2nd ERA-NET CRUE Research Funding Initiative
Flood resilient communities – managing the consequences of flooding
Interim Report

Understanding Uncertainty and Risk in Communicating about floods - URflood

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1. Introduction

This research builds on developments in Europe and the USA in the understanding of social and institutional responses to flooding. Rather than assuming an information deficit model (Irwin,1995), i.e. that providing more or better information will ensure more "rational" responses to flood events or flood risk; the project considers what different audiences for flood communications already know; how they understand and use these flood communications and whether there are erroneous assumptions being made that negatively affect the choices being made by those responding to a flood event or living with flood risk. Improving individual and collective capacity to respond to flood risk communications and flood warnings in this way will directly contribute to improved community resilience. Echoing the wider risk communication literature, research on flooding has identified a large number of variables that influence flood warning response either by inhibiting or enabling action by individuals in flood prone locations (Parker et al, 2007). Understanding responses to flood communication requires both understanding the situational factors (physical characteristics, location) of the risk and social, cultural and cognitive attributes (personal and psychological) of individuals for whom the communication is intended (Tobin and Montz, 1997, Werrity et al, 2007). Making improvements to any single factor, such as the channel of communication, is unlikely to achieve significant changes in response (Twigger-Ross et al, 2008; Miceli et al, 2007).

This project seeks to outline how communities in flood prone areas make sense of the information in order to better tailor flood communications. Thinking in terms of knowledge systems helps to make sense of how these different elements work to generate responses. Knowledge systems view information as a resource that flows around a network of different actors, is converted to knowledge and may influence practices (Roling and Engels, 1990). It challenges the information deficit model by suggesting that it is important to understand how the knowledge is used in decision making. In essence, the starting point of improving communications needs to be based on how to work with people to achieve the intended behavioural response, rather than starting with the content of the communication itself.

Research shows that it is important in flooding to understand the heterogeneity of "the public" (e.g. Thrush et al, 2005) as different characteristics of people affect how they make sense of flood information (Kenyon, 2007). Most of the research on communication and responses to flooding has focused on individual members of the public. As it would be foolish to assume that the "public" are homogenous it would also be naïve to consider "professional partners" as a single group. The few studies on organisational responses, (e.g. McCarthy 2007, Morss et al 2005) suggest that a range of responses can be found, from an "expert" understanding of uncertainty to responses that are much closer to a "lay" perspective. This project explores perspectives and knowledge systems of both flood prone communities and the emergency responders, to understand if there are important differences in their perceptions and if these differences have implications for improving resilience to flood events (as recommended by Miceli at al, 2007). The use of trans-national expertise and experience is central to this project.

The project contributes to the first theme of the current call (improving risk awareness and increasing public participation), and seeks to answer the following three questions relating to the communication of residual risk and uncertainties:

(1) How can public participation in flood risk management be increased through better risk communication and greater risk awareness?
(2) What are the effects of improved risk communication on peoples' behaviour in flood prone areas?

(3) People living in the vicinity of protective structures tend to feel safe. What are the effects of this protection on risk perception and how can residual risk be communicated?

There is little published literature on how people make sense of so-called "residual risks" associated with structures such as dams and dykes. Given the potentially devastating consequences of a dam or flood defence breach, some of our case studies have been selected to explore this residual risk. Furthermore, little research has been done into how information about the likelihood of flooding could be incorporated into flood warnings and what the impact of that information might be on response. Case studies will provide information on how different kinds of uncertainty and risk affect perceptions of and responses to flood communications. Improving relationships and mutual understanding between the emergency responders and the impacted communities will improve resilience to flood events as well as flood communications themselves. The research is intended to support the move towards Flood Risk Assessment and Management (FRAM), a requirement in the EU Floods Directive and to assist with improving resilience to the social, economic and environmental consequences of flood risk.

The main aims of this project are to:

- Improve flood risk planning and responses to flood warnings
- Investigate and illustrate how flood risk communications are incorporated into the knowledge systems of different 'actors'
- Put the communication of uncertainty and risk in the broader context of social, cultural and individual behaviour
- Evaluate current practice to establish potential improvements
- Produce guidance for use throughout the EU in implementing good practice flood communications

The project also aims to contribute to the four overarching questions within CRUE ERA-NET, including:

- Connection to Floods Directive
- Participation
- Harmonisation
- Restrictions

2. Methods

The project is structured in a series of linked work packages as shown in Figure 1. WP1 and WP7 are cross cutting, overarching and link WPs 2 to 6 by ensuring ongoing knowledge exchange using reports from each stage, so that the final report and guidance is based on information that has been reviewed in light of stakeholders' views and the findings of the subsequent WPs. The Macaulay Institute is leader of WP 1, 2, 3, 4 and 7. University College Dublin (UCD) is leader of WP 5, while the Finnish Environment Agency (SYKE) is leader of WP 6. The WP leaders are responsible for the operational management of the work in their WP. Within each WP, the WP leader is responsible for all tasks identified in the WP. Each WP leader has the responsibility for the content and quality of the work and timely delivery of materials.

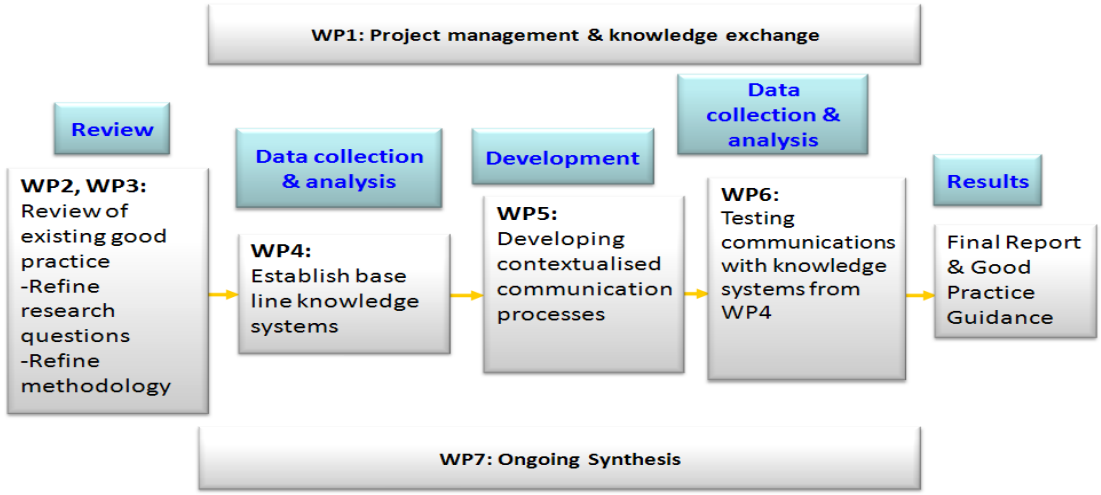

Figure 1 Work Package linkages

2.1 WP 1 – Project Management and Knowledge Exchange

WP 1 aims to achieve an organised and effective research programme that makes best use of limited resources, and through ongoing knowledge exchange and stakeholder involvement, ensure the outputs are utilised in the future. This is ongoing throughout the entirety of the project. Project management and communication between the partners is through a mixture of e-mails, tele-conferences and face to face meetings as facilitated by the wider ERA-NET network. Each partner is responsible for communication of progress of the project with their own national advisory group. Due to the geographical separation of project partners, there have been only two face to face meetings involving all project partners. These include ERA-NET meetings in Rome (20th-21st October 2009) and Madrid (19th-20th October 2010). The first tele-conference took place on the 28th July 2010 and involved all project partners. Two further tele-conferences took place at intervals of six to eight weeks (22nd September 2010, 2nd November 2010). From this point, tele-conferences have been organised monthly using a Doodlepoll to ensure participation from all partners. There is also the option to use Skype if needed to discuss common documents. There is constant communication between partners through emails and phone calls.

2.2 WP 2 & 3 – Understanding the Role of Uncertainty in Flood Risk Communication

WP 2 and WP 3 were required to better understand the role of uncertainty in flood risk communication. This includes identifying the dimensions of uncertainty in flood risk and hazard predictions; what knowledge gaps exist and their implications for communications. A review of published international literature was carried out. The work was divided into different topics to avoid overlap and repetition of work between project partners.

The UCD project team reviewed the following topics:

- Uncertainty in the biophysical processes generating or mitigating flood events
- The features of methods and systems used to communicate flood risk and flood warnings to communities at risk, both across Europe and internationally
- Best practice guidelines on delivering flood-related information to both the general public and stakeholders involved in the flood management process
- Current international practice of flood and other hazard warnings
- Current barriers to effective communication and the constraints involved.
- The influence of characteristics (local hazard) on communication methods

The Macaulay Institute reviewed the following topics:

- Uncertainties in flood hazard mapping and flood warning
- Uncertainty in measuring the socio-economic consequences of flooding
- Types of uncertainty and residual risk

Centro Interuniversitario di Ricerca in Psicologia Ambientale (CIRPA) reviewed the remaining topics:

- Research on good practice in communicating uncertainty
- The influence of characteristics (population at risk) on communication methods.

During the kick-off meeting in October 2009, the partners developed a conceptual map of the relationship between the senders and receivers of flood warnings and the opportunities for understanding or misinterpreting the contents of the message sent and received. This is illustrated in Figure 2.

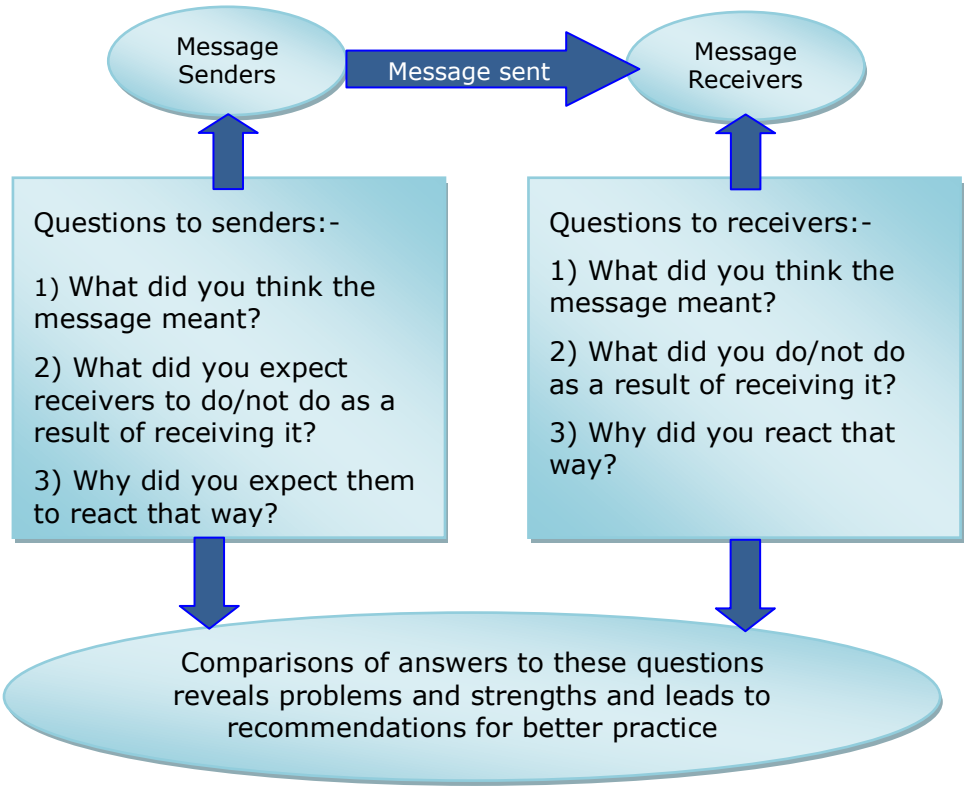

Figure 2 Conceptual map of relationships between senders and receivers

Roles and responsibilities for issuing flood warnings were also discussed at this time. There proved to be complex relationships between levels of authority which varied considerably for each country. It was decided that each country would produce a flow chart of the organisation structures and relationships between same in the context of flood management. By understanding the roles and responsibilities of relevant organisations in flood management, it is hoped that pathways to improved coordination between these organisations could be identified.

