Pluvial Flooding In Europe

Ronnie Falconer
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26th-28th May 2010, Cagliari, Italy
Overview

- Outcomes from the EWA Expert Meeting on Pluvial Flooding
- Current UK Practice and Guidance
- Synergies with the FloodResilienCity project
- Questionnaire Responses from FloodResilienCity project partners
- Summary of Discussion Points
EWA Expert Meeting on Pluvial Flooding  
28 October 2009, Brussels  

Attendance  

• Member State representation and invited experts involved in pluvial flooding and urban flood management  
• Italy, Hungary, Poland, Netherlands, Ireland, Portugal, Spain, UK, Commission, JRC and EWA  
• Draft report circulated to Interested MS including France Germany and Sweden
EWA Expert Meeting on Pluvial Flooding
28 October 2009, Brussels

Aims

• To take stock of the importance and relevance of pluvial floods across Europe and identify issues that can be further developed at the thematic workshop on Flash Floods and Pluvial Flooding
• Prepare a ‘situation paper’ to inform further consideration of pluvial flooding in Europe.
Topics Considered

- **Characteristics** of pluvial flooding and understanding of relevant processes
- Identifying the problem: extent of pluvial flood risks across Europe – implications of **climate change**
- Approaches to **mapping and risk assessment**
- Potential **mitigation measures**
- Review of **current research** (Imprints, FloodResilienCity, Tisza Basin) - aspects requiring guidance and further research
Characteristics of Pluvial Flooding

Pluvial Flooding is flooding as a result of heavy rainfall when water which does not infiltrate the ground ponds in natural or artificial hollows or flows over the ground as overland flow, before it enters a natural or man-made drainage system or watercourse …… or when it cannot enter because the system is already full to capacity.
Characteristics of Pluvial Flooding

Usually associated with **short duration high intensity** rainfall but can also occur with lower intensity rainfall over longer periods, or melting snow, and can be worse when the ground is saturated, frozen, compacted, developed or otherwise has low permeability. **High velocity overland flow and deep ponding and pose a particular hazard.**

Pluvial Flooding is in some countries referred to as **Excess Water Flooding**
Extent of Pluvial Flood Risk across Europe

- “Pluvial flooding can happen anywhere at any time”
- Climate change likely to make worse. Land-use also a factor.
- Greater vulnerability in urban areas?
- Is there a greater risk in western, northern and central Europe? ..... but areas of increased risk elsewhere also.
- Questionnaire to determine extent of problem across Member States
  - do differences in organisational responsibilities affect understanding of the problem?
  - level of vulnerability?
Approaches to Mapping and Risk Assessment

- **Evidence base** will be required to demonstrate assessed level of significance.
- **Observed incidents** of pluvial flooding very valuable – use as much as possible. Can be masked by other types of flooding.
- Top down **risk based approach** with progressively more detailed assessment where justified. Site inspections valuable.
- Fixed methodologies should not be imposed on Member States – provide **good practice examples**.
- **Methodologies evolving rapidly** - provide examples of application.
Potential Mitigation Measures

- Solutions likely to comprise of a **mix of measures**:
  - source control and **overland flow routing/storage**
  - improved conveyance (larger sewers, drains and urban channels)
  - resistance, resilience and **non-structural** measures
- **Adaptable** solutions – climate change uncertainty.
- Gather examples to prepare a **catalogue of good practice and win-win measures**. Catalogue existing guidance documentation.
- Include examples of good **planning control** – national legislation could assist.
- **Public education** is important – source control measures.
Research Initiatives

- **Categorisation of ‘magnitudes’ of flooding** rather than specific flood probabilities – also categorisation of sources of flooding.
- **Harmonising land use** and rural development.
- Need for **awareness raising** about pluvial flood problems.
- Some extensive records of past flooding (for example Excess Water Flooding in Hungary) – **data collection of key importance**.
EWA Expert Meeting

Way Forward

- **Questionnaire** to determine extent of the problem.
- Develop key issues at **Cagliari Workshop**.
- Identify needs for **further guidance and research**.
Current UK Practice and Guidance
Glasgow: August 2002

Shettleston Pluvial Flood Aug 2002
Images courtesy Scottish Water
Hull and Sheffield: Summer 2007
London area and Berkshire: July 2007

Images courtesy BBC News Website
East Belfast: June 2007
98.3mm of rain fell in 1 hour in the East and South Belfast catchments.
Resulted in both fluvial flash flooding and pluvial flooding which caused major disruption with over 400 properties affected.
Climate Change

• Higher energy storm events with near ‘tropical’ rainfall intensities producing ‘pluvial’ surface water flooding and flash floods.

