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## Is there really "nothing you can do"? Pathways to enhanced flood-risk preparedness

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## **Title Page**

***Title:*** ‘Is there really “nothing you can do”? Pathways to enhanced flood-risk preparedness’

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# Is there really “nothing you can do”? Pathways to enhanced flood-risk preparedness

## Abstract

Whilst policy makers have tended to adopt an ‘information-deficit model’ to bolster levels of flood-risk preparedness primarily through communication strategies promoting awareness, the assumed causal relation between awareness and preparedness is empirically weak. As such, there is a growing interest amongst scholars and policy makers alike to better understand why at-risk individuals are underprepared. In this vein, empirical studies, typically employing quantitative methods, have tended to focus on exploring the extent to which flood-risk preparedness levels vary depending not only on socio-demographic variables, but also (and increasingly so) the perceptual factors that influence flood risk preparedness. This study builds upon and extends this body of research by offering a more solution-focused approach that seeks to identify how pathways to flood-risk preparedness can be opened up. Specifically, through application of a qualitative methodology, we seek to explore how the factors that negatively influence flood-risk preparedness can be addressed to foster a shift towards greater levels of mitigation behaviour. In doing so, we focus our analysis on an urban community in Ireland that is identified as ‘at risk’ of flash flooding and is currently undergoing significant flood relief works. In this regard, the case study offers an interesting laboratory to explore how attitudes towards flood-risk preparedness at the individual level are being influenced within the context of a flood relief scheme that is only partially constructed. In order to redress the dearth of theoretically informed qualitative studies in this field, we draw on Protection Motivation Theory (PMT) to help guide our analysis and make sense of our results. Our findings demonstrate that flood-risk preparedness can be undermined by low levels of efficacy amongst individuals in terms of the preparedness measures available to them and their own personal

capacity to implement them. We also elucidate that the ‘levee effect’ can occur before engineered flood defences are fully constructed as the flood relief works within our case study are beginning to affect people’s perception of flood risk in the case study area. We conclude by arguing that 1) individuals’ coping appraisals need to be enhanced through communication strategies and other interventions which highlight that future floods may not replicate past events; and 2) the concept of residual risk needs to be communicated at all stages of a flood relief scheme, not just upon completion.

### **1.0 Introduction: From flood-risk prevention to flood-risk preparedness**

The general realignment of flood-risk management policy away from a singular emphasis on the prevention of floods through engineered structural flood relief works towards one that is more holistic and incorporates softer approaches to reduce the impacts of flooding events has been well documented in the literature (Lennon et al., 2014). This shift has largely been driven by a growing recognition that ‘hard’ measures alone are no longer sufficient to adequately protect communities at risk of flooding. Not only are physical flood defences problematic due to their capital intensive nature (Takao et al., 2004), there is also the omnipresent concern that they cannot completely eliminate the threat of flooding as a degree of residual risk inevitably remains even within areas that are considered ‘protected’ (Ludy and Kondolf, 2014; Scolobig et al., 2012). Such concerns, coupled with the challenges posed by the rising frequency of extreme weather events associated with climate change have stimulated calls amongst a broad spectrum of stakeholders for the introduction of a series of ‘softer’ measures to accompany traditional flood-risk management approaches (O’Neill and Scott, 2011; Takao et al., 2004). This new way of thinking has been substantiated through the introduction of the European Floods Directive (2007/60/EC) triggering the emergence of new governance frameworks that place greater levels of responsibility for managing flood risk at the level of individual

households, and greater emphasis on the role of flood-risk communication, monitoring and warning systems, and spatial planning in the effective management of flood risk.

Despite a plethora of ‘softer’ measures being promoted at the European level to advance a more holistic approach to flood-risk management, in practice the transition has been slow in many countries (see Dzialek et al., 2013). This has been particularly pronounced in relation to individual preparedness measures where there is empirical evidence to suggest that a significant policy-practice gap exists where many ‘at-risk’ individuals do very little (or indeed nothing at all) to protect themselves from risk of damage, injury or loss of life caused by prospective flooding events. This is despite the fact that preparedness measures have been shown to significantly reduce the material damages caused by a flood event, in some cases by up to 80% (Grothmann and Reusswig, 2006).

Whilst policy makers have tended to adopt an ‘information-deficit model’ to increase preparedness levels primarily through communication strategies aimed at promoting awareness, the assumed causal relation between awareness and preparedness is empirically weak (Bubeck et al., 2013; Miceli et al., 2008; Scolobig et al., 2012). As such, there is a growing interest amongst scholars and policy makers alike to better understand why at-risk individuals are underprepared. In doing so, empirical studies have generally focused on exploring the extent to which flood-risk preparedness levels vary depending not only on socio-demographic variables, but also (and increasingly so) the perceptual factors that influence flood-risk preparedness (Birkholz et al., 2014). This study builds upon and extends this body of research by offering a more solution-focused approach that seeks to identify how pathways to flood-risk preparedness<sup>1</sup> can be opened up among communities/householders who are at-risk of flooding.

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<sup>1</sup> For the purposes of this paper we use the term ‘preparedness’ to describe a broad range of non-structural flood-risk reduction measures. In doing so, we do not follow the convention of Lindell and Perry (2004) in distinguishing between adaptive measures taken at various stages of the hazard cycle (i.e. long before, shortly before, and after the event). Instead, we follow the convention of Raaijmakers et al. (2008), who consider preparedness as both the

Specifically, we seek to explore how the factors that negatively influence flood-risk preparedness can be addressed to foster a shift towards greater levels of mitigation behaviour. In doing so, we focus our analysis on an urban community in Ireland that is identified as ‘at risk’ of flash fluvial-flooding and where a structural flood relief scheme is currently under construction. In this regard, the case study offers an interesting laboratory to explore how attitudes towards flood-risk preparedness at the individual level are being influenced within the context of a flood relief scheme which has been only partially constructed. By employing Protection Motivation Theory (PMT) as a theoretical framework to help guide analysis and make sense of our results<sup>2</sup>, this paper helps redress a general dearth of theoretically informed studies within this sphere of research (Kellens et al., 2013). Whereas PMT has been more widely employed over recent years in flood preparedness related studies (Bubeck et al. 2013; de Boer et al. 2015; Franklin et al. 2014; Koerth et al. 2013a, 2013b; Poussin et al. 2014; Reynaud et al. 2013), there is little evidence of the application of qualitative methods in this research area, which we shall employ. This research also contributes to the emerging socio-hydrology literature concerned with understanding the complex interactions and feedback mechanisms “between water and human systems” that arise in areas at risk of flooding and are informed by a range of hydrological and social processes (Di Baldassarre et al., 2013: 3235).

### **1.1 Factors influencing flood-risk preparedness**

Whereas preparedness has been conceptualised in terms of an administrative emergency plan/strategy (Perry and Lindell 2003) or the city system (Grothmann and Reusswig 2006), it is the individual level with which this research is concerned. In seeking to understand what

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capability of coping with a flood throughout the inundation period, and post-flood recovery capability and strategies.

<sup>2</sup> We do not employ a theory verification approach to test the validity of PMT. We merely draw on this theoretical framework to help analyse our data as it offered the greatest explanatory power in terms of interpreting our results. In doing so, we employ a similar approach to Devitt et al. (2016) who employ the Health Belief Model to understand their findings in relation to the perceived drivers and barriers to the effective management of domestic wastewater treatment systems.

accounts for flood-risk preparedness at the level of the individual, numerous studies suggest that preparedness for a natural disaster is linked with a range of socio-economic and demographic variables (for an overview, see: Bubeck et al., 2012; Kellens et al., 2013; Miceli et al., 2008). However, there is a growing body of scholarship which indicates that subjective or perceptual factors are far better predictors of why some people prepare whilst others do not (Bubeck et al., 2012; 2013; Grothmann and Reusswig, 2006). While scientific measures of risk involve objectively calculating the probability of events and the magnitude of the negative consequences, understanding how people perceive, and respond to, flood risk is far more complex (see Aven, 2012). Specifically, it is increasingly recognised that consideration must be given to how people *think* and *feel* about a risk (Slovic et al. 2004), otherwise known as the cognitive and affective components of risk perception. Reflecting this complexity, a broad range of perceptual factors have been identified as influencing levels of flood preparedness at the individual level.