2.3 WP 4 – Investigating Knowledge Systems in Selected Flood Prone Areas

This WP is required in order to clarify roles of flood risk, awareness, preparedness and warning and their position in an overall communications strategy; to understand barriers and blockages in communication channels; to understand how existing flood communications are interpreted and whether they are provoking the intended responses; and to improve flood communication processes. This WP will identify factors that stakeholders take into account in interpreting and using flood risk and flood warning information; identify the facilitators and barriers to effective responses; and identify any dangerous mismatches in knowledge systems between stakeholders.

WP 4 is a significant part of the overall project and consists of case study research in four partner countries: Scotland, Ireland, Finland and Italy. To ensure consistency across all case studies, a common methodology was adopted. Case study work involves questionnaire surveys that focus on key themes including people's current awareness of flood risk, their awareness of flood related communications and availability of information, the role of uncertainty in these communications, responses to flood warnings and how these responses could be improved. The questionnaire adhered to the key principles of questionnaire design and, as such, the majority of questions were short and simple and of a pre-coded and prompted nature. Precise and unambiguous questions were formulated to minimise misunderstanding. Both open-ended and closed questions were included in the questionnaire. Closed questions were designed with a meaningful scale that was selected to provide a good spread of answers. Where appropriate, scales comprised equal intervals between equivalent end points (e.g. disagree strongly, disagree slightly, neither agree nor disagree, agree slightly, agree strongly). All questionnaires contained core questions that were required for meeting the project objectives. Flexibility was also given to address additional questions specific to structures and issues in each partner country. A common database will be made for all common questions in order to analyse data from the four countries as a whole. The data from each partner country can also be analysed separately. Examples of common questions are shown in Table 1 and questionnaires can be downloaded from: http://www.macaulay.ac.uk/urflood/case_studies.php

Table 1 Common questions across case studies

Do you think you currently live in a flood risk area?
Have you been affected by flooding in your current residence?
How many times have floods occurred in your current residence?
What do you think caused these floods?
Did you receive any warning before the last flood?
What actions did you take to prepare for the last flood?
What actions might you do to prepare for a future flood?
What is your current level of preparedness?
What is the level of trust in various authorities?
How reliable do you find various authorities?
What are the sources of information on flood warnings/actions to take?
How would you rate the amount of information that is available on flood warnings/actions to take?
Do you think agencies are accessible/listen to the public?
Do the public think they understand flood terminology (100 year flood etc.)?

Do they actually understand this terminology?
I understand talk about probabilities/risk assessment?
It would be good to have more information about uncertainty in warnings?
We get enough information?
Messages from authorities use too much technical jargon?
Have you visited the national website on flooding?
If so, how helpful was this information?
Have you visited the national flood maps website?
If so, how helpful was this information?
Similar demographics asked between countries

Twelve case study areas were chosen for study across four countries as shown in Figure 3 and in Table 2.

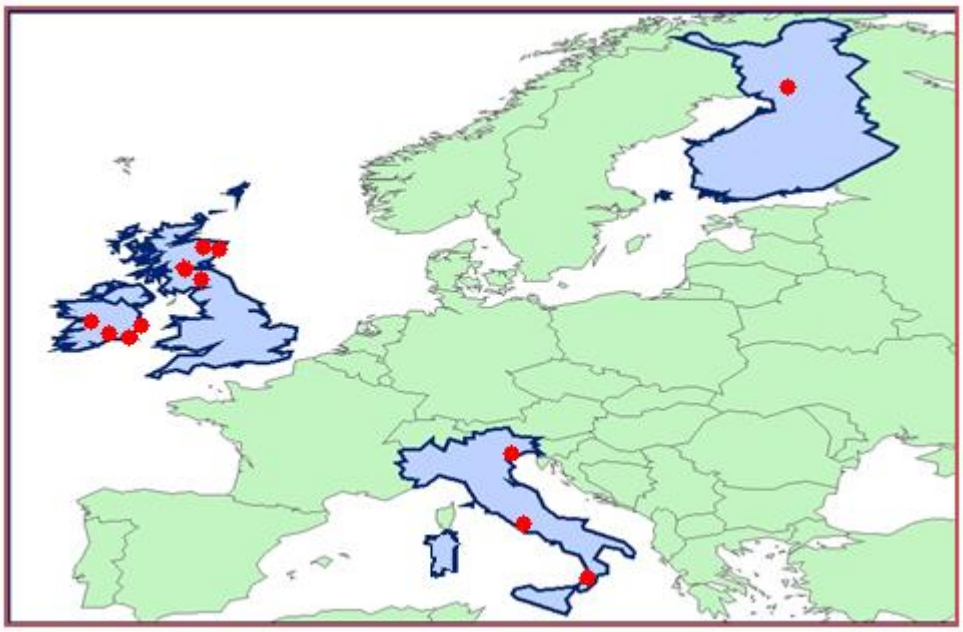

Figure 3 Case study locations

Table 2 Case study areas

Country	Site	Type of Flooding
Scotland	Huntly	Fluvial
	Glasgow	Fluvial; residual risk
	Moffat	Fluvial
	Newburgh	Coastal
Ireland	Ballinasloe	Fluvial
	Wexford Town	Coastal
	Clonmel	Fluvial; residual risk
	Dublin	Pluvial, fluvial and coastal; residual risk
Italy	Rome	Fluvial, pluvial
	Vibo Valentia	Coastal, pluvial
	Marano, Grado	Coastal
Finland	Rovaniemi	Fluvial

2.3.1 Scottish case study areas

Four case study areas were chosen in Scotland: Huntly, Glasgow, Moffat and Newburgh.

2.3.1.1 Huntly

The town of Huntly is situated approximately 65 kilometres north-west of Aberdeen. Several watercourses converge in or near to the town, compounding the potential risk of flooding. The River Deveron flows west to east, effectively forming the northern boundary of the town. The Ittingstone Burn joins the Deveron the west of the town, and the River Bogie joins the Deveron about 1km downstream of Huntly Castle. Between the town centre and the Deveron there is a flat low-lying area called "The Meadows", through which the Meadow Burn runs approximately parallel to the Deveron. In recent decades, this floodplain area has been developed for both housing and leisure purposes (Meadows Housing development, care home and Caravan Park). Huntly has experienced several significant flood events within living memory, and damage has been caused to many residential and commercial properties, with The Meadows area being particularly severely affected. The Meadows was flooded in September 1995, April 2000, October and November 2002, and most recently September and November 2009. After the 1995 event, a flood protection embankment was built on the south bank of the Deveron which affords protection against direct inundation from the Deveron; however the flooding mechanism in the area is complex, with overland flow from the Deveron upstream and the Ittingstone Burn also posing a significant risk to the Meadows.

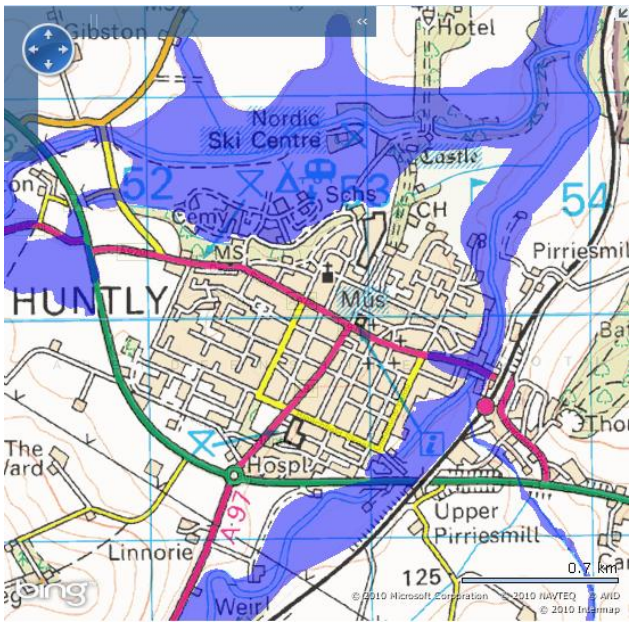

Figure 4 Flood vulnerable areas, Huntly

Figure 4 shows a flood vulnerable area to the north of the town (last flooded in 2009) and the area to the east of the town adjacent to the railway line as vulnerable to flooding but no flooding history.

The area was selected as it is prone to fluvial flooding and has a record of recent flooding events. Also within one community there are areas of the town both at risk and previously flooded as well as areas at risk that have not been flooded.

2.3.1.2 Glasgow/Whitecart

For nearly a century the White Cart Water has been the source of serious flooding to homes and other properties on the south side of Glasgow. This shallow, fast flowing river is prone to flash flooding and just 12 hours of rain can raise water levels by 6 metres. More than 20 significant floods have taken place since 1908, and in 1984 over 500 homes were inundated.

Existing flood defences along the White Cart Water corridor are piecemeal and isolated. Major investment is required to protect properties not only from current flood risks but also from more frequent inundations expected as a result of global climate change. The threat of repeated flooding also presents major insurance difficulties for householders, businesses and the local economy. At the end of 2002 the insurance industry withdrew its guarantee of affordable flood insurance in high-risk areas. The industry confirmed it would have to consider charging higher insurance premiums or even refusing flood cover altogether. This could result in property values being greatly reduced. Hydro-Brake® Flow Control devices have been installed as part of the White Cart Water Flood Prevention Scheme. During peak storms, the Hydro-Brake® Flow Controls will hold back the White Cart Water and its tributaries the Earn Water and Kittoch Water causing the storage areas to fill. Water will be released downstream at a controlled rate so that it does not overspill new flood defences being constructed in the City. Upstream, a total of 90,000 sq metres of rich and diverse wetland habitats will be created. Downstream, the flow of water will be reduced by up to 45% during peak storms, achieving flood protection to a 1 in 200 year standard or a 0.5% probability of a flood occurring in any one year, when combined with the new flood defences. The area was selected as a study site because of its past history of fluvial flooding and more recently the completion of extensive flood alleviation and flood defence works and the existence of residual risk. Figure 5 shows the study area and the risk of fluvial flooding (as developed by the Scottish Environmental Protection Agency (SEPA)) in the absence of any flood alleviation works.