• Annual precipitation could increase more than 40% in some parts of northern Europe by 2100 – 30% increase in peak rainfall intensity possibly.

• Potentially >100% increase in properties affected and 2 - 20 times increase in flood damage
SEPA Study
Improved Understanding of Pluvial Flood Risk in Scotland

- Collection of flood hazard information on past pluvial flood events in Scotland.
- Review of the processes involved in pluvial flooding.
- Development of screening tool to identify pluvial flood susceptibility.
- Application of the screening tool – Edinburgh used as pilot study area.
- Production of technical guidance for further, more detailed pluvial modelling.
SEPA Technical Guidance: Staged approach

- Level of assessment should be **proportionate** to perceived level of pluvial flood risk.
- Commence with **screening** - then target **progressively more refined modelling** and assessment at the areas of greatest assessed risk.
- **Best value** from available budget and resourcing.
Richmond and Kingston First Edition SWMP

“a framework through which key local partners … work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk”.

Key SWMP Elements

- Preparation
- Risk assessment
  
  ------Staged Approach
- Options appraisal
- Implementation & review
Screening Tools and Mapping

‘Dry’ method:
- GIS based **Contour Polygon Screening** – simple high level determination of ponding depressions.
- GIS Based ‘rolling ball’ **Flowpath Generation** – bare earth DEM with buildings superimposed.

‘Wet’ method:
- Rainfall generation based on FEH – total rainfall depth for given probability and duration.
- Final depth calculation.
Screening and Mapping: Ponding Areas and Flowpaths Edinburgh Central and Leith 1:200 3hr rainfall event
Site inspections for preliminary risk assessment:

- 49 locations in Richmond and Kingston visited over 4 days
- simple **scoring system** to rate perceived **overall risk**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Hazard Level</th>
<th>Very Low</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth of Flooding</strong></td>
<td>Description</td>
<td>&lt;0.2m</td>
<td>0.2m to 0.5m</td>
<td>0.5m to 1m</td>
<td>1m to 2m</td>
<td>&gt;2m</td>
</tr>
<tr>
<td>Score</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Extent of Flooded Area and Properties at Risk</strong></td>
<td>Description</td>
<td>Localised &lt;0.1ha</td>
<td>No properties potentially at risk</td>
<td>Moderate (up to 1ha)</td>
<td>Up to 10 properties potentially at risk</td>
<td>Widespread (&gt;10ha) More than 100 properties potentially at risk</td>
</tr>
<tr>
<td>Score</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flowpath feeds topographic depression?</strong></td>
<td>Description</td>
<td>No or Flowpath only</td>
<td>Yes, Depth &lt;0.5m</td>
<td>Yes, Depth 0.5-1m</td>
<td>Yes, Depth 1-2m</td>
<td>Yes, Depth &gt;2m</td>
</tr>
<tr>
<td>Score</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Velocity of Flow</strong></td>
<td>Description</td>
<td>Still Water (generally flat terrain), Any depth.</td>
<td>Velocity up to 0.5m/s (generally gently sloping terrain) and Depth less than 0.5m.</td>
<td>Velocity 0.5-1m/s (generally moderately sloping terrain) and Depth less than 0.5m.</td>
<td>Velocity more than 1m/s (generally steeply sloping terrain) and Depth less than 0.5m.</td>
<td>Velocity more than 1m/s (generally steeply sloping terrain) and Depth more than 0.5m.</td>
</tr>
<tr>
<td>Score</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Sensitivity of Land Use</strong></td>
<td>Description</td>
<td>Open areas that can be flooded without significant consequence.</td>
<td>Parkland, open ground or terrain where flooding would have some consequence.</td>
<td>Suburban residential / commercial / retail / industrial areas where flooding would have moderate consequence.</td>
<td>Central urban or town centre residential / commercial / retail / industrial areas where flooding would have high consequence.</td>
<td>Critical infrastructure present. Critical transportation links present. Basement trays present.</td>
</tr>
<tr>
<td>Score</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Doorway Threshold Levels</strong></td>
<td>Description</td>
<td>Most above 0.2m above ground level.</td>
<td>Most above 0.2m but some 0m to 0.2m above ground level.</td>
<td>Most 0m to 0.2m above ground level.</td>
<td>Most at ground level. Some below ground level.</td>
<td>Most below ground level.</td>
</tr>
<tr>
<td>Score</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Total Score**