### *Awareness*

Flood risk awareness can be regarded as the core cognitive element of risk perception and is defined by Raaijmakers et al. (2008: 311) as the “knowledge or consciousness of the flood risk that an individual or a group is exposed to”. The general hypothesis is that people will be more prepared if they are aware of, and understand the dangers associated with, a prospective flooding event, thereby lowering the impacts of an inundation (Botzen et al., 2009; Burningham et al., 2008; Dzialek et al., 2013). However, flood-risk awareness can be rather problematic, not least because of the considerable divergence that can exist between subjective and objective measures of risk amongst individuals, otherwise known as ‘perception bias’ (Daniel et al., 2009). More specifically, individuals can have different awareness levels ranging from expert awareness to complete ignorance of risk (Raaijmakers et al., 2008). Furthermore, several studies have undermined the assumed causal relationship between flood-risk awareness and

preparedness stressing that attitudes are not always great predictors of how people behave<sup>3</sup> (Blake, 1999; Bubeck et al., 2012; Eriksen, and Gill, 2010; Kollmuss and Agyeman, 2002; Miceli et al. 2008; Scolobig et al., 2012).

### *Emotions*

The disjoint between awareness and preparedness has led to a growing interest amongst researchers into the affective component of risk perception which relates to the emotional feelings of individuals towards a flood hazard (e.g. fear, worry, dread) (Miceli et al, 2008; Raaijmakers et al., 2008; Takao et al., 2004; Terpstra, 2011). Such ideas are inherently linked to the ‘affect heuristic’ (Slovic et al., 2004) or the ‘risk-as-feelings hypotheses’ which predicts that “positive and negative emotions attached to natural hazard experiences should influence risk perceptions and, possibly, preparedness behaviour” (Terpstra, 2011: 1660). Within this overall context, the feeling of worry has been identified as being of particular importance in determining the preference for risk reduction by scholars such as Raaijmakers et al. (2008). Specifically, they argue that if levels of worry are high, there will be a greater demand for risk reduction thus stimulating higher levels of preparedness and vice versa. This general line of argument has been supported empirically in several studies (see Harries, 2008; Miceli et al., 2008; Zaleskiewicz et al., 2002). Other authors have demonstrated similar affects in relation to other emotions such as fear (Takao et al., 2004), place attachment (Mishra et al. 2010) and an emotional desire to feel secure in one’s home (Harries, 2008).

### *Flood Experience*

Many empirical enquires have highlighted that the negative emotions emanating from previous flooding events helps explain why flood victims take more precautionary actions against future

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<sup>3</sup> Such evidence undermines the direction of official policy in places like the UK and Ireland which have become increasingly focused on raising awareness in a bid to improve levels of preparedness and more appropriate responses to future flooding events (see OPW, 2004).



floods than non-victims (Burn, 1999; Norris et al., 2009; Siegrist and Gutscher, 2006;). In this regard, it is assumed that those who have been negatively affected by floods in the past are keen to ensure that they are better prepared in terms of protecting themselves and their property should another flooding event arise in the future. While past experiences can positively influence preparedness at both the individual and community level, this relationship can be complicated by a range of other factors such as the recency of the event (Burn, 1999) and the level of damages incurred (Miceli et al., 2008; Takao et al., 2004). Moreover, people may find themselves underprepared by anticipating floods of the same magnitude as a previous event, thereby neglecting the possibility that the risks to property and individuals associated with a future flood might be much greater (Kates, 1962; Hopkins and Warburton, 2014). Past experiences might also adversely influence levels of preparedness by creating feelings of helplessness and hopelessness, particularly if the mitigation measures employed previously were overwhelmed and failed to provide the desired level of flood protection (Siegrist and Gutscher, 2008). In such instances, individuals can overlook the possibility that future floods may in fact be smaller in magnitude and thus easier to manage than before. Such issues are closely related to issues of trust in the mitigation measures available (i.e. response efficacy), as well as one's belief in their ability to adopt them (i.e. self-efficacy) (see section 1.2).

### *Trust*

Trust has also become an increasingly prominent variable used to explore how people perceive, and respond to, flood risk. The term 'trust' is somewhat broad, but within the field of flood-risk management it is generally used to refer to: 1) Institutional trust (i.e. the government's ability to cope with flood); or 2) Trust in specific mitigation measures (i.e. flood defences) (Kellens et al., 2013). With regards the former, Lin et al. (2006) show that higher levels of trust amongst individuals in terms of crisis management and flood warning systems increased the take up of mitigation intentions (e.g. purchasing insurance, information seeking etc.).

However, it is the latter type of trust referred to above which has tended to be the focus of empirical enquires, with various studies exploring how faith in mitigation measures, particularly engineered flood defences, might influence levels of preparedness (see Hung, 2009; Terpstra, 2011). The general hypothesis is that high levels of trust in public defences decreases perceptions of flood-risk (especially perceived probability), which in turn keeps citizens from preparing for potential flood disasters (Terpstra et al., 2009; Viglione et al., 2014). Evidence supporting this overall relationship can be found in studies carried out by Dzialek et al. (2013), Grothmann and Rueswig (2006), Hung (2009), Scolobig et al. (2012), and Terpstra (2011), .

The obvious problem with this of course is that there is always an element of residual risk<sup>4</sup> given that carefully engineered flood defences “cannot prevent damage if a flood exceeds the capacity of a structure designed to prevent it” (Takao et al., 2004: 777). With this in mind, it is clear that at risk populations may have excess confidence in the structural measures available which reduces perceptions of risk and fosters an unwarranted resistance to the adoption of preparedness measures at the individual level – a phenomenon commonly known as the ‘levee effect’ (Bradford et al., 2012; Ludy and Kondolf, 2014; Scolobig et al., 2012;).

#### *Attitudes towards controlling risk*

A number of studies have begun to explore the notion that an individual’s level of preparedness may vary based on whether or not a person is of the opinion that the risk in question can be controlled. The general assumption is that feelings of control over risk leads to a higher willingness to engage in mitigating behaviour. This idea has been supported by Norris et al., (1999:45) who argue that control is “a central cognitive mechanism explaining why many victims change their behaviour” and “a lack of perceived control is equally implicated as an explanation for why many victims do not”. In this regard, it has been highlighted that some

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<sup>4</sup> Residual risk (or net risk) is the term generally used to describe the risk that remains after controls are put in place.

individuals or communities share an opinion that floods are something which simply cannot be controlled and little can be done to decrease the losses incurred regardless of the types of measure proposed (Dzialek et al., 2013). This type of attitude has been found to be more common in smaller rural communities which tend to be more in touch with nature and possess “more lay knowledge about natural processes” in comparison to urban communities who have a tendency to place more faith in technological solutions (White, 1974 as cited in *Ibid*: 2560). The importance of context in this regard is further elaborated on by Dzialek et al. (2013) who argue that people who are at risk of flash flooding may be particularly prone to adopting a fatalistic approach in terms of their ability (or lack thereof) to prepare for a flooding event given the speed at which an inundation occurs (see also Scolobig et al., 2012).

### *Responsibility*

The concept of responsibility is another variable which has been used to explain the disjoint between how people perceive and ultimately respond to flood risk. Theoretically it is generally assumed that people are more likely to adopt mitigation behaviour if they feel it is their responsibility to do so (Lara et al., 2010). While recent policy shifts have meant that aspects of flood-risk management are increasingly considered the responsibility of individual households, a number of empirical enquiries reveal that such ideas are often at odds with the attitudes of citizens themselves. In particular, it is evident that many individuals still consider the state as being ultimately responsible in terms of preparing for flood events (see Botzen et al., 2009; Dzialek et al., 2013). There thus appears to be a significant disjoint between policy and practice, as individuals continue to perceive flood-risk management as a state responsibility while the state (in light of new policy approaches) sees risk management responsibilities being shared. Indeed Grothmann and Reusswig (2006) find reliance on public flood protection reduces household motivation to take precautionary action, with high levels of public confidence in institutions responsible for flood management found to reduce the likelihood of households

taking preparedness actions (Reynaud et al., 2013). The reluctance of individuals to accept responsibility for flood-risk management may reflect a desire to exonerate themselves for taking individual actions (Terpstra, 2011). An alternative explanation may reside in the fact that national agencies continue “operating in accordance with old habits that are typical of an interventionist approach” (Dzialek et al., 2013: 2563) despite rhetoric that a change in direction in terms of how we think about floods is needed.

### *Social Capital*

A relatively small body of work also identifies a relationship between social capacity and flood preparedness (Babcicky and Seebauer, 2016; Dittrich et al. 2016; Lara et al., 2010; Scolobig et al., 2012; Tran et al., 2008;Dzialek et al., 2013). For instance, the work of Dzialek et al (2013) demonstrates how bonding social capital<sup>5</sup> enables “the strengthening of memories about past natural disasters and the exchange of information about possible future risks and mitigation behaviour” (*Ibid*: 2556). The study also highlights the importance of bridging social capital in terms of helping to transfer knowledge to more marginalised groups (e.g., new inhabitants etc.). In a similar vein, Scolobig et al. (2012) found that higher levels of community embedding were linked with higher evaluations of preparedness at the community level, although Babcicky and Seebauer (2016) find that expectation of social support ‘downplays risk’. However, in general, such studies elucidate the importance of strengthening both formal and informal community networks in terms of promoting enhance flood preparedness.