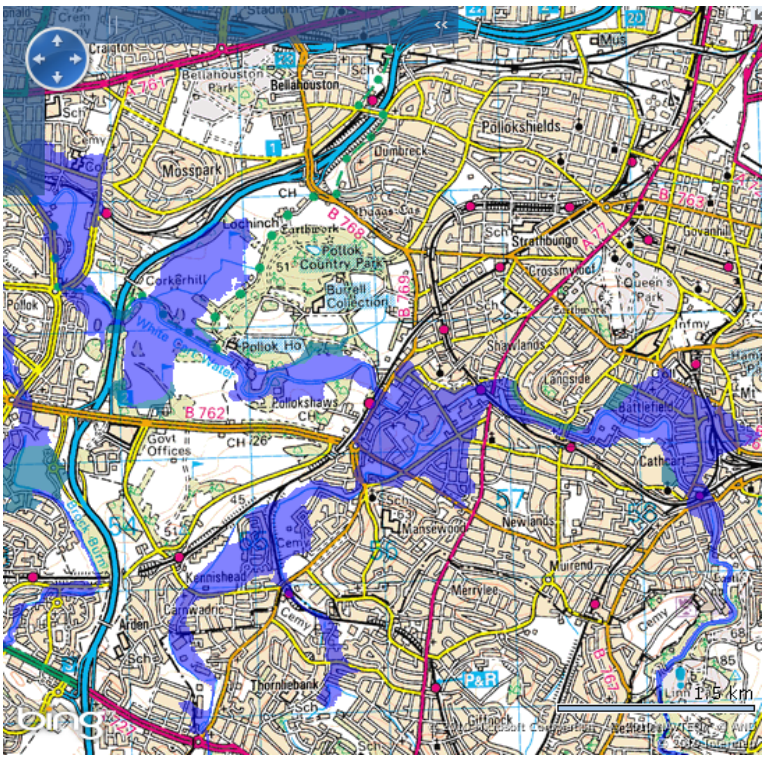

Figure 5 Flood vulnerable areas, Glasgow

2.3.1.3 Moffat

Moffat is a small rural town in South-West Scotland, approximately 60 km south of Glasgow and 20km North of Dumfries. The town has a history of both fluvial and pluvial flooding. The source of flooding is from the main watercourses of Annan River, Birnock Water and Crosslaw Burn. As these flow through urbanised areas there are a number of culverts under capacity and development pressures. Flooding of residential properties is the major concern. The study was selected as the Scottish Flood Forum offered to undertake the work as part of an ongoing programme of engagement with the community affected by the recent flooding. Figure 6 shows the study area and the risk of fluvial flooding (as developed by SEPA).

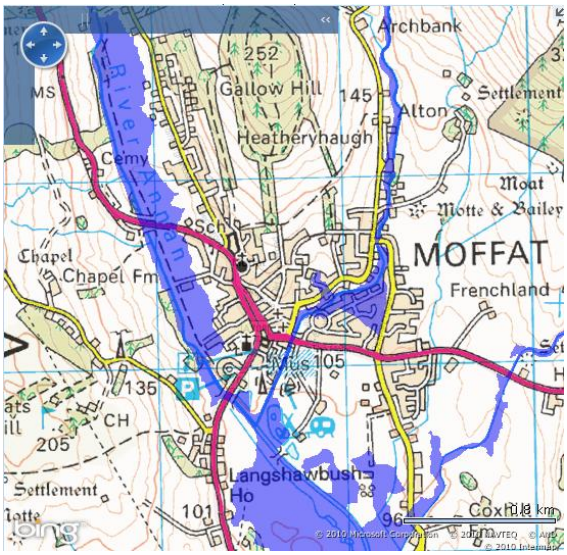

Figure 6 Flood vulnerable areas, Moffat

2.3.1.4 Newburgh

Newburgh is a small rural community in North-East Scotland, approximately 20km north of Aberdeen. The village is at the mouth of the Ythan River and estuary. It has been identified by SEPA as vulnerable to both coastal and fluvial flooding. The main risk is to residential properties. There is no known history of flooding; although recent research by Dundee University suggests that the combined effect of climate change and rising sea levels in this part of the Scottish coastline will increase the risk of flooding in the future. Figure 7 shows the indicative combined fluvial and coastal and fluvial flood risk for Newburgh as developed by SEPA.

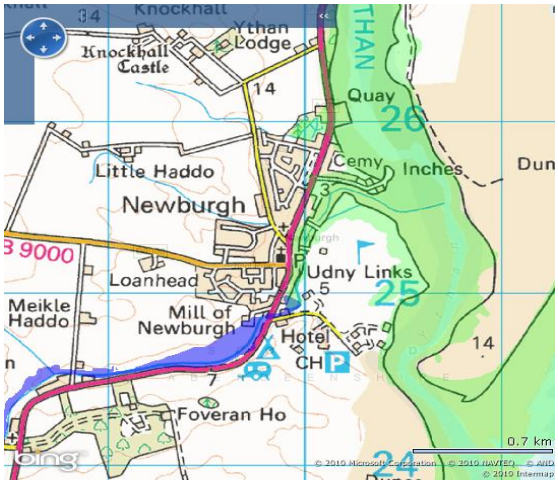

Figure 7 Flood vulnerable areas, Newburgh

2.3.2 Irish case study areas

After discussion with the Irish national funder, the Office of Public Works, four case studies were agreed in Ireland: Ballinasloe, Co. Galway; Wexford Town, Co. Wexford; Clonmel, Co. Tipperary and areas within the flood contour of the River Dodder in Dublin. Sites were chosen to include the primary risks from fluvial, pluvial and coastal flooding episodes. Residual risk was also assessed. Residents and small business owners within the 100 year flood envelope were chosen for fluvial risks, while the 200 year flood envelope was used for coastal risks as agreed with the national funder. In areas where the 100 or 200 year flood envelopes were not available, a previous flood extent envelope was used.

2.3.2.1 Ballinasloe, Co. Galway

Ballinasloe, Co. Galway is situated along the banks of the River Suck in the west of Ireland. The River Suck is approximately 125 km in length, has a catchment area of 1,590 km^2 and is a tributary of the River Shannon, the longest river in Ireland. Ballinasloe is the largest town in County Galway, after Galway City, with a population of over 6,000 (2006 Census). Ballinasloe was chosen for study as this is an area of "new risk". It was severely flooded from the River Suck in November 2009 (Figure 8); with little history of flooding before this.

Figure 8 Flooding in Ballinasloe, November 2009

353 residents and small business owners in Ballinasloe were targeted using the 2009 flood extent envelope, overlain with a database of addresses, represented on an Arc-GIS platform (Figure 9). Questionnaires were posted along with a cover letter from the Office of Public Works and a "freepost" self-addressed return envelope in August 2010, following a notice in the local newspaper a week prior. Reminder letters were sent to those who had not responded after approximately two weeks in order to boost return rates.

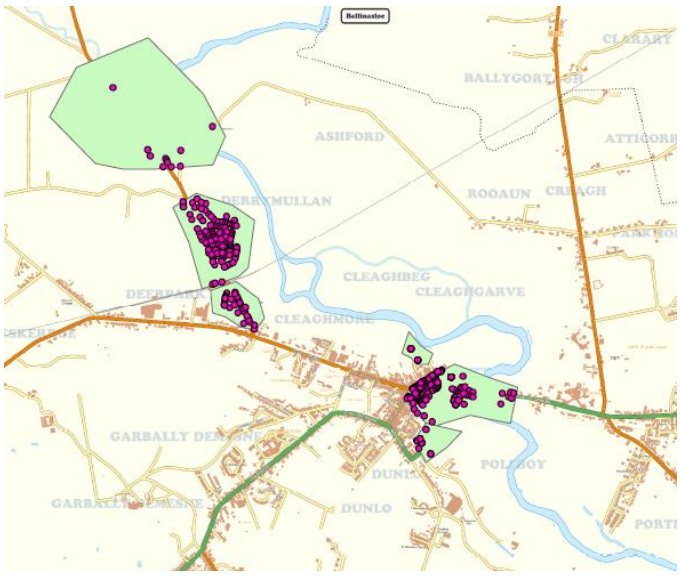

Figure 9 Targeted respondents, Ballinasloe

2.3.2.2 Wexford Town, Co. Wexford

The town of Wexford is situated in County Wexford, near the south-eastern tip of Ireland. Wexford Harbour is at the mouth of the River Slaney. The population of Wexford Borough is 8,854 (2006 Census). Wexford Town was chosen as a coastal flooding area, with the most recent flooding being October 2004. Serious coastal flooding occurred at this time, caused by high tides and strong south-easterly winds; rainfall had an insignificant role in the flooding (Figure 10). Sea walls and pumping stations provide some protection to low-lying lands south of Wexford Bridge. North of Wexford Bridge, the Irish Rail embankment provides some flood protection. An Early Warning System is in operation in the King Street Area. This involves issuing residents with tidal information and flow-bars.

Figure 10 Coastal floods in Wexford, October 2004

494 residents and small business owners in Wexford were targeted using the 1 in 200 year flood extent envelope, overlain with a database of addresses, represented on an Arc-GIS platform (Figure 11). Questionnaires were posted in September 2010, following a notice in the local newspaper a week prior. Reminder letters were sent to those who had not responded after approximately two weeks.

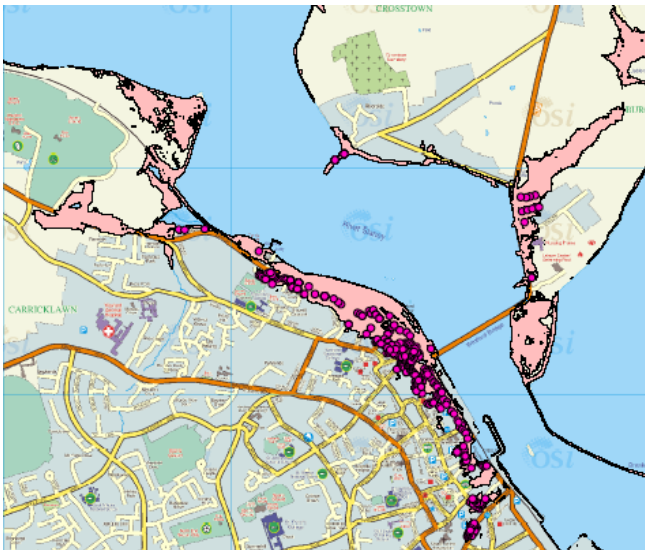

Figure 11 Targeted respondents, Wexford

2.3.2.3 Clonmel, Co. Tipperary

The town of Clonmel lies mainly on the north bank of the River Suir and is situated in a valley. At times of extreme weather conditions the River Suir overflows its banks onto the floodplain. The result is flooding of thousands of acres of land in the Suir Valley, including the town of Clonmel (Figure 12). People in this area live with constant risk of flooding. Clonmel has a population of over 16,000 (Census 2006). Clonmel was chosen as it has a long history of fluvial flooding from the River Suir and a new residual risk due to new demountable barriers, scheduled for completion in 2012.

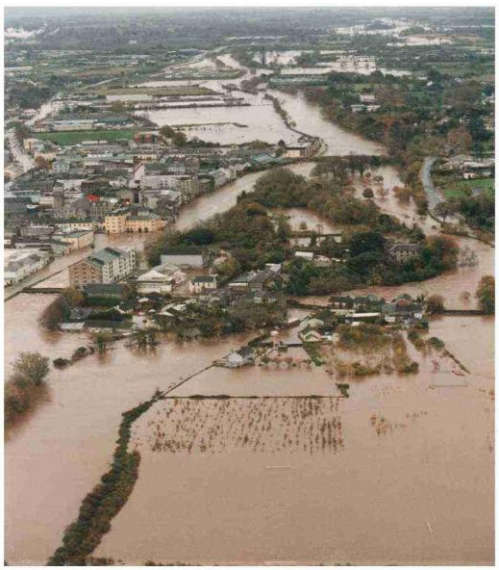

Figure 12 Clonmel in flood

649 residents and small business owners in Clonmel were targeted using the 1 in 100 year flood extent envelope, overlain with a database of addresses, represented on an Arc-GIS platform (Figure 13). Questionnaires were posted in September 2010, following a notice in the local newspaper a week prior. Reminder letters were sent to those who had not responded after approximately two weeks.