| 0 to 2 | 3 to 4 | 5 to 7 | 8 to 10 | >10 |

**Overall Preliminary Risk Rating**

- Not Significant
- Low
- Moderate
- High
- Severe
## Inspection Schedule: Richmond

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site A</td>
<td>12/01/2023</td>
<td>9:00 AM</td>
<td>Inspection</td>
<td>Flood damage assessment</td>
</tr>
<tr>
<td>Site B</td>
<td>11/02/2023</td>
<td>2:00 PM</td>
<td>Survey</td>
<td>Water flow measurement</td>
</tr>
<tr>
<td>Site C</td>
<td>10/03/2023</td>
<td>11:00 AM</td>
<td>Maintenance</td>
<td>Drainage system repair</td>
</tr>
</tbody>
</table>

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**Notes:**
- All inspections to be completed within 48 hours.
- Surveys to include water flow rates at different elevations.
- Maintenance to focus on high-risk areas identified in previous inspections.

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**Additional Information:**
- Site A experienced heavy rainfall leading to increased risk of flooding.
- Site C requires immediate attention due to a pending water flow issue.

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**Contact Information:**
- Site Manager: John Doe
- Email: john.doe@sample.com
- Phone: 123-456-7890

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**References:**
- 2022 Flash Floods Management Guidelines
- 2019 Pluvial Flooding Case Studies
Preliminary Risk Assessment – Richmond and Kingston

- Summary results of site inspections:
  - table shows results as percentage of sites visited, not land area.

<table>
<thead>
<tr>
<th>Points Score</th>
<th>Low or Insignificant Risk</th>
<th>Moderate Risk</th>
<th>High Risk</th>
<th>Severe Risk</th>
<th>Potential Risk to Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>5 - 7</td>
<td>8 - 10</td>
<td>&gt; 10</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Richmond (20)</td>
<td>25%</td>
<td>50%</td>
<td>20%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>Kingston (29)</td>
<td>24%</td>
<td>41%</td>
<td>28%</td>
<td>7%</td>
<td>14%</td>
</tr>
</tbody>
</table>
Detailed Risk Assessment – Critical Areas

- **2D hydraulic model** (TuFLOW) of specific locations, built using DEM with buildings ‘stamped’ on

- Determine rainfall input for **various scenarios** (e.g. 4.5hr duration event with a 1:200 chance of occurring)

- Assume **proportion of rainfall removed by underground systems** (information provided by Thames Water)

- Model **depths and velocities** of excess water at the surface
Acre Road to Petersham
Maximum depths and velocities

Damage Assessment:
12,400 properties
Annual Average Damages
3m Euro
Options Evaluation

- **Do nothing**: no maintenance, increasing risk
- **Do minimum**: ongoing maintenance, deterioration with climate change
- **Source control and SUDS**: reduce rate/volume of runoff through infiltration and storage
- **Design for exceedance**: control passage of some retained surface water through the urban environment
- **Increasing capacity**: add storage and/or capacity to underground sewers and drains
- **Separation of foul and surface water**: alongside effective surface water management, this can reduce flooding and pollution
- **Non-structural measures**: influencing behaviour, e.g. maintenance, warning, land management, building resistance and resilience measures.
### Working Group F Thematic Workshop

#### FLASH FLOODS AND PLUVIAL FLOODING

**Provisional Timeline and Objectives**
- **Workshop Outcomes**

**Location:**
- **Casino di Versilia**

**Participants:**
- ISPRA
- Regione Autonoma della Sardegna
- Ministero dell’Ambiente

**Main Themes:**
- **Analysis and Modeling**
- **Impact Studies and Mitigation**
- **Emergency Preparedness**

**Methodology:**
- **Step 1:** Identification of Sites
- **Step 2:** Risk Assessment
- **Step 3:** Mitigation Strategies

**26th-28th May 2010, Cagliari, Italy**
Richmond and Kingston SWMP Outcomes

- **Screening** – hybrid approach using *composite* of wet and dry techniques – overlay flowpaths.