## 1.2 Protection Motivation Theory

The foregoing section illustrates that understanding what motivates people to protect themselves and their property against a flooding event is far more complex than one might

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<sup>5</sup> Bonding social capital relates to strong ties among family members, friends and neighbours and are typical of more stable and deep rooted communities, whereas bridging social capital is more common in newer less established neighbourhoods

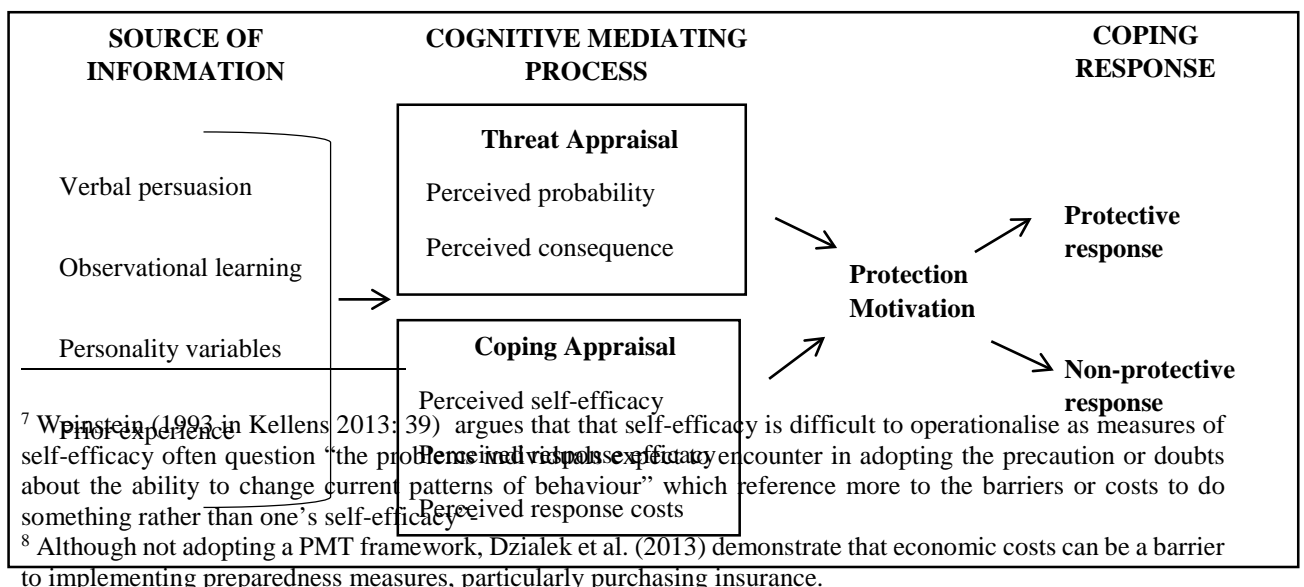
assume. Indeed, various models have been developed to understand these complexities in greater detail. One such framework is Protection Motivation Theory (PMT), a theoretical model originally developed in the 1970's to help understand behaviour in response to certain health risks. This model has since been employed within the realm of environmental hazards in general (Martin et al., 2007; Neuwirth et al., 2000), and in the context of flood-risk preparedness in particular (Bubeck et al., 2012; 2013; Grothmann and Reusswig, 2006;). As a model, it attempts to reflect the cognitive processes leading to a protection motivation in response to a threat. PMT's core feature is the differentiation it makes between two perceptual processes, threat appraisal and coping appraisal. The former takes into account how an individual evaluates a certain risk and is strongly related to common measures of risk perception, namely perceived probability and perceived consequences. Perceived probability refers to an individual's "expectation of being exposed to a threat" such as a flooding event (e.g. high risk of being flooded within the next 10 years). Perceived consequences on the other hand refers to an individual's estimate of the damages caused if the threat were to occur (e.g. damage to property and valuables, loss of life etc.) (Grothmann and Reusswig, 2006: 104)<sup>6</sup>. However, it is the notion of 'coping appraisal' which really distinguishes PMT from other models as this component seeks to capture not only how people think about the benefits of taking an action, but also their own competence to carry it out (Bubeck et al., 2012). In order to determine an individual's coping appraisal, three key variables are explored: 1) response efficacy; 2) self-efficacy and 3) response costs. Response efficacy is the belief that the response is effective in terms of reducing risk (i.e. level of faith in response). This variable is almost identical to that of trust in physical flood defences already discussed, but instead it relates to a series of non-structural mitigation measures that can be adopted at the individual level (e.g.

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<sup>6</sup> In addition to these two core variables, Grothmann and Reusswig (2006) highlight the existence of a third component, namely fear. This is considered to play a more "indirect role in threat appraisal by affecting the estimate of the severity of the danger" (*Ibid*: 105).

sand bags, building alterations, flood-proof kits, evacuation plans etc.). Self-efficacy<sup>7</sup> relates to the confidence of an individual in terms of their own capacity to carry out or implement a mitigation measure. Reponses costs seeks to capture the estimated costs involved in adopting a preparedness measure, which can include things like time and effort as well as monetary expenses<sup>8</sup> (Grothmann and Reusswig, 2006). The general assumption underpinning this model is that people who have a high perception of risk (i.e. threat appraisal) will adopt a protective response, but only if their coping appraisal is also high (see Figure 1). By way of contrast, people who may have a high perception of risk, but a low coping appraisal will tend to adopt non-protective responses (e.g. denial, fatalism, wishful thinking etc.) (*Ibid*). According to this model, these cognitive processes are informed by a variety of variables including verbal persuasion, observational learning, personality variables and prior experience.

**Figure 1: A schematic overview of protection motivation theory**



(Source: Bubeck et al., 2012)

This overall framework has been explored empirically and has been shown to be highly effective in terms of explaining why people prepare (or not) for a prospective flooding event (Bubeck et al., 2012; Grothmann and Reusswig, 2006). More specifically, several authors have highlighted the robustness of ‘coping appraisal’ in particular as an explanatory factor in this regard (Bubeck et al., 2013; Grothmann and Reusswig, 2006; Poussin et al., 2014; Terpstra, 2011). For instance, Bubeck et al.’s review (2012) argues that the coping appraisal component has a greater predictive validity than the threat/risk perception component. Grothmann and Reusswig (2006: 107) also outline that understanding whether or not people decide to protect themselves against a flood is not determined by an individual’s perception of risk, it is “instead decided on the basis of the coping appraisal” as self-efficacy and response efficacy were correlated with non-protective responses in their study<sup>9</sup>. Similar findings are reported by Poussin et al. (2014) who found that threat appraisals have a small effect on preparedness, while coping appraisals have a more important influence amongst the French case studies they surveyed. Bubeck et al.’s (2013) empirical work also supports this contention with self-efficacy emerging as a significant predictor of whether individuals adopt structural building measures. These studies highlight the robustness of coping appraisal as a key variable accounting for flood-risk protection.

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<sup>9</sup> See Figure 2 of Grothmann and Reusswig (2006: 105) for direction of influence of the variables in the cognitive mediating process.

## 2.0 Methodology

### 2.1 Case study

The research takes a case study approach by focusing on the coastal and riverside town of Bray, Co. Wicklow, which is located in the east of Ireland (see Figure 2). The town has a history of flooding with four major fluvial flood events taking place since the turn of the 20<sup>th</sup> century (1905, 1931, 1965 and 1986) and with a series of flood warnings issued in 2008 and 2011. A ‘dry run’ community flood drill was also undertaken in 2009 to increase community preparedness. Importantly, the most recent large-scale flooding event occurred in 1986 whereby large areas of the town were extensively flooded by the River Dargle during Hurricane Charlie (having an estimated return period of 100 years) (Bray Town Council et al., 2007). Based on the geographical and hydrological features at play within this river catchment the River Dargle is particularly prone to flash flooding. In light of the high level of risk that is posed to both people and personal property within the River Dargle’s fluvial flood zone in Bray, Bray Town Council and the Office of Public Works, the state agency responsible for flood-risk management in Ireland, undertook a design process<sup>10</sup> including public consultation initiatives for the River Dargle Flood Relief Scheme, with funding approval for its construction first announced in 2011. The scheme commenced construction in 2012 and upon its completion is designed to provide protection against a 1-in-100 year fluvial flood and 1-in-200 year tidal flood, and so comprises a variety of measures including: the widening of the river channel; dredging; river walls; culvert etc. The works have been subject to significant delays but are expected to finish in late 2016 with an estimated total cost now in the region of €40 million.