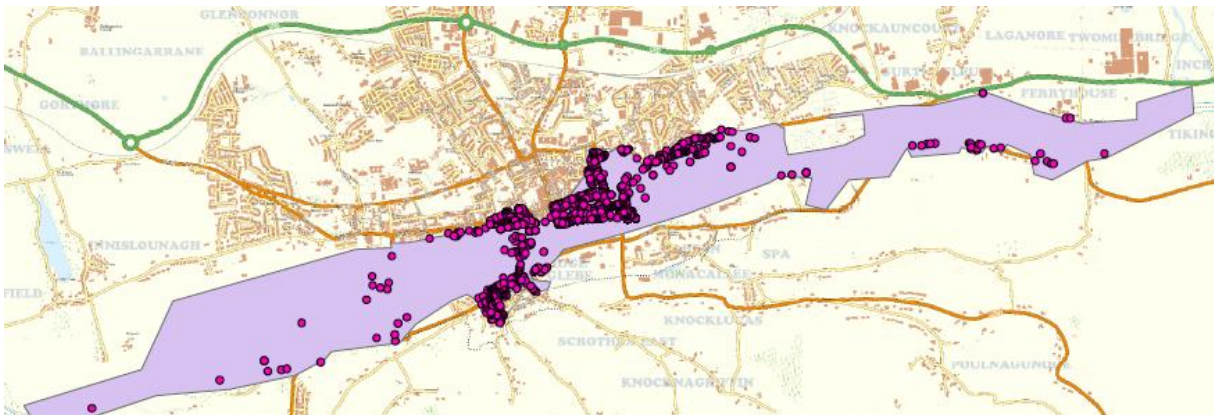

Figure 13 Targeted respondents, Clonmel

2.3.2.4 The River Dodder, Dublin

The River Dodder is one of Dublin's best known and most important rivers. It has a relatively steep and flashy catchment of approximately 125 km^2 and is 27km in length. The river rises in the Dublin Mountains and forms a reservoir system in its upper reaches. This reservoir system is an integral part of the water supply to Dublin. The River Dodder flows down through suburban areas and through the city before discharging into the Liffey Estuary. The lower section of the river is tidal. The River Dodder in Dublin was chosen as it incorporates fluvial floods; pluvial floods, due to the urban nature of the catchment; coastal floods, as the mouth of the river is tidal; and residual risk as there are some flood defences along its course. The River Dodder is well known for its flashy characteristics and quick reaction to rainstorms and has flooded many times in the last century. Tidal flooding occurred on the 1st February 2002 causing major property damage. Severe flooding also occurred on 25th August 1986 with over 300 properties affected. Several tens of millions of pounds of economic losses were suffered. Over 200mm of rain fell in just 24 hours in the upper catchment, as a part of Hurricane Charlie moved north-eastwards over Ireland (Figure 14).

Figure 14 Hurricane Charlie causing damage along the River Dodder in 1986

676 residents and small business owners in Dublin were targeted using a previous flood extent envelope, overlain with a database of addresses, represented on an Arc-GIS platform (Figure 15). Questionnaires were posted in October 2010, following a notice in the local newspaper a week prior. Reminder letters were sent to those who had not responded after approximately two weeks.

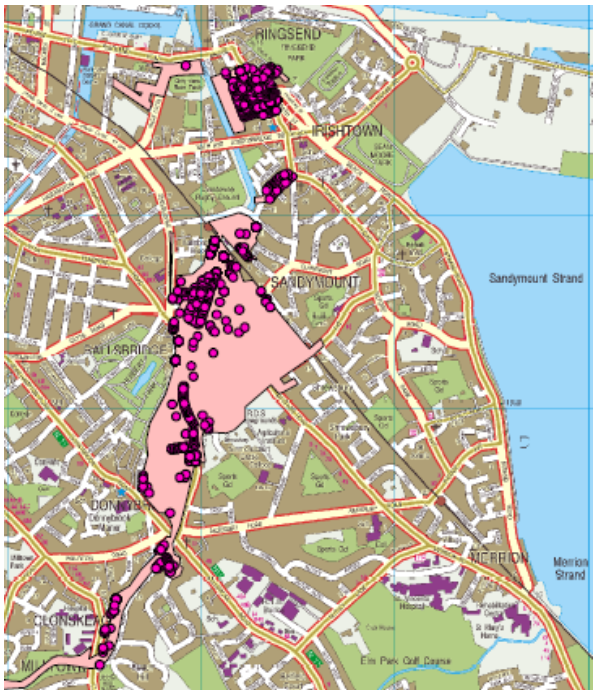

Figure 15 Targeted respondents, Dublin

2.3.3 Finnish case study areas

2.3.3.1 Rovaniemi

Rovaniemi, the principal city of Lapland province, is located on the Arctic Circle in the junction of rivers Kemijoki and Ounasjoki. The River Kemijoki watershed is the largest watershed in Finland (51,127 km²) and consists of two major rivers, Ounasjoki and Kemijoki. The mean discharge of the river downstream is 550 m³/s. The River Kemijoki is regulated for hydropower and flood protection purposes.

Measured by population (59,353), Rovaniemi city is the 15th largest city in Finland. In addition to the official population, there were for example about 5,000 students living in the city in 2008. Rovaniemi is one of the most flood prone areas in Northern Finland and Saarenkylä ("island's village") is among the identified risk areas. There are 1,985 people living in the island and approximately half of the buildings and people would experience a flood occurring every 250 years.

Figure 16 Saarenkylä flooded in 1973, when building and population density was much less than nowadays

The area was last remarkably flooded in 1993. This flood was estimated to occur once in 20 years. Since then some 200 new buildings have been built, representing almost 25 percent of the building stock. Other greater floods have occurred in 1859, 1920 and 1973. Some minor floods cause harm almost yearly. In addition to high discharges, river ice break up jams may cause high water levels in the area.

The central Rovaniemi around the river junction including Saarenkylä was a national pilot in a detailed scale flood mapping in 2003. These maps form the ground for further flood planning, for example the general plan for flood risks, which has also been done in Rovaniemi. Saarenkylä was one of the key areas when national dam safety training was carried out in Rovaniemi-Kemijärvi area in 2006. The city is currently launching a flood protection program.

The city of Rovaniemi had previously gathered addresses of the people living in the area. This contained 1,698 residents over the case study area. A questionnaire was sent by mail with a free of charge return envelope.

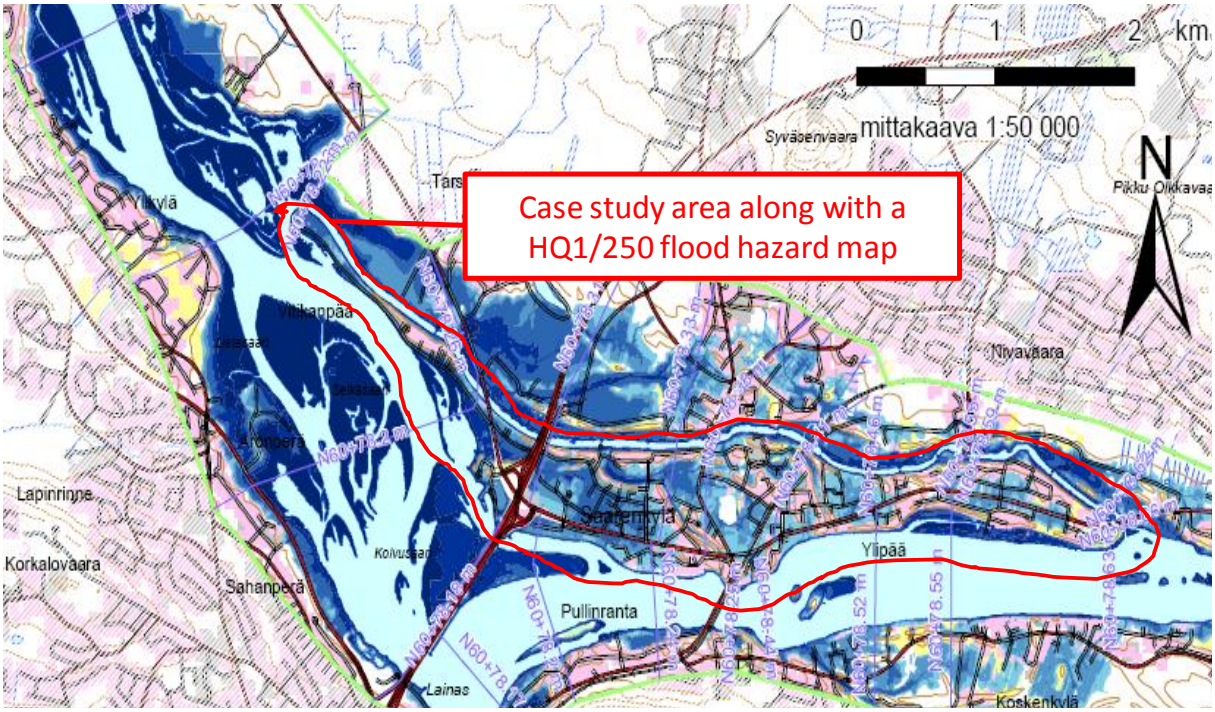

Figure 17 Rovaniemi case study area along with a detailed flood hazard map of HQ 1/250.

2.3.4 Italian case study areas

After discussions with the Italian national organizations which focused on hydro-geological issues, three case studies were agreed in Italy: Rome (Prima Porta urban area), Calabria (Bivona and Vibo Valentia Marina urban areas) and Friuli Venezia Giulia (Marano Lagunare and Grado). Sites were chosen to include the primary risks from fluvial, pluvial and coastal flooding episodes.

2.3.4.1 Rome – Prima Porta urban area

Rome is situated along the banks of the Tiber River, which enters in the North-East part of the city and leaves in the South-West. It is 406 kilometres long, has a catchment area of 17,375 km^2 and is the third-longest river in Italy. Rome is the Capital of Italy, with a total population of around 2,700,000 (ISTAT, 2007). Prima Porta urban area was chosen for study as this is an area with a fast urban development and quick deforestation, with an increase in flood risk a consequence of these factors. This urban area was chosen after several discussions and interviews with important institutional stakeholders such as the Land Defence Regional Association (A.R.Di.S. - Associazione Regionale per la Difesa del Suolo), Civil Protection (Protezione Civile Comune di Roma) and the Regional Functional Centre (C.F.R. - Centro Funzionale Regionale della Regione Lazio). It is divided into a High Risk area (HR, Labaro neighbourhood) and a Low Risk area (LR, Prima Porta and Valle Muricana neighbourhoods), with three tributaries along the area that meet the Tiber River in the High Risk area. The whole Prima Porta urban area was severely flooded from the Tiber River and tributaries in 1965 as well as from other flooding episodes in more recent years (e.g. Figure 18).

Figure 18 Rome in flood, 2008

The main goal of the existing emergency plan "*Commissione di studio per l'elaborazione di un Piano speditivo, finalizzato a ridurre le condizioni di rischio dei soggetti esposti al rischio di allagamento abitanti nel quartiere di Prima Porta – Maggio 2006*" (Study commission for a plan to reduce risk condition of inhabitants of Prima Porta that live in flood risk area), is to create an effective warning system, to inform citizens about risk and create prevention programs about the flood risk in the Prima Porta urban area. In our pilot study, 134 residents, small business owners and workers in the Prima Porta urban area, were targeted randomly in the three specific neighbourhoods (Figure 19) - Labaro (HR), Prima Porta and Valle Muricana (LR) - using a questionnaire given in public places along the street during September and October 2010. The sample is divided into approximately 50% in the High Risk area (Labaro 50%) and 50% in the Low Risk area (Prima Porta 30% and Valle Muricana 20%).

