcoming of the labels is that not all homes have them. This is due to only two thirds of homes having had them delivered and of these ten per cent having refused to accept a label. It is interesting to note that about 10 per cent of the population is refusing to acknowledge that the Valley floods.

The advantage the labels have over the other detailed information media such as brochures and magnets is that they are not easily mislaid, they remain with the house when residents move and will be noticed when new residents go to the meter box as happens from time to time.

5.6.6 Meetings

These had a poor attendance rate but a high level of interest from attendees. While the survey indicates that these have not been an effective direct communications initiative, it should be remembered that a community's influencers often attend these meetings and it is important for those people to properly understand the messages.

5.6.7 Media Releases

These also did not figure strongly in people's recollections of flood messages but probably were effective in preventing Sutherland Council and the SES being overwhelmed with enquiries when the flood signs were erected.

6 CONCLUSIONS

With little benchmarking, it is difficult to gauge the overall contribution that the strategy has made to flood awareness and preparedness in the Woronora Valley. However much of the following outcomes would be largely due to the strategy:

- 95 per cent of people in the Valley recall that they have received information about flooding, compared to 20 per cent prior to strategy implementation;

- 90 per cent believe they live in a flood prone area. This is likely to be significantly higher than it was prior to the strategy, given the limited flood experience of residents and the low level of recollection of previously receiving flood information;
- 82 per cent know at least one appropriate action they can take in response to a flood;
- 80 per cent believe being prepared for a flood increases personal safety;
- 62 per cent believe being prepared for a flood decreases property losses;
- 56 per cent are prepared to self evacuate in the event of a flood;
- 51 per cent know to ring the SES or tune into the local radio station for more specific flood information. This compares to 44 per cent who previously said they would contact the SES;
- 45 per cent believe their house is at risk of being flooded;
- 37 per cent know, or know where to get specific information on, how a particular flood would affect their house because they know they have a flood label on their house as part of the strategy. This may increase to about 60 per cent if labels are delivered by the SES to all houses;
- 25 per cent of the population have kept one or more booklets or brochures distributed as part of the strategy providing them with details of how to respond in a flood;
- 4 per cent have a flood emergency kit as a result of the strategy.

There is still significant room for improvement in these achievements, particularly in regard to people being aware of the flood risks to their property and having access to more detailed information on how to respond appropriately.

Ten per cent of the Woronora Valley population do not believe flooding is an issue and about 60 per cent of the population expect to rely upon is own observations of the weather and river to decide whether the river is likely to enter their home. These proportions need to be reduced significantly if people are to have sufficient time to respond appropriately to flood warning messages.

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