### Figure 2: Case Study Area

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<sup>10</sup> The design and consultation process commenced in 2006.





**Figure 3: Flood Relief Works in Bray**



(Image source: adapted from [www.bray.ie](http://www.bray.ie))

## 2.2 Study Design

Research ethical approval was granted by the University College Dublin Human Research Ethics Committee. Qualitative research methods were used to explore perceptions of flood risk among a small cohort of householders living inside the identified flood zone in Bray (for flood zone extent details see Figure 2). A qualitative research design was favoured to generate more detailed insights into the barriers preventing individuals from effectively preparing for flood risk thereby redressing the dominance of quantitative survey-based research designs to date. In doing so, a series of focus groups were conducted with residents at various locations within the flood zone. Used across a variety of disciplines, focus groups can be understood as ‘somewhere between a meeting and a conversation’ (Agar and MacDonald, 1995: 80), comprising a group of participants discussing a specific topic. Focus groups were favoured as they allow participants to ‘explore and clarify their views in ways that would be less easily accessible in a one to one interview’ (Kitzinger, 1995: 299), and they can often yield intangible or hidden data (e.g. non-verbal or physical expressions) (Wilkinson, 1998; Sim, 1998). In addition, focus groups can allow for the maximisation of data collection, particularly if time is limited (Acocella, 2012), and when used in exploratory research, can help inform more structured approaches to data collection (Wilkinson, 1998; Sim, 1998).

### 2.3 Participant recruitment

Six locations within the 1-in-100 year modelled flood zone (see Figure 2) with varying degrees of access, and physical and visual positioning relative to the river and the flood defence works (see Table 1) were selected by the research team. All of these locations had been previously surveyed as part of a quantitative study within a wider research project (see Brennan et al., 2016; O’Neill et al., 2015; O’Neill et al., 2016), however the sample locations of this qualitative study were narrowed to six more discrete locations within the flood zone, each comprising a cluster of adjoining residential roads or an individual residential estate. Just under 200 individual properties received an invitation, comprising 30% of all residential properties that

are located within the flood zone, but located differentially across the study area. It was intended that each individual focus group would be drawn exclusively from one of these six locations. A tailored letter of information (available from the authors) was hand delivered directly by the research team to individual houses within each location one week prior to the planned focus group. The letter outlined the following: focus group date and location; study objectives; what participation involved; how the data generated was being used; the protection of participant privacy; the benefits and risks involved as a result of participation; and information on the dissemination of results; contact information and background information on the research team. In order to maximise participation rates, householders were offered compensation for their participation (i.e. a monetary voucher to the value of €10), and the data collection sessions were conducted at a community facility (i.e. a meeting room adjoining a local not-for-profit cafe), within walking distance of each specific location, and at an appropriate time of day (between 7pm- 9pm.). Two days prior to each planned focus group, reminder letters were circulated to householders. The research team liaised closely with individuals who contacted the team to express their interest in participating in the research. Focus Groups were conducted between July and August 2015.

Although six focus groups were proposed, there were varying degrees of success regarding levels of participation. Small focus groups comprising between four to six participants are considered sufficient, although larger groups of eight to twelve are preferred (Krueger, 2000; Sim, 1998). Despite following good practice techniques in terms of focus group recruitment (Sim, 1998), in some instances the number of participants failed to meet the lower recommended threshold number of four (see Table 1). This minimum number was achieved in the case of Focus Group 2 and Focus Group 3. In the case of Focus Group 1 and Focus Group 5, the group dynamic attribute was achieved despite the lower number of participants. The planned Focus Group 6 turned into a face-to-face interview with one participant. One location (FG4) yielded no participants despite extensive efforts made in terms of recruitment. This may

be reflective of the occupancy profile of the location (i.e. rented accommodation versus ownership), and a lack of direct experience of flooding, such as that caused by Hurricane Charlie in 1986, given that it is a relatively recent area of development. In total, 18 individuals participated in the study. As noted by Brod et al., (2009) and O'Reilly and Parker (2012), data collection should continue until no new insights are generated (i.e. data saturation). There was a high degree of consensus in terms of the themes that emerged from the focus groups and face-to-face interview suggesting that saturation was achieved, albeit limited to those who had prior direct or indirect experience of flooding. A breakdown of the focus groups in terms of participant numbers, location within the flood zone and their experience of flooding are documented in Table 1.

**Table 1: Breakdown of focus groups in terms of participant numbers, location within the flood zone and experience of flooding.**

<b>Focus Group</b>	<b>No. of Participants *</b>	<b>No. Dwellings Targeted**</b>	<b>Proximity of participants' dwellings to the river</b>	<b>Participants' experience and potentially modifying variables</b>
Focus Group 1 (FG1)	3	20	<ul style="list-style-type: none"> <li>• Not directly adjacent to the river.</li> <li>• No direct view of the river.</li> </ul>	<ul style="list-style-type: none"> <li>• Direct and indirect experience of flooding.</li> <li>• Experience of flood warning.</li> </ul>
Focus Group 2 (FG2)	5	35	<ul style="list-style-type: none"> <li>• Direct view and physical access to the river.</li> </ul>	<ul style="list-style-type: none"> <li>• Direct and indirect experience of flooding.</li> <li>• Experience of flood warning.</li> </ul>
Focus Group 3 (FG3)	7	40	<ul style="list-style-type: none"> <li>• Physical access to the river (via Public Park).</li> <li>• Limited view of the river.</li> </ul>	<ul style="list-style-type: none"> <li>• Direct and indirect experience of flooding and flood warning.</li> </ul>
Focus Group 4*** (FG4)	0	40	<ul style="list-style-type: none"> <li>• Adjacent to the river, with limited view and physical access.</li> </ul>	<ul style="list-style-type: none"> <li>• Development built subsequent to Hurricane Charlie in 1986.</li> <li>• To date, this development has not been flooded.</li> </ul>
Focus Group 5 (FG5)	2	30	<ul style="list-style-type: none"> <li>• Limited view and physical access to the river.</li> </ul>	<ul style="list-style-type: none"> <li>• Direct experience of flooding.</li> </ul>
Focus Group 6 (FG6)	1	30	<ul style="list-style-type: none"> <li>• Physical access to the river (via Public Park).</li> <li>• Limited view.</li> </ul>	<ul style="list-style-type: none"> <li>• No direct experience of flooding but experience of flood warnings.</li> </ul>

\* Focus groups should ideally be between 4-8 participants.

\*\* Number of dwellings targeted reflects differences in terms of neighbourhood size.

\*\*\* As focus group 4 yielded no participants this row refers to a development, not individuals.

## 1 2.4 Data collection

2 A review of existing literature on risk perception and preparedness helped inform the  
3 development of a topic guide for the purpose of data collection. The topic guide covered a  
4 number of thematic areas, which sought to elicit the perceptions of participants in relation to:  
5 flood risk; previous flood experiences, levels of preparedness; types of preparedness measures  
6 adopted, issues of responsibility and trust, as well as attitudes towards the flood relief works.

7 On arrival at the focus group location, participants were greeted by the researchers attending  
8 the session and offered some light refreshments so as to generate a relaxed setting. The meeting  
9 room where the sessions were conducted was spacious and well-lit, with the session undertaken  
10 around a large roundtable facilitating face-to-face group interaction amongst participants. Prior  
11 to commencing the session, the moderator discussed some basic ‘ground rules’ and participants  
12 were assured that this was a learning environment for the research team (Sim, 1998) and they  
13 were all encouraged to share their views and experiences ‘without repercussion’, in line with  
14 the approach of McLafferty (2004).

15 Data collection sessions typically lasted between 60 and 90 minutes. Discussions were  
16 moderated by a member of the research team and were attended by a second team member who  
17 observed the session. All discussions were recorded digitally with the verbal consent of  
18 participants. Although a snowball sampling technique was not employed, in a number of focus  
19 groups, householders knew each other outside of the study setting. This is not surprising given  
20 that all properties were co-located across the locations (i.e. road/estate) targeted for participant  
21 recruitment. According to Kitzinger (1999), such social familiarity may have a number of  
22 implications. While on one level, this may have added to the group dynamic; on the other,  
23 social familiarity with other participants may result in self-censorship whereby individuals feel  
24 unable or uncomfortable sharing a particular viewpoint or experience for fear of social isolation.  
25 Householders may also express a response bias, sharing opinions and viewpoints that they

26 regard as being socially desirable and fitting with the views of other participants. In order to  
27 help redress such issues, the moderator was cognisant of the importance of seeking verification  
28 and validation from householder participants throughout the data collection phase, and as a  
29 result, often repeated viewpoints back to the participant group to see if they were shared by all  
30 members of the group. This process helps ensure interpretive validity and research rigor (Morse  
31 et al., 2002). Whereas Farnsworth and Boon (2010) note non-verbal dynamics and interaction  
32 can run parallel to the primary information gathering process, all the sessions maintained a  
33 cordial and relaxed atmosphere throughout. Nevertheless, for example, when recalling flood  
34 memories, this generated emotions of upset for some participants at times. Whilst these  
35 participants were offered the opportunity to take a break<sup>11</sup>, they all felt comfortable in the focus  
36 group atmosphere to continue to share their experiences. In line with Nyamathi and Shuler  
37 (1990: 1286) the moderator sought to apply ‘mild, unobtrusive control’ so as to maximise the  
38 group dynamic between participants on the topic of interest and to avoid domination of  
39 discussion. Where, on occasion, consensus on an issue may have been assumed, the use of  
40 member checking through careful probing by the moderator brought forward dissent on some  
41 issues suggesting the existence of initial self-censorship amongst some participants, but also a  
42 level of trust in the moderator to overcome this. Post-session debriefings<sup>12</sup> and research team  
43 reflection did not suggest any undue influence on the part of the moderator in terms of biasing  
44 participant responses or excessively controlling group discussion.