Figure 19 Targeted areas, Rome

2.3.4.2 Calabria – Vibo Valentia Marina and Bivona

Vibo Valentia County is situated in the central-west part of Calabria along the Tirreno Sea side of the region. During the last two to three centuries, small towns have grown along the coast as fishing villages. On the 3rd July 2006, a coastal flood occurred over a stretch of 10 km involving the two towns of Bivona (High Risk area) and Vibo Valentia Marina (Low Risk area). In the High Risk area the population was approximately 2,000 while it was approximately 8,000 in the Low Risk area (ISTAT, 2010). The whole area was chosen for study as it includes an area which suffered from a catastrophic flood (Bivona) and also an area which suffered damages although protected by breakwaters (Vibo Valentia Marina). Several discussions and interviews occurred with important institutional stakeholders such as the Regional Environment Protection Agency (A.R.P.A.-CAL. – *Agenzia Regionale per la Protezione Ambiente Calabria*), Regional Functional Centre (C.F.R. - *Centro Funzionale Regionale della Regione Calabria*), Flood Operative Centre (C.O.A. - *Centro Operativo Alluvione*), Vibo Valentia Municipality (*Comune Di Vibo Valentia*) and Civil Protection (*Protezione Civile Regione Calabria*). During three hours there was 190mm of rainfall and strong wind which, combined with the sea storm caused the flood that involved an area of 15 km^2 (Figure 20). The tragedy involved Bivona citizens, with twelve serious injuries and four deaths. The highest amount of rainfall in that area happened on the 11th October 1960 (125mm) and the 24th December 1990 (126mm) but on those occasions no flooding occurred due to the event's lower intensity.

Figure 20 Vibo Valentia Marina and Bivona in flood, 2006

In general, there is not an effective emergency plan and people feel abandoned by the authorities. 112 residents, small business owners and workers in both towns (Bivona and Vibo Valentia Marina) were targeted randomly in the whole flooded area, using a questionnaire given in public places in the street during November 2010. The sample is divided approximately 50% between the two towns (Figure 21).

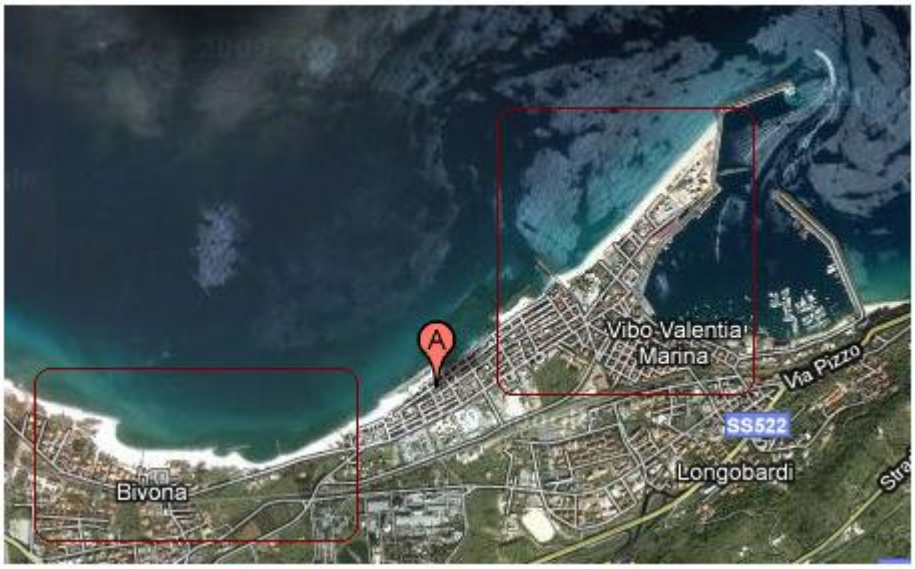

Figure 21 Targeted areas, Vibo Valentia

2.3.4.3 Friuli Venezia Giulia – Marano Lagunare and Grado

This third Italian case study is presently on standby due to unforeseen logistic and organizational problems during the questionnaire administration, which started in November 2010 but could not be completed. Alternative solutions are presently under close scrutiny in order to assess whether it will be possible and worthy to recover and complete the in-place questionnaire administration process to provide the missing part (about 80%).

2.4 WP 5 – Designing New Communication Methods

WP 5 will identify and develop a set of flood risk communication processes that will be included in a contextualised framework that can be used by agencies responsible for flood risk communication. These revised communication processes will be tested in WP 6. Results from the desk top reviews of best practice and the current state of flood communication in the partner countries (in WP 2 & 3), combined with the understanding of how this information is used within individuals' knowledge systems, should illustrate what, if anything, could be modified to improve resilience to flood events. The WP will have three phases. The first phase will review the technical options available to the project, based on the best practice examples provided through WP 2 & 3. The second phase will consider these options in light of the findings from WP 4 and choices will be made to select the most appropriate modifications to develop in this WP. These choices will be informed by the match with the main blockages and barriers in flood communication processes identified in WP 4 and the time and resource available within each country. The third phase is to develop the modification to flood communications process. Work has only recently been initiated on this work package as it entails a detailed analysis of questionnaire responses. The use of this 'needs' based approach by working closely with the communities, was a strong message from the literature review.

2.5 WP 6 – Testing New Communication Methods in Selected Areas

This WP will test the outcomes of WP 5, in the same area, and where possible, with the same sample used within WP 4 to test out changes to inputs to the knowledge systems that might support current good practice or unblock barriers to effective responses. As with WP4, the first part of the WP will be to agree a common framework to capture participants' responses to the interventions and how, if at all, these alter their knowledge systems. Again, there will be explicit attempts to understand how uncertainty and residual risk are perceived, interpreted and influence behaviour. The testing of new communication methods will be undertaken by use of focus group discussions and analysis or through workshops. The final details of the testing of communications will be discussed and agreed by the consortium partners during tele-conferences in the coming months.

2.6 WP 7 – Synthesising Results

Principles arising from the project's synthesis report will be converted in a short and practical trans-national guidance document that will be utilised by the responsible authorities to provide a response-focused flood communication strategy. The principles will also be of interest to scientists wanting to communicate uncertainty and risk more effectively to other stakeholders.

In order to convert the findings from the different work packages and across the partner countries into unified guidance, the synthesis report will answer the following questions:

- What are the most significant elements in the knowledge systems which emergency responders, responsible authorities and members of the public use to make sense of flood risk information; how much do differences in location, the types of flooding experienced and the characteristics of communities alter knowledge systems?
- What evidence is there that information about the probability of flood occurrence or other information about uncertainties alter responses by different stakeholders and are there circumstances under which information on flood risk uncertainty would be accepted or even welcomed?
- How could more response-based approaches and tools for communicating flood risk be developed by taking account of stakeholder characteristics and knowledge systems?
- Where are the mismatches between different knowledge systems and what implications do these mismatches have for emergency planning and community resilience?
- What are the possible alternative communication methods that take account of understanding different knowledge systems and how did they work in practice?

The table of deliverables developed after the kick-off meeting in Rome, 2009 is provided in Table 3, along with the current status and suggested revised dates.

Table 3 Deliverable dates (tasks in italics represent work to be done)

Code	Deliverable	Deliverable date	Status	Suggested Revised date
D.1.1	Set up Website	Oct-09	Done	-
D1.2	Project Summary Leaflet	Oct-09	Draft	-
D1.3	Set Up NAC/VSB	Oct-09	Done	-
D1.4 - 1.6	Project updates	Jan 09; July 10; Feb 11	On track	-
D1.7	CRUE ERA-NET seminar	Oct 09; Oct 10; Aug 11	Done	-
D1.8	Local Stakeholder Events*	Aug-11		-
D1.9	CRUE ERA-NET report	Aug 10; Aug 11		Oct-10
D2.1	Lit Review Report	Dec-09	Done	-
D2.2	Website update	Dec-09	Done	-
D2.3	Country Practice Report	Nov-09		Dec-10
D2.4	Website update	Nov-09		-
D2.5	Final Report	Dec-09	Done	-
D2.6	Website update	Dec-09		-
D4.1	Lit Review Report	Dec-09	Done	-
D4.2	Website update	Dec-09	Done	-
D4.3	Framework Report	Feb-10		Nov-10
D4.4	Website update	Feb-10	Done	-
D4.5	Synthesis Report	Aug-10		Nov-10
D4.6	Website update	Aug-10	Done	-
D5.1	Circulate options to NAC/VSB for comment	Jul-10		Dec-10
D5.2	New comms approach (or equivalent)	Sep-10		Jan-11
D6.1	*Synthesis Report*	*May-11*	*Back on inititial schedule*	
D6.2	*Website update*	*May-11*		
D7.1	*Synthesis Report*	*Aug-10*		
D7.2	*Website update*	*Aug-10*		
D7.3	*Synthesis Report*	*Aug-11*		
D7.4	*Website update*	*Aug-11*		
D7.5	*Transnational Guidance*	*Aug-11*		
D7.6	*Country Specific Guidance**	*Aug-11*		
D7.7	*Journal Article**	*Aug-11*		
D7.8	*Conference Presentations**	*Aug-11*		
	* where appropriate & resources allow			

3. Results and Discussion

3.1 WP 2 & 3

A 103 page report on the literature review has been prepared and circulated to the individual country sponsors. The final draft report prepared as work in progress can be viewed from:
http://www.macaulay.ac.uk/urflood/Draft_CRUEresearchreport_URFloodv2.pdf

As part of the review and improving a better understanding of how current roles and responsibilities in relation to flood risk communication differs between the case studies, each country developed flow diagrams or "organograms" of who and how responsibility is shared between the relevant authorities. By understanding the roles and responsibilities of relevant organisations in flood management, it is hoped that pathways to improved coordination between these organisations can be identified. These can be seen in Figure 22, Figure 23, Figure 24 and Figure 25 .

The four figures tend to follow a "top-down" approach; government at the top of the chain, public at risk at the bottom. From the literature review, a top-down approach is known to be linear and often expert driven, with little engagement of end-users. There is usually a focus on the role of government rather than the individual at risk and there is little room for feedback loops needed to improve the system. A "people-centred" approach is now recognised as an important part of flood risk management and involves communities having input into the design and operation of the system. The public at risk do not feature in any of the four figures below. The Finnish organogram includes "participation" as a suggested practice, but is not yet in current practice.