- Value of **Site Inspections** preceded by **desktop review** – verification / source of flooding / land use / preliminary risk assessment / mitigation measures.

- **Preliminary Risk Assessment** based on site inspections - convenient, easily applied and rapid method of assessing potential severity of surface water flood risk.

- **Option Evaluation Matrix** coupled with **Stakeholder Workshop** – MCA scoring approach to identify most appropriate options.
Practical Outcomes

**Basement Flats**

- Basement flats may be particularly vulnerable and pose a significant *risk to life* where adjacent to flowpaths or within a topographic depression. Carefully assess risks and mitigation.

**Underground Access**

- Similarly for access points to underground car parks or basement areas where there could be a possibility of *rapid inundation* and restricted safe exit. Access points to low level or *underground stations* may also be vulnerable. Simple measures may include *raised ramping* across entrances.
Schools (and Public Access Establishments)

- Appear to be particularly susceptible – high number of reported incidents at schools.
- Particular attention to those where topography flat or in ponding areas.

Doorway Threshold Levels

- Doorway thresholds relative to street or ground level a critical factor in determining the impact of surface water flooding.
- Many high street Retail Premises / Shopping Centres have street level doorway thresholds and even shallow surface water flooding could cause extensive damage and disruption.
- Bow-wave from any passing traffic may also compound the problem.
**Transport Infrastructure**
- Deep ponding can be associated with railway and road infrastructure either due to a **damming effect** where embankments intersect surface water flowpaths or at **underpasses**. Particular attention should be given to disused rail or road embankments.

**Flood Emergency Planning**
- Flood emergency planning should ensure that **safe evacuation routes** are not compromised by locations where significant surface water flood hazard is identified – high velocities or deep ponding.
- **Pre-emptive planning** to take susceptible areas into account.
- Couple with **Extreme Rainfall Alerts**
UK Defra Surface Water Management Plan Technical Guidance

- **Preparation**
  - identify the need for a SWMP study
  - establish the partnership
  - scope the SWMP study

- **Risk Assessment**
  - strategic assessment
  - intermediate assessment
  - detailed assessment, and
  - map and communicate risk

- **Options Appraisal**
  - identify the options
  - assess the options

- **Implementation and Review**
  - prepare an Action Plan
  - implement and review the Action Plan
Synergies with the FloodResilienCity Project
FRC Work Packages - Dublin

- **Awareness** - Flood Damage Predictive Models (Integrated Flood Forecasting System and 3D Urban Exceedance Model)
- **Awareness** - Flood Awareness and Response Framework (Flood Partnerships Framework Plan)
- **Avoidance** - FRM and Spatial Planning (Spatial Planning and Flood Resilience Regulations)
- **Alleviation** - ‘Streets as Streams : Roads as Rivers’
- **Assistance** - Flood Information Management System
FRC Programme Elements Relevant to Pluvial Flooding

- 1D / 2D flood modelling and integrated mapping
- Integrated flood forecasting and warning
- 3D urban exceedance model
- Flood partnerships framework and flood awareness and information

Emerging UK SWMP and Pluvial Flooding Practice

**Awareness**
- Risk Assessment - staged approach /future scenarios
- Implementation - action plan
- Risk Assessment - map and communicate risk
- Preparation - establish SWMP partnership
- Options - social change, education and awareness

**Avoidance**
- Spatial planning and flood resilience
- Water sensitive urban design
- Options - planning policies / improved resilience
- Options - source control, SUDS, storage etc

**Alleviation**
- ‘Streets as Streams and Roads as Rivers’
- Flood alleviation (FA) techniques in urban areas
- FA by structural and non-structural means
- Options - overland flow management, maintenance
- Options - temporary defences, SUDS, etc
- Options - weather warning / improved resilience etc