45 While due to ethical considerations, householders were not asked to provide any biographical  
46 information (such as age, income and education profile, etc.), the participants were generally

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<sup>11</sup> The option to opt out of the session at any time was also put forward in the ground rules.

<sup>12</sup> A post-session debriefing of the research team after each focus group discussed how the session was conducted by the moderator, areas of agreement or dissent, important social dynamics that should be recorded, and also reflection about any possible modifications to be applied to subsequent sessions (Kidd and Parshall, 2000).

47 older and had either direct or indirect experience of Hurricane Charlie, and a relatively even  
48 gender balance was achieved.

## 49 2.5 Analysis

50 Audio recordings were imported into an on-line transcription tool for transcribing by the  
51 researcher. This tool provided the option of slowing down the audio-file if required, to allow  
52 ease of transcription, while also allowing the researcher to develop an initial familiarisation  
53 with the data (see Braun and Clarke, 2006). In order to protect anonymity, any identifiable  
54 information (such as names and location specifics) were removed from the transcripts.  
55 Individual lines of transcript formed the text unit for the purpose of analysis; however, the  
56 transcripts were formatted in such a way so that each individual spoken passage comprises a  
57 section. Full transcripts were subsequently imported into NVIVO-8 (QSR-NUD\*IST  
58 International)<sup>13</sup> for the purpose of analysis.

59 In the initial stages of analysis, “borrowing” concepts and codes from existing literature was  
60 used, an approach often used to help analyse data deductively (Benaquisto, 2008). Hence, the  
61 initial stages of analysis were informed by a review of existing literature documenting  
62 preparedness and flood risk protection. More, specifically, concepts associated with Protection  
63 Motivation Theory proved particularly useful in terms of sorting the data along thematic lines,  
64 (e.g. ‘self-efficacy’, ‘response-efficacy’, ‘perceived probability’, ‘perceived consequence’,  
65 ‘protective response’, ‘non-protective response’ etc.) . However, other codes were also  
66 borrowed from a wider body of literature such as Kates (1962) ‘prisoner of experience’ phrase  
67 as well as the ‘levee effect’ concept (Ludy and Kondolf, 2014; Scolobig et al.,

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<sup>13</sup> NVIVO-8 is a computer software programme which facilitates the analysis process by allowing the researcher to manage and organise large amounts of unstructured and semi-structured data.



68 2012). Employing borrowed codes to inform our analysis proved to be valuable in terms of  
69 reflecting how our findings relate to the existing body of literature in this area.

70 In terms of assigning data to different parts of the cognitive process, a number of criteria were  
71 established. For instance, participants had to make some reference to a particular issue which  
72 affected their ability to take protective action (or not) in order for the comment to be assigned  
73 to the ‘self-efficacy’ code (e.g. health, age, social networks etc.). Similarly, participants must  
74 have referred to the effectiveness of a specific preparedness measure in order for their  
75 comments to be assigned to the code labelled ‘response efficacy’ (e.g. flood gates, sandbags,  
76 evacuation plans etc.). Any comments which referred to the likelihood or frequency of flooding  
77 were assigned to the ‘perceived probability’, while references to the social, economic or  
78 environmental impacts of past or future flooding events were ascribed to the code of ‘perceived  
79 consequences’. In certain circumstances, it was more difficult to clearly attribute comments as  
80 belonging exclusively to one particular component of cognitive process, especially more  
81 generalised fatalistic comments which could be viewed as constituting either a ‘non-protective  
82 response’ or lack of ‘self-efficacy’. In such cases, the comments were assigned to both  
83 categories for completeness and were subsequently analysed within the broader context of the  
84 results.

## 85 **3.0 Results**

### 86 3.1 Protective measures

87 Similar to other studies, which examine communities ‘at-risk’ of flooding, our results reveal  
88 that participants generally feel underprepared for a major flooding event. Several clearly  
89 expressed that they “*wouldn’t be prepared*” (FG1) with others describing the relatively minor  
90 preparedness measures (e.g. checking insurance, placing valuables upstairs, putting furniture  
91 up on tables) they typically employ, and which they acknowledge are unlikely to significantly

92 mitigate the damages incurred by a major flood event. As outlined by some of the participants  
93 in Focus Group 1:

94 *“We didn’t make any changes to our home. At the time, knowing that they are floor  
95 board houses, there are air vents in the front, we got the sandbags, we blocked up the  
96 air vents, just to slow it down if it did get to the level of the gardens to stop it going into  
97 the floor boards. That was done while we were waiting to see if there was going to be  
98 flooding”* (FG1)

99 *“The only thing we would know to do is to block off our gate...and that would stop it  
100 from getting in past the level of concrete [plinth].”* (FG1)

101 *“Since 1986, we have sandbags in our garden”* (FG1).

102 When prompted with a broader range of possible preparedness measures from the moderator,  
103 there was a general lack of uptake, and indeed familiarity, with the measures raised (e.g. flood  
104 proof fixtures, community flood drills, floodgates etc.). For instance, when asked if anyone had  
105 emergency flood response kits (e.g. including torch, radio, first aid kit etc.) in their homes, one  
106 participant asked what they were and jokingly suggested that they should include a boat and a  
107 life jacket (FG2).

108 Whilst the uptake of property-protective measures was generally low and limited to relatively  
109 minor actions, the results reveal a stronger tendency amongst the participants to adopt more  
110 self-protective measures geared towards protecting themselves and their loved ones rather than  
111 their property (e.g. evacuation plans, flood warnings etc.):

112 *“We had our car, and put it on top of the hill at [location in town], in case we needed  
113 to leave.”* (FG, 1)

114 *“I remember the night we had the flood, and this guy came around and told us that  
115 there was going to be a flood. This was Hurricane Charlie... I went down to look at the*

116 *river, I will never forget it, it was raging... it was very near the top, and I immediately*  
117 *went back and moved my car up high [for evacuation purposes]” (Int3).*

118 *“If I heard it was coming, I would just go. Go to higher ground, ye know”.* (FG1)

119 Interestingly, some explained that they would not evacuate their homes even if an order was  
120 issued. The cited reason for this was due to security concerns- a potential barrier to evacuation  
121 that has not been reported elsewhere in the preparedness literature. To illustrate:

122 *“I wouldn't leave my home, no... security. You get out of the house, and people come*  
123 *in”* (FG2)

124 *“You wouldn't be two minutes out of it [the house] and it would be raided”* (FG6).

125 Despite a small number of participants outlining that they would not vacate their homes, their  
126 focus on the adoption of self-protective mitigation measures (i.e. evacuation) may reflect the  
127 flood characteristics of the catchment area, which is particularly prone to flash flooding events  
128 that have fast inundation periods and pose greater risks to life than slow rising floods.  
129 Furthermore, this finding might also be explained in part by the topographical features within  
130 the case study area where low-lying tracts of land are encased by much higher ground thus  
131 preventing water from dissipating outwards to any great degree.