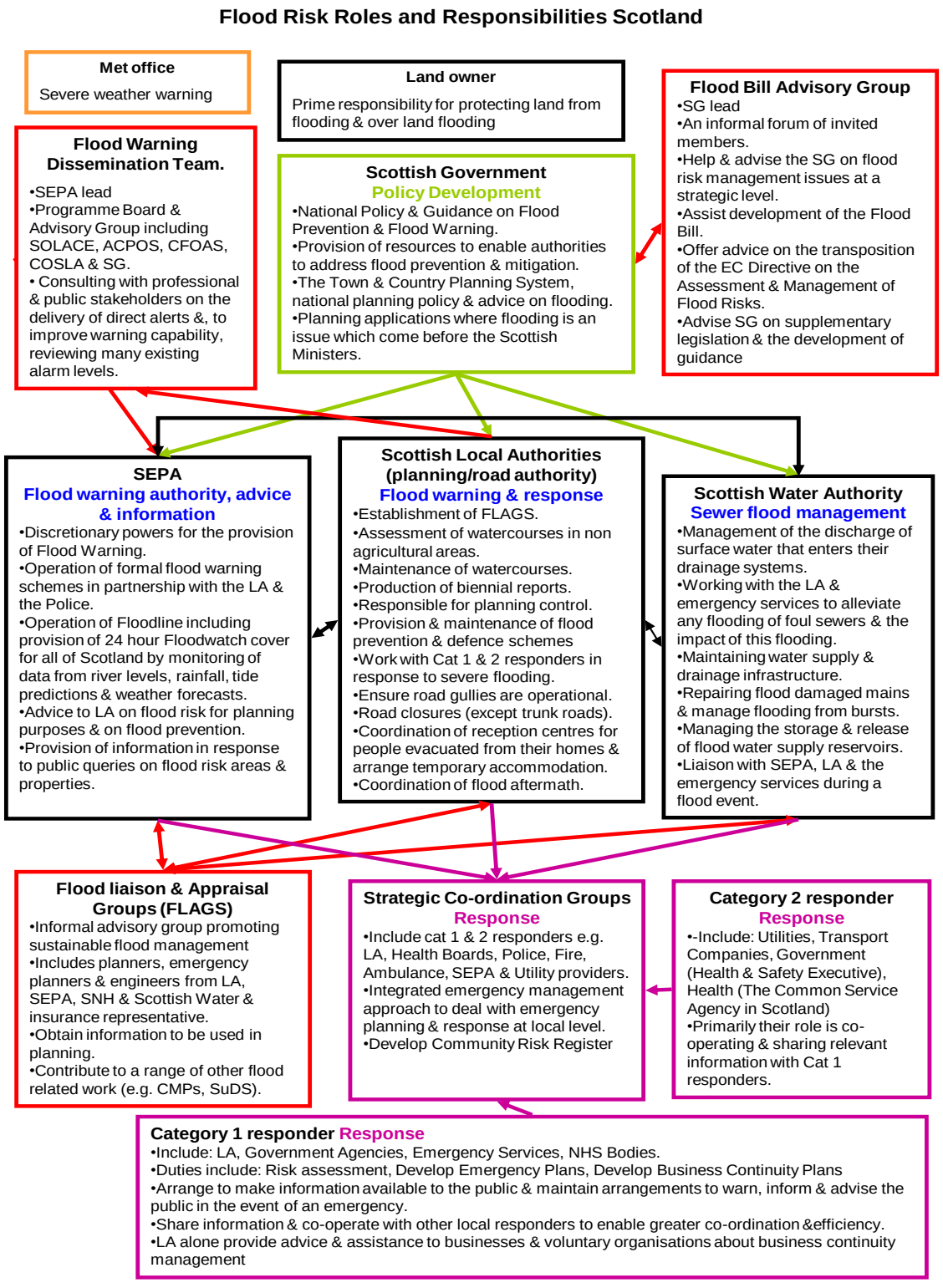

Figure 22 Roles and responsibilities, Scotland

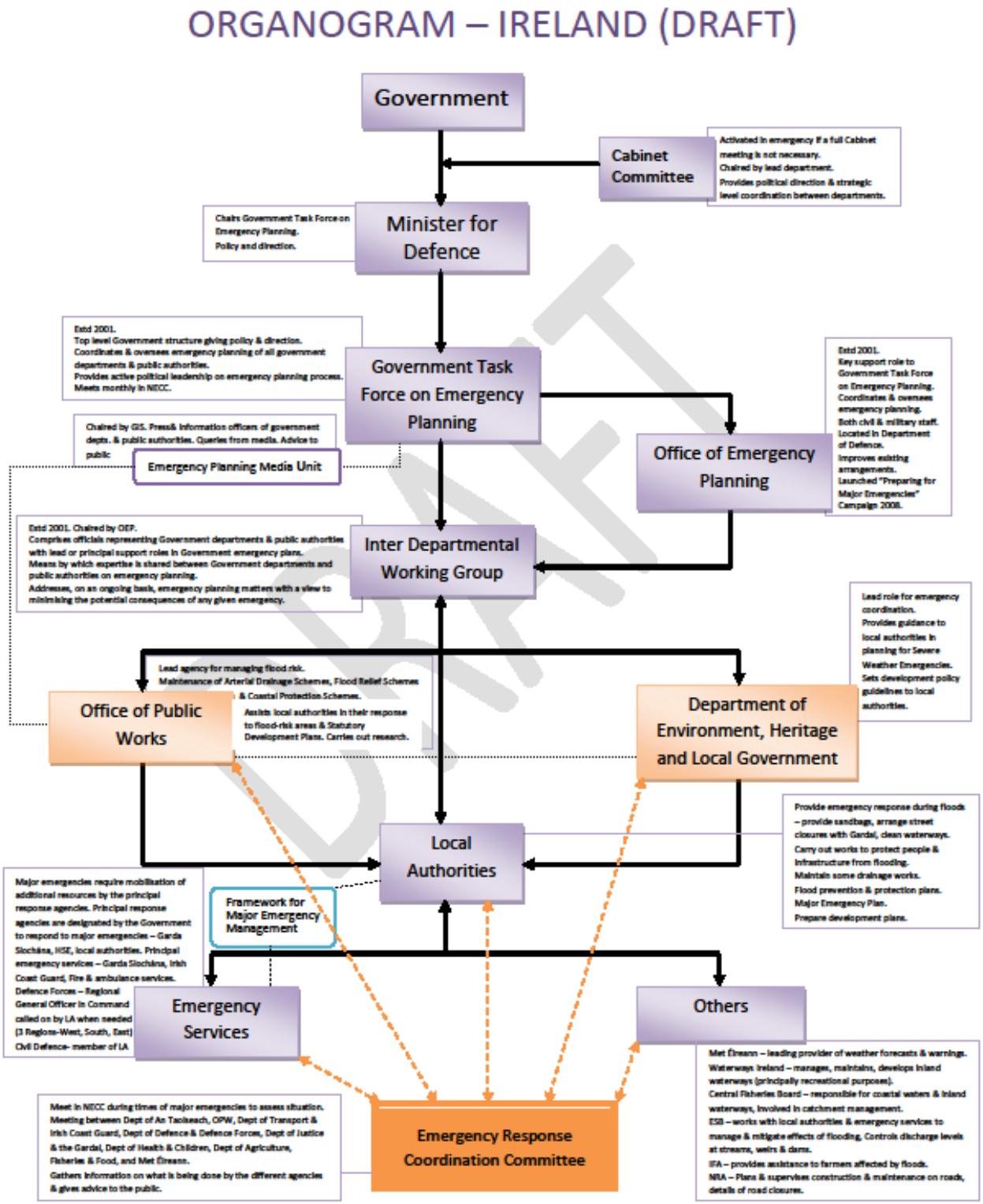

Figure 23 Roles and responsibilities, Ireland

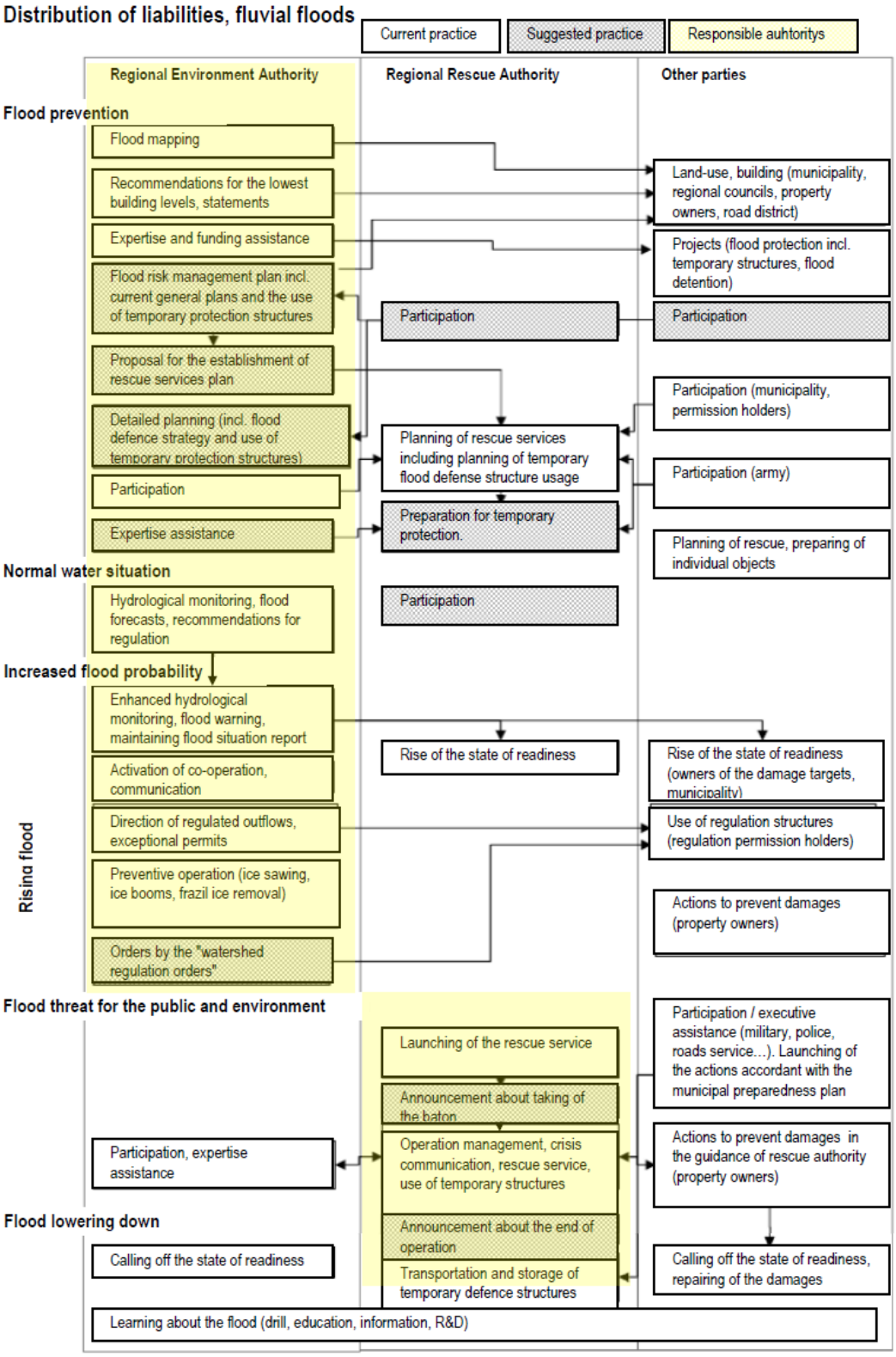

Figure 24 Roles and responsibilities, Finland

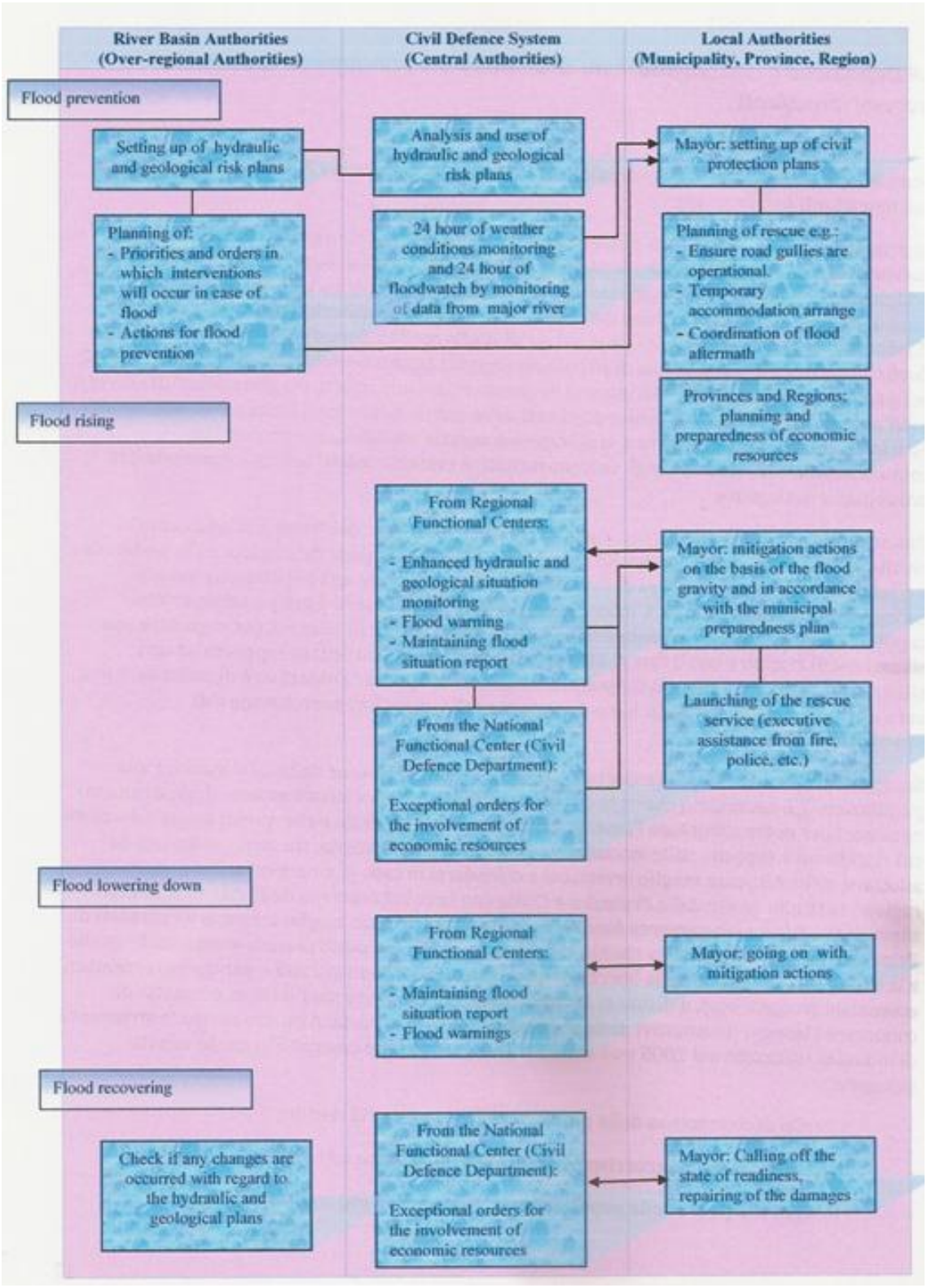

Figure 25 Roles and responsibilities, Italy

3.2 WP 4

Progress and return rates of questionnaires in the individual case studies has been summarised in Table 4 below:

Table 4 Progress of questionnaires

Country	Case study site	Number issued	Number returned	% returned
Scotland	Huntly	86	47	54.7%
	Glasgow/Whitecart	180	37	20.6%
	Moffat	60	22	36.7%
	Newburgh	100	36	36%
Ireland	Ballinasloe	353	84	23.8%
	Wexford Town	494	78	15.8%
	Clonmel	649	126	19.4%
	Dublin	676	148	21.9%
Finland	Rovaniemi	1678	375	22.3%
Italy	Rome	150	134	89.3%
	Friuli Venezia Giulia	In progress	In progress	In progress
	Calabria	120	112	93.3%
	Total	4546	1199	26.4%

A common database is currently being developed in order to analyse responses to common questions from the project as a whole. Data is also being analysed separately for each country. From a preliminary analysis of comparisons from each country the following results have been found:

3.2.1 Understanding uncertainty

Understanding uncertainty is central to this project. Some preliminary analysis is as follows:

- Understanding the flood risk is highly variable between case studies and individual characteristics
- Understanding of probability was found to be low to moderate in Scotland and Finland