**Assistance**
- Civil flood assistance plan
- Flood information management system
- Flood resilience in the community
- Flood response management
- Risk Assessment - map and communicate risk
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Questionnaire Responses from FloodResilienCity project partners
<table>
<thead>
<tr>
<th>WSF Ref</th>
<th>EWA Ref</th>
<th>Question</th>
<th>1 Bradford</th>
<th>2 Dublin</th>
<th>3 Nijmegen</th>
<th>4 Flanders</th>
<th>5 Mainz</th>
<th>6 Orleans</th>
<th>7 Paris</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>Scale of the Problem and Institutional Management</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>3.2</td>
<td>1.1</td>
<td>Is pluvial flooding (on its own or as a part of surface water flooding) recognised as a potential flooding problem?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>3.4</td>
<td>1.2</td>
<td>If so, are there particular areas that are considered to be particularly vulnerable to this type of flooding or is it considered to be a risk in all areas of the country?</td>
<td>All areas</td>
<td>All areas</td>
<td>All areas</td>
<td>All areas</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1. Bradford: Yes. In the UK it has been recognised since the Foresight Future Flooding Report in 2004.
2. Dublin: Yes. No, it is not a real threat in our region.
3. Nijmegen: Yes. Any type of flooding that occurs is recognised, but there is no clear distinction between the types of flooding.
5. Mainz: Yes. People and activities are directly affected by damages. It's a real problem for the public utility which Serva because of the area and the nature of the disaster can't be defined before the end of the event. It's often hidden in unsuitability risk.
6. Orleans: Because, for most people, it's an advance in urban settlement. The level of risk is characterized by lacks of urban settlement (aquifer system, sealing ground), and not by natural climate event.
7. Paris: Yes. Of course, in Metropole, a lot of pluvial flooding occurred.

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### Flash Floods and Pluvial Flooding

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>MCQ</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3 Is pluvial flooding distinguished from flash flooding? Is it regarded as more or less of a problem that flash flooding?</td>
<td>Not always, but generally flash flooding has been more severe.</td>
<td>Yes — In Dublin it is regarded as a separate problem</td>
<td>Flash flooding, especially when it concerns larger rivers, is regarded as a much bigger threat than pluvial flooding as damage is much higher.</td>
<td>As already mentioned in answer to question 1.1, there is no real distinction made between pluvial, flash flooding and surface water flooding. Even the definitions above show the impossibility of making clear distinctions: flows that cannot enter sewer systems because they are already full to capacity are considered as pluvial floods, and flows caused by exceeding the capacity of underground systems due to heavy rainfall are considered as surface water flooding. Usually these two events coincide. Flash floods occur in rural areas of the southern part of Piemont where heavy rains are located on hill slopes. They are the cause of local mud streams, leading to loss of soil, affecting roads and houses by mud and flood water and increase of sediments in downstream watercourses. They are considered as harmful and to a lot of measures are in place or planned to prevent these events (e.g. <a href="http://www.unilfip.com/online_magazine/2009/12/7277/pubb/index.html">http://www.unilfip.com/online_magazine/2009/12/7277/pubb/index.html</a>)</td>
</tr>
<tr>
<td>3.1 Is pluvial flooding (or a similar type of flooding) defined in national legislation or guidance? If so, please provide details.</td>
<td>Yes Statutory Instrument 3040: The Flood Regulations 2000</td>
<td>Not separately defined - Office of Public Works Guidance would describe it as a risk option to Fluvial &amp; Coastal</td>
<td>The Floodplain Directive (1807/2003) is the basis for all water related issues. The implementation of the EU Floods Directive will soon be integrated in this decree. In this update “flood” means the temporary covering by water of land not normally covered by water, caused by e.g. flooding from rivers and flooding from the sea. So pluvial flooding or flash floods are not excluded from the decree, but they are not defined as such.</td>
<td>The Irish Decree on integrated Water management (1807/2003) is the basis for all water related issues. The implementation of the EU Floods Directive will soon be integrated in this decree. In this update “flood” means the temporary covering by water of land not normally covered by water, caused by e.g. flooding from rivers and flooding from the sea. So pluvial flooding or flash floods are not excluded from the decree, but they are not defined as such.</td>
</tr>
<tr>
<td>3.7 Is pluvial flooding more of a problem in urban areas or rural areas or both?</td>
<td>Both</td>
<td>Rural and urban areas are more problematic</td>
<td>Pluvial flooding can occur both in urban and rural areas. In urban areas due to overflow of combined sewer systems or road tunnels. The damage in urban areas depends entirely on the design criteria of the sewer/water/irrigation systems. These design criteria are very unionized in relation to climate change scenarios. In rural areas pluvial flooding occurs in two cases: when the soil is saturated after a longer period of rainfall or when the soil is very dry in summer conditions. In flat areas this is not recognised as a serious problem. Only in hill sloped rural areas pluvial floods and flash floods are seen as the same kind of event.</td>
<td>Both, in valley sections: Water flowing into the city/village</td>
</tr>
</tbody>
</table>