### 132 3.2 Non-protective measures

133 In more extreme cases, some participants explained that they take no action at all to protect  
134 themselves against potential flooding events, otherwise known as ‘non-protective’ responses.  
135 This type of inaction can be described as the ‘ostrich effect’, otherwise known as ‘wishful  
136 thinking’/denial whereby individuals tend to neglect the realities of the situation, instead living  
137 in hope for best possible outcome:

138           *“I haven’t thought about it, haven’t a clue, and can’t think ahead after tomorrow. If it*  
139           *happens, it happens”*. (FG2)

140           *“I really don’t think about it to be honest”*. (FG3)

141           *“I have enough of worries without have to worry about something that might never*  
142           *happen. After the Hurricane, you were more worried about getting yourself back*  
143           *together. You feel disillusioned.”* (FG6)

144 For others, there was a sense of fatalism where their responses echoed feelings that nothing  
145 that can realistically be done to mitigate the damages if such an event were to reoccur:

146           *“But what can you do, what can you do to protect yourself except move out. Ye know,*  
147           *because it is impossible, it comes in through everything”* (FG5)

148           *“Well in 2008 and 2009 [flood warnings], we never lifted anything upstairs. We said ‘that if*  
149           *we’re going to be flooded, we are going to sit here, and let it come in and out the door...’.”*  
150           (FG6)

151 In seeking to understand what accounts for such low levels of preparedness amongst the  
152 participants, a number of interesting findings emerged which relate strongly to ideas of efficacy  
153 and one’s appraisal of flood risk. It is to these themes our attention now turns.

### 154 3.3 Coping Appraisal

#### 155 *Response efficacy*

156 A prominent theme emerging from the data which helps explain the low levels of preparedness  
157 measures adopted is the general lack of faith that participants have in terms of the range of  
158 preparedness measures available to them. In particular, many participants rubbish the idea  
159 that sandbagging is an effective way of protecting one’s home from rising floodwaters.

160           *“We're talking about barricading our houses with sandbags, but it won't stop it coming*  
161           *up the toilet downstairs, up through the sewers. Yes, our toilet downstairs overflowed.”*  
162           (FG6)

163           *“Yes, even a simple issue like getting sand-bags. Our house is so old. It doesn't have*  
164           *proofing, it will seep up anyway. Sandbags or no sandbags... Someone said sandbags*  
165           *don't make any difference. We've had no sandbags.”* (FG6)

166   In this regard, it seems that the low level of faith in the flood-risk preparedness measures stems  
167   largely from the participants negative experiences (be them direct or indirect) of Hurricane  
168   Charlie where there was extensive damage to property from the unprecedented flood event.  
169   Other participants also demonstrated a lack of faith in other preparedness measures such as  
170   floodgates:

171           *“I thought about physical flood-gates, but if the water went three feet high, you would*  
172           *want something, but it can seep up through the floors... We would need a double one,*  
173           *we have a huge long wall....even we had flood gates on both ends; sure the wall could*  
174           *be knocked down with the water.”* (FG6)

175           *“We bought a thing, it's an inflatable thing you are supposed to jam it into you door.*  
176           *But the water came up through the sewerage”* (FG2)

177   While many of the observations raised here may be entirely warranted and substantiated based  
178   on the participants knowledge of the scale of the flood waters which occurred during Hurricane  
179   Charlie, these findings show that participants fail to acknowledge that subsequent floods may  
180   not be as aggressive as before. In doing so, they overlook the fact that there may be potential  
181   to mitigate the damages incurred by a future event through individual property protection  
182   measures which they have largely dismissed as offering a “*false sense of security*” (FG6).

183   *Self efficacy*

184 In addition to the participants' low level of faith in the preparedness measures available to  
185 them, the results reveal a low sense of self-efficacy amongst some respondents in terms of their  
186 own ability to effectively implement mitigation responses based on other variables such as age,  
187 health, etc. In particular, several participants highlighted that individuals may have a low sense  
188 of efficacy due to the physical demands that are often involved. Several of the older participants  
189 articulated this issue clearly:

190 *"We were so much better able to cope back then, we were younger. I think if it happened*  
191 *now, I would just throw myself into it. I just couldn't cope with it, couldn't cope with it*  
192 *[shuddering voice]. It took a lot of physical energy, we had to move out, and let them*  
193 *in to do the walls. And if we are carrying things upstairs on the night of the flood. All*  
194 *that physical energy that I had loads off back then, that I wouldn't have now. I just feel,*  
195 *I just couldn't cope with it". (FG5)*

196 *"You know, moving furniture. I have arthritis, and he is not well either" (FG6).*

197 *"They [sand bags] can be heavy on elderly people, or if you live on your own. I am on*  
198 *my own, and to move them or anything, we really need something concise [in terms of*  
199 *planning]" (FG6)*

200 In a similar vein, several participants communicated the practical considerations, which are  
201 often overlooked, and which limit an individual's capacity to implement some of the most basic  
202 flood-risk preparedness measures such as sandbagging or moving valuable items upstairs:

203 *"They [local authority] put a pile of sandbags up at the entrance into the estate, but you*  
204 *had to go and collect them yourself if you wanted them. That was 2011, but nobody did.*  
205 *But that was their idea of protection...So you can imagine if you were a 90 year old,*  
206 *you would hardly go up and get a sand-bag" (FG5)*

207           *“It was it was code red [flood-risk warning].... but unlike you [another participant], I*  
208           *would worry. I do keep an eye on the rain. I basically live on my own, and I can't lift*  
209           *this and I can't lift that. What do I decide to move upstairs? The animals being the main*  
210           *thing”* (FG6)

211   Similar concerns were echoed by participants in Focus Group 3;

212           *“I went up to the council and I filled up my own. You had the sand and you had the bags*  
213           *but you had to fill them yourself...”*

214           *“Elderly people couldn't do that.”*

215           *“Wheelchair users...”*

216           *“Just down the road from us is the handicapped house and they are all in*  
217           *wheelchairs...”*

218   In addition to these specific examples, low levels of efficacy in a more general sense were also  
219   observed amongst the respondents which in many respects could be considered akin to fatalistic  
220   comments regarding their inability to prevent the consequences of flooding events in any  
221   meaningful way. Such responses again appear to be closely rooted to their past experiences of  
222   Hurricane Charlie – an event which is etched within the memories of those who were directly  
223   or indirectly affected by it:

224           *“It can get in under your door, come in through the letter box, even lower than that. I*  
225           *was on the stairs, watching it come in through the letterbox. I don't think you can*  
226           *prevent it, you can't”* (FG5).

227           *“When it started to come we looked out the front door and you could see it come over*  
228           *the football pitch. It was like a tide coming in. All you can do is go upstairs and let it*  
229           *come...”* (FG6)

230 It is interesting to note that several participants recalled the damages previously incurred with  
231 great clarity despite the event taking place almost 30 years previously. The level of detail in  
232 the description and emotion which was offered when recalling their experiences about an event  
233 which took place so long ago is at odds with many other studies which highlight how people's  
234 recollection of flood events fades significantly (Burn 1999). The following quotations illustrate  
235 the level of recollection amongst some participants:

236 *“Our floods came in through underneath the wall... I could hear the water flowing*  
237 *underneath the house. And I said, it has stopped, but [name] said, "No, it has reached*  
238 *floor level", and next minute I could see the carpet rising. And we said, "Okay, upstairs,*  
239 *turn off all the lights, upstairs... It was so frightening.” (FG1)*

240 *“It was a very strange experience back in 1986, that particular year... I only had a baby*  
241 *in July, and this was August, so I am sitting upstairs in a room, with a baby and a*  
242 *Labrador, and all am worried about is the Labrador.... my neighbour, she had her baby*  
243 *two weeks after I had my baby. And I remember walking across the road to her mothers,*  
244 *with a wash-basket, and the baby was in this wash basket. And her house was*  
245 *completely destroyed. Everything was destroyed.” (FG1).*

246 While attempts can be made to enhance the self-efficacy of individuals by communicating the  
247 effectiveness of flood-risk preparedness measures and providing practical guidance on how to  
248 implement them, these findings demonstrate that communication alone may be insufficient. In  
249 particular, these results suggest that dedicated assistance needs to be provided to potentially  
250 vulnerable groups – such as older members of the community, or householders who may have  
251 a disability – whose low sense of self-efficacy is insurmountable though communication alone.

## 252 3.4 Threat Appraisal

### 253 *Perceived probability*



254 Another dominant finding emerging from the data is the disjoint between risk awareness and  
255 preparedness which is supported by the literature. Specifically, the data reveals a generally high  
256 threat appraisal of flooding amongst the participants which discredits the notion that the low  
257 levels of preparedness reported can be explained in terms of an information deficit. In particular,  
258 the participants demonstrated a strong awareness of the likelihood of another flooding event  
259 occurring in Bray and displayed a strong understanding of the natural processes and  
260 environmental triggers which signal that their immediate risk of being flooded is heightened.  
261 For instance, several made reference to the weather conditions and other environmental cues  
262 which signal an increased likelihood of a flooding occurring in the locality as the following  
263 quotations help illustrate:

264 *“...when it is lashing rain and you look out and you see the road flooded outside. You*  
265 *do get worried... Some of the heavier rains, you would keep an eye on the window”*  
266 (FG6)

267 *“Well, it’s always a threat, when its pouring rain and you look out to see if it is going*  
268 *flood”* (FG5)

269 *“Well it would just be a concern for me. And you know, you might walk over the bridge*  
270 *and the river would look very high, and the park will get soggy. That would be a*  
271 *worry.... you wouldn’t want to dwell too much about it”.* (FG3)

272 *“I remember being down at the harbour, we were looking at the river, we would always*  
273 *watch the height of the river because normally it is quite low, but yeah, we were on the*  
274 *alert that time.... Well I didn’t get any warning, I just went down with a neighbour and*  
275 *we walked down and stood at the bridge near the sea, and we saw the river water rising*  
276 *and the tides coming it. Gosh, it was very near, it was very near.”* (FG5)

277 *Perceived consequences*

278 In addition to the perceived probability of flooding being generally high amongst participants,  
279 the data reveals a similarly high perception of the perceived consequences of flooding. In this  
280 regard, it was clear that anticipated damages arising from a future flooding event are closely  
281 connected to individuals past experiences of Hurricane Charlie, regardless of whether the  
282 damages were experienced directly or indirectly.