- In Ireland a higher percentage of people claimed to understand probability. This was independent of flood experience (Table 5)

Table 5 "I understand probability", Ireland

		Affected by flooding		
		Yes	No	Total
Disagree strongly	Count	11	4	15
	% within Affected by flooding	3.9%	4.2%	4.0%
Disagree	Count	34	5	39
	% within Affected by flooding	12.2%	5.2%	10.4%
Neither agree nor disagree	Count	76	18	94
	% within Affected by flooding	27.2%	18.8%	25.1%
Agree	Count	135	58	193
	% within Affected by flooding	48.4%	60.4%	51.5%
Agree strongly	Count	23	11	34
	% within Affected by flooding	8.2%	11.5%	9.1%
Total	Count	279	96	375

3.2.2 Trust in agencies

The trustworthiness and reliability were gauged for several potential sources of warning information. Some preliminary results are as follows:

- Agencies were on the most part considered reliable and trustworthy. However, there were differences between countries
- There is a higher level of trust in emergency services for all countries (example Figure 26 and Figure 27)

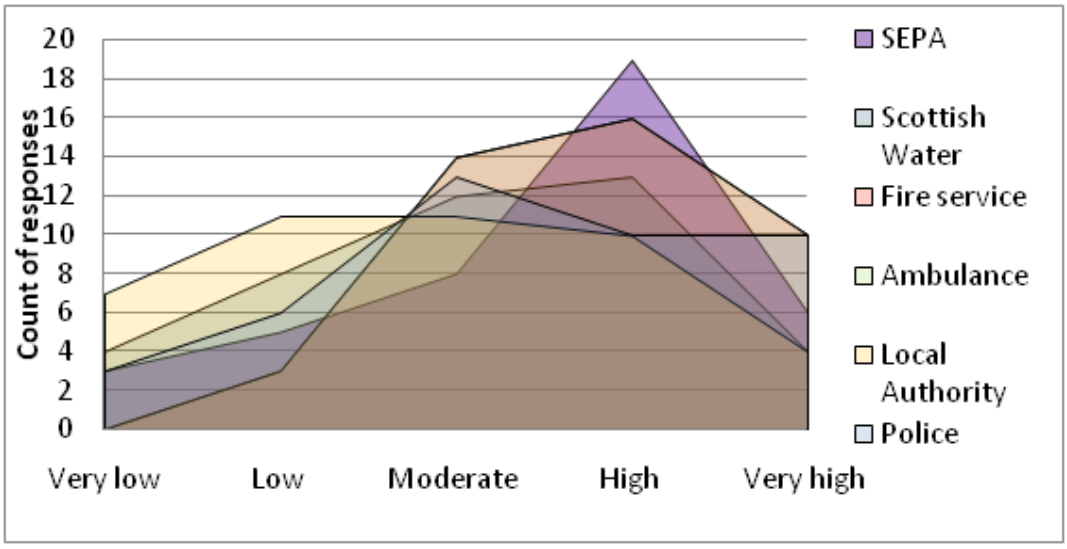

Figure 26 Trust in agencies, Scotland

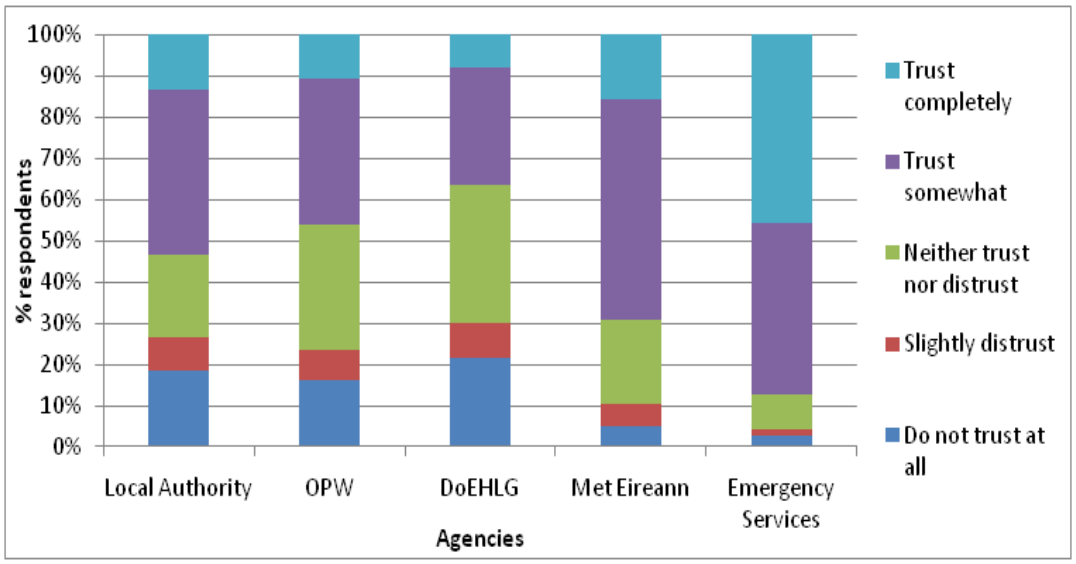

Figure 27 Trust in agencies, Ireland

3.2.3 Flood Communication

Respondents were asked to choose their preferred communication methods from a list, with the following preliminary conclusions being drawn:

- Preferred communication methods tend to be TV, radio, phone calls and SMS messages (Figure 28 and Figure 29)
- The least preferred methods tend to be internet and emails
- The importance of pre-flood communication was also assessed (Figure 30), with a large majority of respondents finding this important or very important