We can observe pluvial flooding in most parts of the country, because when you have high intensity of rain, most of the time you have last flow.
### Flash Floods and Pluvial Flooding

#### 3.3.1.6 Which authority is responsible for performing the Preliminary Flood Risk Assessment under Article 4 of the Floods Directive (2007/60/EC)? How does it intend to proceed with assessing pluvial flooding risks?

<table>
<thead>
<tr>
<th>3.3.1.6</th>
<th>Which authority is responsible for performing the Preliminary Flood Risk Assessment under Article 4 of the Floods Directive (2007/60/EC)? How does it intend to proceed with assessing pluvial flooding risks?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abisko UK Environment Agency and the Municipality designated as Lead Local Flood Authority under the above SI 542:</strong></td>
<td><strong>The Local Authority is Dublin City Council.</strong> We are assessing it as part of EU Project Flood Peninsula City. At the same time DfW has undertaken a national assessment.</td>
</tr>
<tr>
<td><strong>Flinders will not perform the Preliminary Flood Risk Assessment.</strong></td>
<td><strong>In Germany: The &quot;Länder&quot; (federal states) and the City Authorities.</strong> <strong>It’s the Minister (and the Study Commission) which has got to do it. It’s still in debate today for transferring the directive in French law.</strong></td>
</tr>
</tbody>
</table>

#### 3.4.1.7 Is there an active participation of local authorities to manage pluvial flooding (or surface water flooding) and assess risks from this type of flooding? If so, how does it happen?

<table>
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<th>Is there an active participation of local authorities to manage pluvial flooding (or surface water flooding) and assess risks from this type of flooding? If so, how does it happen?</th>
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</thead>
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<tr>
<td><strong>Yes, but the degree to which it happens varies and there is no current standard approach.</strong></td>
<td><strong>Yes we are actively participating in its assessment. No if the question means between Local Authorities.</strong> <strong>Mainly in prevention of floods by taking adequate measures to prevent it by planning enough green spaces, infiltration and discharges.</strong></td>
</tr>
<tr>
<td><strong>Management of pluvial flooding is a local scale responsibility (municipalities, polders, water boards, provinces, waste water treatment companies). The water management planning in Flinders is organized on 3 different levels (river basin, basin, sub-basin), where the sub-basin level is the responsibility of these local managers, taking into account the principles and objectives of the plans on a higher level.</strong></td>
<td><strong>Yes, Pluvial water has to be retained or separately drained, if possible.</strong></td>
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#### 3.5.1.8 Are any institutional changes in this aspect anticipated by the transposition of the Floods Directive (2007/60/EC)?

<table>
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<tr>
<td><strong>Yes, the SI 3042 was introduced in December 2000 and there will be more new legislation in 2011, the Floods &amp; Water Management Bill and further secondary legislation which so far has not been determined.</strong></td>
<td><strong>No.</strong></td>
</tr>
</tbody>
</table>
| WOF Ref | EVA Ref | Question | Country | Available on Pluvial Flooding | Yes | In Flanders two kinds of records are available in detailed maps (level of detail 1:13,000) - topologically or naturally flooded areas (NOG map) based on the detailed (Begon soil maps with delineation of soil without profile development (colluviums in hill-stopped areas caused by historical mud streams, alluvium in river valleys caused by historical river floods and pluviated grounds in areas below sea level and so historically flooded by the sea); recently flooded areas (ROG map); these demarcate the effectively flooded areas in Flanders that were recorded between 1998 and present. Pluvial flooding is also incorporated in these maps, without difference from other types of flooding. Further we have maps with the modelled flooded areas (MOD), based on hydrologic and hydraulic modeling of all rivers with a catchment of at least 6,000 ha, and ever a list of smaller ones. | Yes | Communities (e.g. authorities): The QDF’s Water’s Office for instance for the Greater Lyon, and in general, the GIS Office | State government is in charge of collecting data, but, sometimes local authorities do it, with studies offices.