283 *“You don’t realise how high the water is going to be, we got sofas and chairs up, but*  
284 *the kitchen table was floating around. We didn’t think to empty the kitchen presses, and*  
285 *the eggs were floating around in a bowl of muck, you don’t think of the little things. We*  
286 *lost loads of photos.... It’s the silly little things that after, you ask “do you know where*  
287 *that’s gone’?” (FG6)*

288 *“My husband was alive then, it was very tough. You lost all your belongings- everything*  
289 *on floor level... The electrician came in, and he just said ‘That’s going, that’s going,*  
290 *that’s going’. All our stuff in the kitchen, everything at floor level, where the water*  
291 *came in, soaked everything in the cupboards, all that was gone, the carpets...” (FG5)*

292 *“It was a different environment the next day, you knew who lived down in the whole of*  
293 *Little Bray, because everyone from there was wearing muddy boots cos there was silt*  
294 *everywhere. It was disgusting... people didn’t realise how much damage was done. It*  
295 *was shocking” (FG3)*

296 Such findings lend support to the contention that flood-risk awareness does not automatically  
297 translate to mitigation behaviour as the participants demonstrated a high threat appraisal on the  
298 one hand, but low preparedness levels on the other. This further undermines the approach  
299 favoured by various government agencies to develop communication strategies designed to  
300 enhance risk awareness in the hope that greater awareness will foster greater flood-risk  
301 preparedness levels.

302 *The levee effect*

303 Despite evidence of high threat appraisals amongst participants, it is clear that the  
304 commencement of the flood relief works within the case study area is having a substantial  
305 influence on the risk perception on many of the participants. In particular, it is evident that  
306 there is a general feeling that the threat of flooding has reduced significantly since the flood  
307 relief works have commenced despite only reaching the mid-way point of construction<sup>14</sup>.  
308 Several quotations help illustrate this general observation:

309 *“We should see it [the river] as a threat, but definitely now that they are working on it,*  
310 *it won't be a threat, we feel that. But if they didn't do that, if they hadn't started on that,*  
311 *we would still be worried”*. (FG5)

312 *“Well, I look at the amount that they dredged out of the base of that river in the last*  
313 *couple of weeks... to take the flow off and slow it down, and all of that has to have an*  
314 *impact, even if it is not finished.”* (FG1)

315 *“Whatever they have done, the chances of flooding are less than they could be. Because*  
316 *they put a culvert in, they've raised the wall”*. (FG2)

317 *“I would be less and less worried, because last year, when everyone along the south*  
318 *east coast [was experiencing flood events], we would have been one of those pointing*  
319 *when that would have hit the top end of that wall, yeah.... and it may or may not come*  
320 *over it, and it didn't get to the level at all. So, the work they had done in my mind... even*  
321 *though it has not finished has made a difference.”* (FG1)

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<sup>14</sup> At the point fieldwork was undertaken.

322           *“It is only in the last number of years that we have had this sort of rain, we can see it,*  
323           *we can see the danger, and if they weren’t working on it now, I would be getting worried,*  
324           *very worried.”* (FG5)

325           *“It’s [risk of flooding] after getting better now with works, it will not come.”* (FG1)

326           *“I believe in these works, I really believe they are going to work.”* (FG5).

327   Although a small number of participants spoke less assuredly about the ability of the flood  
328   relief works to eliminate the risk of flooding, they were nonetheless largely optimistic about  
329   the protection it offers in its present guise:

330           *“[I am] slightly less worried [about flooding]. Before [the works], you would be always*  
331           *concerned when there was heavy deluge around, lasting for a day, you would certainly*  
332           *get concerned. You feel a bit more protected [now].”* (FG2).

333   Interestingly it seems that the influence of the flood relief works may be linked to the concept  
334   of observational learning whereby individuals perceive the works as being highly effective  
335   based on their observations of them working well in other locations:

336           *“It will make a huge difference; you see it in other parts of country. They have done*  
337           *reviews, down in Cork [county located in south-west Ireland], where they have built*  
338           *them, and there haven't been any floods since... I am not expecting it. I am expecting*  
339           *that it won't happen again. Because they are working on it.”* (FG5)

340   Another participant explicitly stated how her concerns over the likelihood of future flooding  
341   events have virtually disappeared since there was an announcement that the flood relief works  
342   were going ahead (not to mention when they are actually built to completion):

343            *“I have no worries at all now, once we were reassured that they were going to go ahead*  
344            *with the flood protection...I got reassurance from that... so now I wouldn't be at all*  
345            *worried.”* (FG5, emphasis added)

346 These findings highlight the influence that engineered flood defences can have in terms of how  
347 people perceive and ultimately respond to a threat. While one participant clearly articulated  
348 that the works *“are highly likely to reduce the risk of flooding”* (FG1), others had an  
349 overarching faith in terms of the ability of the flood relief works to virtually eliminate the risk  
350 of flooding entirely. Indeed, many considered that this risk had been eliminated at a time before  
351 the flood relief works have even reached completion. Such findings highlight the prevalence  
352 of the ‘levee effect’, but also demonstrate that this phenomenon can take effect before the  
353 engineered flood defences are built in accordance with their design specification.

#### 354 **4.0 Discussion**

##### 355 4.1 Pathways to flood-risk preparedness

356 This paper sought to unearth the core factors negatively influencing flood-risk preparedness in  
357 a bid to identify how a shift towards greater levels of mitigation behaviour can be harnessed.  
358 In doing so, we relate our findings to PMT to make sense of our results and think about how a  
359 shift from non-protective to protective actions can be best realised (see Figure 4). To this end  
360 our study reveals a number of interesting findings which in some places lend support to existing  
361 empirical enquiries, e.g. our findings generally align with the direction of influence reflected  
362 in Figure 2 of Grothmann and Rueswig (2006:105), but also offers new and fresh insights in  
363 others.

364 Specifically, the results demonstrate that a high perception of risk is in itself insufficient to  
365 motivate people to prepare for a prospective flooding event thus corroborating with the findings  
366 of other scholars ( Miceli et al. 2008; Bubeck et al. 2012; Scolobig et al.2012; Poussin et al.

367 2014). Indeed, the findings reveal a generally high perception of risk amongst our participants  
368 based on their past experiences with a significant flooding event (i.e. Hurricane Charlie), but  
369 also their intimate understanding of the natural processes at play within the river catchment  
370 signalling times that they are in danger. Despite this knowledge however, it is clear that there  
371 remains an unwillingness and reluctance to engage in mitigation behaviour. Specifically, it is  
372 clear that participants tend to favour non-protective responses despite an acute awareness that  
373 they are at substantial risk of flooding and the scale of damages that would arise from such an  
374 event.

375 In seeking to explain this disjoint between awareness and action, it is clear from our results that  
376 the concept of coping appraisal is crucially important. In particular, the findings elucidate that  
377 our participants are unwilling to take protective action based on their perceived inability to  
378 cope when confronted with a flooding event. The low level of faith amongst the participants in  
379 terms of the preparedness measures available is particularly noteworthy and appears strongly  
380 rooted in peoples' past experiences of Hurricane Charlie where extensive material damages  
381 were caused. In this regard, the foregoing demonstrates the 'prison of experience' phenomenon  
382 (Kates, 1962) in action, whereby individuals correlate the expected frequency and  
383 consequences of future floods with their past experiences (see Hopkins and Warburton, 2014).