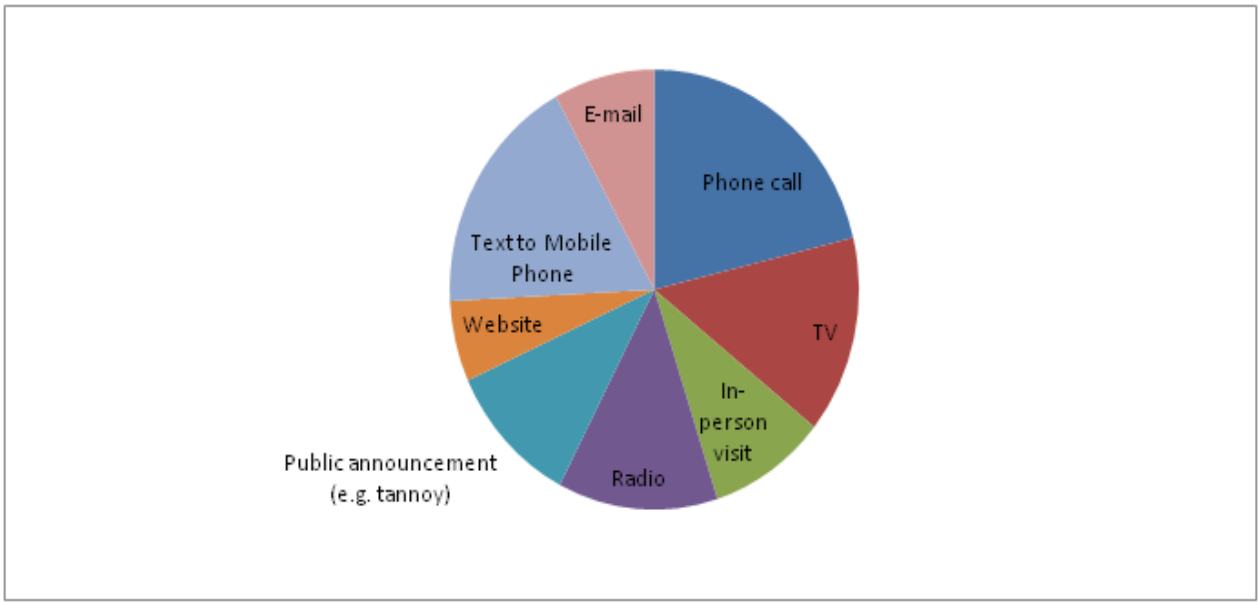

Figure 28 Preferred communication methods, Scotland

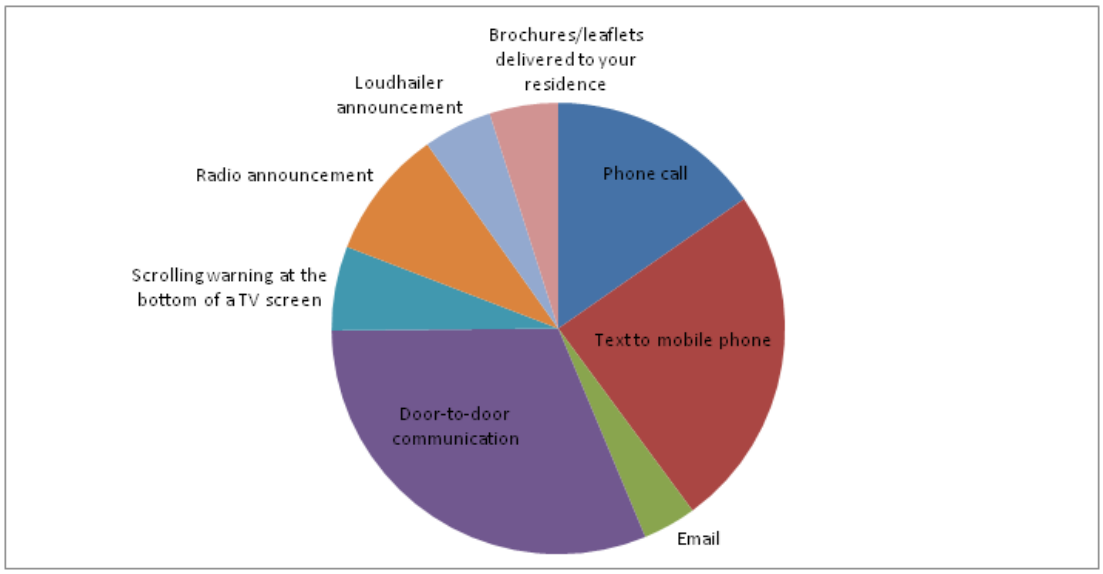

Figure 29 Preferred communication methods, Ireland

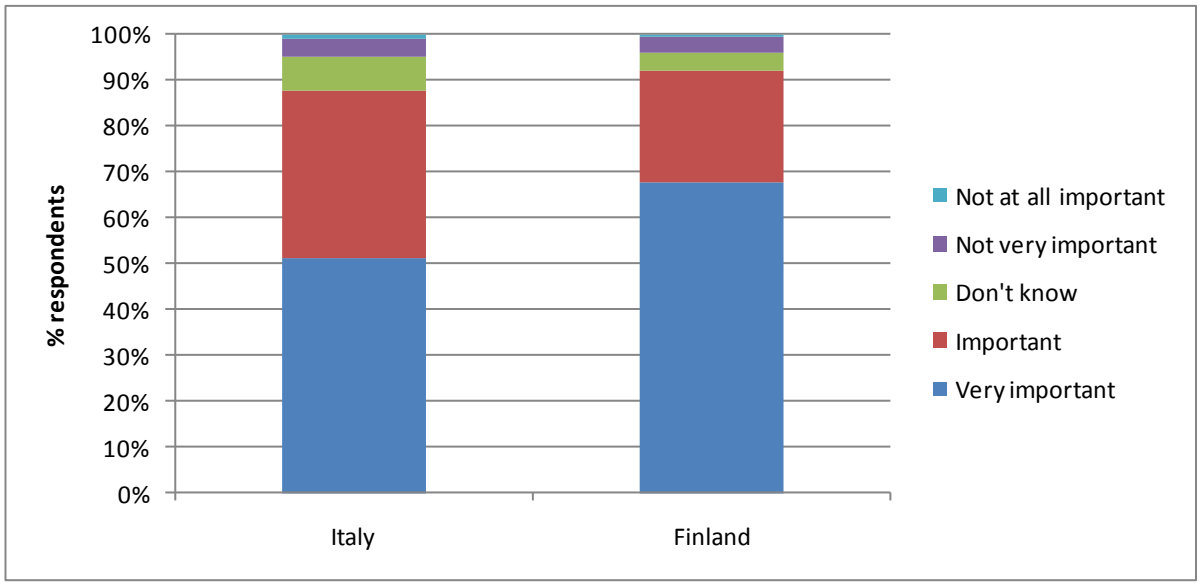

Figure 30 Importance of pre-flood communication

These results are at the very early stages of development. Full results, discussion and recommendations will be given in the final report.

3.3 WP 5

In order to design new communication methods, the strengths and weaknesses of existing flood warning communication in the case studies will be analysed from the questionnaire responses. Some initial observations and comments are as follows:

- Currently in Scotland, the default position is that residents may receive warnings if they wish and subscribe to a service. It may be that the service should be compulsory unless residents wish not to receive flood warnings
- There is a need to encourage greater ownership of the problems associated with floods and flood warning so that residents take a more proactive role in considering their options for courses of action
- Over reliance on websites should not be used as many people do not have access
- Information in awareness campaigns is useful but many people are not aware of them

This work package will be developed over the coming months. The communication method(s) produced will be subsequently tested in WP 6.

4. Contributions to overarching questions

4.1 Connection to Floods Directive

How does your project contribute to the implementation of a) preliminary flood risk assessment, b) flood hazard maps and flood risk maps and c) FRM plans as designated by the Floods Directive.

The Floods Directive specifies the importance of flood risk management plans over flood defence measures. It stresses the importance of public participation and the need for a "people-centred" approach to flood risk management. A major part of this research is to assess the public at risk and their attitudes to flood risk and uncertainty. This will be used to develop a communication framework that can be used as guidance across Europe. Current flood risk management plans will be assessed in order to understand what is working, and where there may be blockages in communication. The results of the UR-Flood project will be used to improve flood risk management plans as designated by the Floods Directive. The project incorporates a high level of participation, given as key to flood risk management plans by the Floods Directive.

4.2 Participation

How did you account for interests of all potentially affected parties, i.e. general public, trans-boundary parties, policy maker etc and how did that impact your results. How does your project contribute to a) strengthening public participation in the establishment of future FRM plans, b)valuable lessons for public authorities/institutions and c) good governance.

Participation plays a central role in the UR-Flood project. Extensive quantitative research was carried out on stakeholders in fourteen case study areas across four countries. These stakeholders included residents and small business owners at risk to various types of floods, including fluvial, pluvial and coastal floods. It also included those with residual risk. A communications framework will be developed based on analysis of stakeholder's views on various themes, including people's current awareness of flood risk, their awareness of flood related communications and availability of information, the role of uncertainty in these communications, responses to flood warnings and how these responses could be improved. This framework will subsequently be tested by

stakeholders using focus groups in the same areas. These focus groups will actively involve participation from the public at risk. In this way, the UR-Flood project contributes to strengthening public participation in future flood risk management. The UR-Flood project follows a "people-centred" approach to flood risk management, by basing a communication framework on information received from communities at risk. The literature suggests that for a flood communication strategy to be effective, the public must be involved in the planning stages. The UR-Flood project, using a high level of participation is aiming to achieve this.

The interests of all potentially affected parties were taken into account in this project. There has been ongoing consultation with the relevant national bodies in each partner country, including the Scottish Environmental Protection Agency, the Irish Office of Public Works, the Finnish Government and the Institute for Environmental Protection and Research in Italy. The public at risk have been studied in depth through questionnaires in the fourteen case study areas. The communication framework will be tested using the public at risk with input from local authorities and emergency responders. The project will contribute valuable lessons to public authorities and institutions by showing the strengths and weaknesses of current emergency plans. The project contributes to good governance by including the input of stakeholders in producing and improving flood risk management plans.

4.3 Harmonisation

What insights will your case studies provide to balance the drive for consistent, trans-national FRM strategies and the need for local tailor-made solutions?

Case studies across four countries within the UR-Flood project ensure a trans-national aspect. A common methodology with core questions was the approach taken in each case study, to ensure straightforward comparison of data collected. A database of all core questions from each of the fourteen case studies will be used in order to develop a trans-national flood risk management strategy. In addition to this, each of the individual countries has the option to analyse data to provide a national strategy. Furthermore, each case study area can be used to produce a local tailor-made solution; thus providing a balance regarding the drive for consistent, trans-national flood risk management strategies and the need for local tailor-made solutions.

4.4 Restrictions

To what extent is the generalisation of the results restricted by context variables in the case study area, such as a) social/socio-cultural-historical/legal-institutional/political/economic characteristics, b) the flood type and degree of awareness, and c) uncertainties and the way they are dealt with?

The case studies chosen include a large range of social, socio-cultural-historical, legal, institutional, political and economic characteristics, both within each partner country and also on a trans-national level. The case studies were also chosen to include different types of flooding including fluvial, pluvial and coastal flooding, along with residual risk. The framework developed will include general results found from the core questions asked in each case study area. This will provide guidance that can be used across in a generic way across Europe. Restrictions may become more apparent through further data analysis.

5. Dissemination

UR-Flood partners have been involved in a range of dissemination activities as listed in Table 6. In addition to this, each country has regular communication with their respective national funder.

Table 6 Highlighted dissemination activities undertaken

Date	Place	Description
Oct. 2009	Rome	Presentation to ERA-NET kick off meeting
Nov. 2009	Scotland	Press release on UR-Flood
Nov. 2009	Ireland	Presentation to representative of Dublin City Council involved in Flood Resilien City Project
Dec. 2009	Finland	Presentation given in meetings with city of Rovaniemi
Jan. 2010	Germany	Participation in IMRA Scientific Colloquium
Feb. 2010	Scotland	Presentation to national conference on flooding
March 2010	Venice	Participation in FREEMAN Stakeholder Meeting
March 2010	Finland	Presentation given in meetings with city of Rovaniemi
March 2010	Finland	Meeting of steering group in Rovaniemi
April 2010	Ireland	Presentation to national funder
July 2010	Scotland	Progress reported to National Advisory Group
July 2010	Ireland	Progress report submitted to national funder
Aug. 2010	Scotland	Workshop on research needs for Flooding in Scotland
Aug. 2010	Ireland	Presentation to national funder
Aug. 2010	Ireland	Letters to local authorities regarding questionnaire dissemination in the area
Sept. 2010	Scotland	Community presentation on flood management
Sept. 2010	Ireland	Press releases regarding questionnaire dissemination
Oct. 2010	Madrid	Presentation to ERA-NET mid-term meeting
Nov. 2010	Scotland	Agency presentation on flood management
Nov. 2010	Ireland	Research poster "Understanding Uncertainty in Flood Communications" presented at National Hydrology Conference, Athlone, Ireland
Nov. 2010	Ireland	Research paper "Improving Communication Strategies in Flood Risk Communities" submitted for IAHR conference, Brisbane, July 2011
Ongoing	www	UR Flood web pages updated. Hosts information and progress
Ongoing	Scotland	Join Steering Group of Scottish Flood Forum
Ongoing	Ireland	Writing state–of-the-art review on flood risk communication to be submitted for journal publication
Ongoing	All	Discussions with authorities and funders

6. Project Progress

The progress of the UR-Flood project is shown in the following table (Table 7).

Table 7 Project progress

WP 1 - Project Management **Reason for delay:** No Delay **Comments:**	☒on schedule ☐behind schedule, but can easily be caught up ☐seriously behind schedule
WP 2 & 3 - Understanding the Role of Uncertainty in Flood Risk Communication **Reason for delay:** No Delay **Comments:**	☒on schedule ☐behind schedule, but can easily be caught up ☐seriously behind schedule
WP 4 - Investigating Knowledge Systems in Selected Flood Prone Areas **Reason for delay:** Delay in collecting case study data. **Comments:**	☐on schedule ☒behind schedule, but can easily be caught up ☐seriously behind schedule
WP 5 - Designing New Communication Methods **Reason for delay:** Delay is as a result of the delays experienced in WP 4. **Comments:** This WP has only recently started. The work will be back on schedule by January 2011.	☐on schedule ☒behind schedule, but can easily be caught up ☐seriously behind schedule
WP 6 - Testing New Communication Methods in Selected Areas **Reason for delay:** No delay **Comments:** This WP has not yet started.	☒on schedule ☐behind schedule, but can easily be caught up ☐seriously behind schedule
WP 7 - Synthesising Results **Reason for delay:** No delay **Comments:**	☒on schedule ☐behind schedule, but can easily be caught up ☐seriously behind schedule

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