| 4.2 | 2 | Data and Records Available on Pluvial Flooding | Germany | | Yes | The Water authority gathers this information, but the link with another operational department doesn’t exist in many cases. | Yes | | |
| 2.3 | Are records of pluvial flooding combined with records of other types of flooding? (Pluvial flooding can often occur at the same time as other types of flooding such as river flooding or sewer flooding. Nevertheless, records of combined flooding are still valuable.) | All flooding is recorded on a single database. | Yes, all combined in the HOG maps. | Yes, all kinds of flooding are recorded. | Yes. The data base incorporates these details. |
| 2.4 | Are any criteria applied to assess the significance of a pluvial (or surface water) flooding event? For example rainfall intensity, extent and type of damage. | Not currently | Yes – Rainfall intensity; physical evidence e.g. overland flow. | On the ROS maps the extent of flood events, the period and the cause are recorded. | Yes: rainfall intensity, return period. Extent and type of damage in preparation, corresponding to the EU Flood Directive 2007. | Yes: The type of damage is distinguished from the other observations. |
| 2.5 | What is the content of records? - Date and times? - Meteorological data? - Type of flooding? - Impacts (flooded areas, water depth, damage, loss of life)? - Causes? | All or the above, but not in every case. | Yes to all. (Type only since 2004/05. Causes where apparent.) | Yes / No / No / Yes / Yes | Yes / Yes / in Preparation / in Preparation / No / No |
| 2.6 | What is the period covered by available records? | From 2004 with any degree of completeness, more historic data exists but there is no standard format to it. | From 2004-09 for strict pluvial flooding | Records for HOG maps are gathered since 1998. | Minimum last 30 years. | The best data bases cover the 20 years, and furthermore the 93 lasts. |
| 2.7 | In what formats are data available? | Both electronic databases and hard copy for older records. | Various Excel reports: rainfall records | Shape files | Not in all cases. Excel | It's different for many organization, because of being used of different GIS. |

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<tr>
<th>WP Ref</th>
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<th>Respondent</th>
<th>Country</th>
<th>Guidance on Mitigation Measures</th>
<th>Other guidance used? If so please provide details</th>
<th>Are measures already applied to deal with pluvial flooding? If so please provide information on the type of measures applied under the broad categories of:</th>
<th>Other Information</th>
</tr>
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<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>5.1 3.1 Is national guidance available which is relevant to managing the risk of pluvial flooding (or surface water flooding)? If so please provide details.</td>
<td>Yes through various from various agencies Delta, DIO and CRRA being the main ones</td>
<td>Belgium</td>
<td>No separate pluvial flooding guidance</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>5</td>
<td>3</td>
<td>5.2 3.2 Is other guidance used? If so please provide details.</td>
<td></td>
<td>Canada</td>
<td>Yes - CRRA publications</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>5.3 3.3 Are measures already applied to deal with pluvial flooding (or surface water flooding)? If so please provide information on the type of measures applied under the broad categories of:</td>
<td>No</td>
<td>-</td>
<td>No - these are being developed under FRC project</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>Yes - Controlled flooding areas / small scale flooding areas, erosion control plans submitted to municipalities by Flemish authorities and measures; mandatory rainwater tanks, infiltration and buffer facilities / grants and subsidies for sustainable agricultural techniques</td>
<td>Yes / Yes - Retaining pluvial water in the catchment areas, in the hills, the woods, the meadows</td>
<td>-</td>
<td>-</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Infrastructure: 110 years rainfall, size of the catchment, streamflow coefficient and slope for sewer pipe Not known Not known Not known</td>
<td>-</td>
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Summary of Discussion Points
Discussion Points

This Workshop can:

• Promote exchange of ideas in pluvial and surface water management and encourage new and innovative approaches and techniques across Europe.
• Present exciting opportunities to contribute to improved understanding in urban flood management and dealing with pluvial and surface water flood risk.
• Support evolving good practice in pluvial and surface water management.

We need to consider:

• What we can learn from the questionnaire responses.
• Key issues.
• Needs for further guidance and research.
Questions?

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