384 As such, flood-risk communication strategies disseminated within communities with robust  
385 flood histories should be tailored to communicate the fact that future events may not replicate  
386 those of the past. In doing so, there needs to be considerable emphasis on the point that various  
387 mitigation measures can prove highly effective in the case of lower magnitude events.  
388 Moreover, our results suggest that the tendency for those who do take some form of action tend  
389 to prioritise their personal safety rather than making any significant attempt to protect their  
390 property may reflect the flood-risk characteristics at play in the case study area (i.e. flash  
391 flooding river catchment). In this regard, the results suggest that flood-risk communication

392 strategies need to be designed with respect to the flood characteristics of the area in question.  
393 Within the context of a flash flooding river catchment, it is apparent that individuals would  
394 benefit greatly from information about the types of preparedness measures that can be  
395 realistically implemented in situations where there is a small lead in time thus reflecting the  
396 particular circumstances (e.g. flood depths) at play in their locality.

397 Alongside any effort geared towards strengthening levels of response efficacy amongst  
398 individuals at risk, this study demonstrated that self-efficacy is paramount if the take up of  
399 preparedness measures is to succeed. In particular, our study lends support to others who have  
400 highlighted the need for detailed guidance to be provided to at risk communities, not only in  
401 terms of the preparedness measures available, but also through the provision of detailed  
402 information about how they are actually implemented in practice (Bubeck et al., 2013: 1327)

403 Throughout our data, the financial costs (i.e. response costs) associated with implementing  
404 flood-risk preparedness measures did not emerge as a significant concern. However, the  
405 inability for particularly vulnerable groups to implement mitigation actions was raised as an  
406 issue by a number of participants. In this regard, our study suggests that funds which may be  
407 ring-fenced to provide financial assistance to roll out the provision of mitigation measures (e.g.  
408 flood gates) could be redirected towards providing direct assistance to people to help them  
409 implement measures which they feel they cannot do by themselves. Moreover, our findings  
410 suggest that financial incentives to stimulate the adoption of mitigation measures would be  
411 better spent strengthening levels of response and self-efficacy of households via tailored and  
412 targeted communication campaigns. This could take the form of individual household  
413 assessments to inform individuals of the specific measures available to them, and providing  
414 assistance with their implementation when required - similar to the RainReady program  
415 operated by the Center for Neighborhood Technology (CNT) in Chicago.

416 In addition to the need to bolster coping appraisals to stimulate a shift from non-protective to  
417 protective actions within our case study area, the results also signal the need to increase  
418 individuals' appraisal of flood-risk in light of the current flood relief works. In particular, it is  
419 clear that the flood relief scheme which is partially constructed in Bray is negatively  
420 influencing individual's perception of the probability of a flooding event taking place in the  
421 future now that the relief scheme is underway. Any reduction in an individual's risk perception  
422 will undoubtedly influence the take-up of preparedness measures in a negative way. Although  
423 we acknowledge that our focus group participants were generally underprepared before the  
424 works ever commenced, the findings suggest that the few who do currently seek prepare to  
425 protect themselves and their families against prospective floods (most notably through  
426 evacuation planning) will become more vulnerable as they begin to consider themselves fully  
427 protected as the flood relief scheme reaches completion.

428 While various authors have argued that flood-risk communication strategies need to more  
429 specific in explaining that "*no structural protection measure is infallible*" (Scolobig et al.,  
430 2012: 515) this study goes further by demonstrating that communication of residual risk should  
431 not only take place once engineered defences are put in place, rather there is a need for such  
432 communication to take place at various stages throughout the entire programme of works. This  
433 is admittedly not going to be easy as such an admission would undoubtedly create problems  
434 for those responsible for delivering structural components of flood-risk management  
435 programmes, particularly in terms of generating stakeholder 'buy in' during the design and  
436 consultation stages, which can often be hotly contested.

437 **Figure 4: Application of results to the PMT Framework**



**SOURCE OF INFORMATION**

**COGNITIVE MEDIATING PROCESS**

**COPING RESPONSE**

**Verbal persuasion**  
N/A

**Observational learning**  
Faith in flood relief works rooted in observation of their success elsewhere

**Personality variables:**  
For some, age, health and living status can impact negatively on their perceived ability to cope.

**Prior experience:** The experience of Hurricane Charlie impacts negatively on an individual's belief in the effectiveness of flood protection measures, and their sense of self-efficacy in responding to flood risk.

**THREAT APPRAISAL**

**Perceived probability:** High threat appraisal based on experiences, but the modifying effect of structural flood defences means that participants believe that current and future risk of flooding is reduced because of protection offered by the flood defences.

**Perceived consequence:** Awareness shown of the consequences of flooding based on experiences of, and stories about Hurricane Charlie.

**COPING APPRAISAL**

**Perceived self-efficacy:** Low self-efficacy reflected through feelings of helplessness, and variables such as age and health.

**Perceived response efficacy:** Low sense of belief in the effectiveness of flood protection measures based on previous experiences

**Perceived response costs:** Little emphasis on the costs (financial, time, effort) as a barrier to protective action

**PROTECTIVE RESPONSE**

Amongst the small numbers who adopt protective actions, measures geared towards 'self-protection' (i.e. evacuation) over property protection. Rooted in lack of response efficacy & self-efficacy.

**NON-PROTECTIVE RESPONSE**

Results reflect the prevalence of non-protective responses. The potential for protection motivation is reduced by a low sense of coping appraisal informed by prior experiences of a major flooding event in 1986.

While participants are aware of the threat of flooding, faith in the effectiveness of the flood relief schemes appears to be lowering their threat appraisals.

Interventions are required at "Source of Information" to re-align the cognitive mediating processes that motivate protective actions to be taken.

440 The authors acknowledge the small sample size of participants. Ideally, focus groups should  
441 comprise between four and twelve participants (Kitzinger, 1995; Carlsen and Glenton, 2011).  
442 While every effort was made to help ensure ease of participation (i.e. the provision of sufficient  
443 information on the research objectives and participation, the provision of compensation for  
444 participation, and the time and location of the focus groups), a number of planned focus groups  
445 did not yield the required numbers. In one instance, the focus group was instead categorised as  
446 a semi-structured interview. This demonstrates the difficulty in terms of terms of engaging  
447 people in research in relation to hazard events such as flooding, specifically those who do not  
448 have any prior flood experience. The difficulties encountered in this regard may reflect the fact  
449 that various other channels of communication have been available to residents within the case  
450 study area over the past number of years as part of the overall programme of works running in  
451 parallel with the flood relief scheme (e.g. public consultation, access to liaison officers/  
452 engineers etc.). The various outlets available amongst those within the flood zone to voice their  
453 concerns may have reduced the appeal of the focus groups sessions. Indeed, the low levels of  
454 turnout may reflect a case of 'stakeholder burnout' (Fainstein, 2000) whereby those typically  
455 interested and engaged in flooding issues no longer wish to engage in any further discussion  
456 surrounding the topic.

457 Secondly, the authors acknowledge that the composition and outcomes of this exploratory,  
458 small-scale study may not necessarily mirror the views and experiences of the overall  
459 population. Given the significance of flood experience, particularly from 1986, it is possible to  
460 suggest that those affected directly or indirectly by flooding were more likely to participate in  
461 the research. Although this argument may explain the absence of participants from Focus  
462 Group 4, the significance of experience in explaining interest in the research may introduce an  
463 element of bias into the results. Recruitment drives in any future research activity needs to be

464 cognisant of the need to target those who may not have direct or indirect experiences of  
465 flooding

### 466 4.3 Conclusion

467 Overall, this paper demonstrates that there is a pressing need for a shift away from an  
468 information deficit model to redress the disjoint between the changing direction of flood-risk  
469 management policy and the lack of individual preparedness often observed in practice. This  
470 study offers fresh insights in this regard by offering detailed qualitative data to explore how  
471 pathways to enhanced flood-risk preparedness can be opened up. In doing so, it presents a  
472 number of interesting findings which have not been elucidated by existing enquiries which  
473 have a predominantly quantitative focus. In particular our research reveals that engineered  
474 flood defences can have a substantial influence on flood-risk perception during the construction  
475 phase thus highlighting that the levee effect can take hold before a relief scheme is fully  
476 implemented. In this regard, this paper adds to the socio-hydrology literature by offering a  
477 greater understanding of the social processes leading to misperception of risk in response to  
478 hydrological changes that are arising from construction works; thereby capturing some of the  
479 “feedbacks between physical and social processes” as discussed by Di Baldassarre et al. (2015:  
480 4770). Moreover, the paper demonstrates the inherent value of coping appraisal as a cognitive  
481 process, which can be targeted to help ensure that individuals with high perceptions of risk are  
482 prompted to take action to reduce their exposure to the risk of flooding. Bubeck et al.  
483 (2013:1327) previously noted that “empirical literature on coping appraisals is still scarce”.  
484 This paper contributes to addressing that gap and our qualitative findings support the contention  
485 that coping appraisal as a variable accounting for flood-risk protection is one which is worthy  
486 of more investigation.

487

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