Minutes of the Interreg III FLOOD1 End Users Meeting
held on Wednesday 23rd May 2007 at 2:30 p.m. in LT1.

Present:

University of Brighton and British Geological Survey
Rory Mortimore, David Pope, Ian Molyneux, Neill Hadlow, Brian Adams (BGS), Anne Williams (BGS).

FLOOD1 Advisory Group
Raymond Coe (Black and Veatch), Martin Eade (Brighton and Hove City Council), John Ellis (Environment Agency), Lindsay Frost (Lewis District Council), Mike Packman (Southern Water), Colin Warren (Halcrow Group).

Additional End Users
Lawrence Mockett, Cllr Jeane Lepper, James Rhodes, David Harris, Melanie Andrews, Rosa Tyson, Ian Tripp, John Hunter, Brian Dudman, John Challoner, Claire Sheahan, John Hall, Chris Frith, David Cobby, Jane Burstow, Sue Garlick, Graham Birch, Helena Wicks, Ulrike Feistel, Richard Allitt, Graeme Lake and Richard Charman.

Edward Rhodes was in attendance.

Apologies for absence:

Received from Martin Smith (University of Brighton)

1. Welcome and General Introduction

Raymond Coe (Black and Veatch) introduced the event and welcomed attendees. He briefly introduced the European Union Interreg III scheme which ran from 2000 to 2006 and which has provided €5 billion in grants with the FLOOD 1 project being one of the more heavily funded schemes. FLOOD1 comes under strand A of the Interreg scheme which funds schemes involving cross border collaboration between two or more adjacent European regions from different Member States. The FLOOD1 project involves four UK local authorities (Brighton and Hove, East Sussex, Kent and Medway) and four French Départements (Nord, Pas de Calais, Seine Maritime and Somme).

2. Introduction to the project and the role of the University of Brighton

Rory Mortimore welcomed the attendees and noted that a key objective of any Interreg funded project is to communicate the results to the community. Professor Mortimore thanked the members of the Steering Committee and introduced the three main parties involved in the project, namely: the University of Brighton, the British Geological Survey and the French BRGM. He particularly noted the role played by Ian Molyneux and Neill Hadlow as the only full-time members of the FLOOD1 team.

The project focussed on three main sites, namely:

- Patcham Valley
- Pang Valley (East Ilsley)
- Somme Valley (Hallue)

Professor Mortimore explained that approval of the project gained added impetus from the 2001 floods in southern Britain and northern France.

The key objectives of FLOOD1 include:

- To understand the hydraulic behaviour of water flow in the unsaturated zone leading to the triggering of groundwater flood events
- To develop unsaturated zone monitoring techniques (such as Magnetic Resonance Sounding).
- To provide more appropriate methodologies and tools for forecasting groundwater flood events.

Due to the overall size of the Somme valley, the project has had to focus on a specific area around the Hallue river catchment that includes a gauging station. In this area a number of existing British Army wells exist dating from the First World War. The project has also benefited from recent work carried out associated with ground collapse of part of the TGV Nord railway.

Initial findings conclude:

- That predictions based on only 39 years of data are of limited value
- That forecasting based on rainfall alone is also of limited value
- That new forecasting models are needed, especially to better predict the time, location and duration of groundwater flooding events.
- That these new techniques and models need to be based on extensive research into the geology of the area.
- That a greater focus on the unsaturated zone is required.

Professor Mortimore briefly explained the structure and function of the saturated and unsaturated zones in the storage and flow of groundwater through chalk.

He also outlined the role of the Research Sites set up at Patcham and the Hallue Valley which utilise boreholes and a range of other ground monitoring equipment which it is hoped can remain in use after the end of the project. The various techniques, particularly the measurement of pore water tension, logging of cores and video camera logging, were briefly introduced.

Professor Mortimore noted that the project requires 50% match funding from industry which has enabled the research team to obtain valuable information from various diverse organisations and projects, including East Sussex Fire and Rescue Service, the Highways Agency, Black and Veatch, the Channel Tunnel Rail Link and the A303 Stonehenge Diversion Tunnel. The role of the University of Brighton includes providing ground model data, field logging, laboratory work and utilising industrial contacts.

3. The role of BGS and BRGM including field sites and monitoring

Brian Adams (BGS) introduced the work of the BGS and its French counterpart BRGM.

It was noted that BRGM came to the FLOOD1 project having already established a hydrogeological model of the Somme valley, which has had some success in predicting the floods of 2001 though not their extent and duration. The BRGM had also made use of the GARDENIA ground water model and hope that the FLOOD1 project will enable them to improve the accuracy of their models for predicting groundwater flooding.

It was noted that at Patcham a particular borehole has been used to predict flooding (although James Rhodes, a local resident, has made helpful suggestions in this regard) and an interesting feature was noted whereby when local groundwater level has passed the 'switch on' point triggering a flood, it continues flooding even when regressing below this initial 'switch on' point until reaching a much lower 'switch off' point. BGS hope that FLOOD1 research can increase the warning period which can be given of an impending ground water induced flood event.

The main equipment in use at the three main sites was briefly summarised, as follows:
- The Patcham site utilises two boreholes to the north of Waterhall with deep tensiometers installed. A nearby Recharge Site includes rain gauge, shallow tensiometers and a Neutron Probe (which measures water content in the unsaturated zone)
- The East Ilsley site whilst utilising boreholes does not have a Recharge Site as existing monitoring sites in the area can provide this data.
- The Hallue valley site also includes a Recharge Site and boreholes with both shallow and deep tensiometers
- BRGM has also been able to make use of a non-destructive technique called Magnetic Resonance Sounding to measure water content of the chalk in the unsaturated zone. It was noted that although this technique was under development for use in chalk, ultimately it could remove the need for drilling to determine natural moisture content. The BRGM have also provided a number of chalk core samples for testing at Brighton.

Hydrographic testing at the three sites has indicated the following:
- That the Hallue and Pang sites while flooding less easily flood for a longer duration.
- That the Patcham site floods relatively quickly but for a shorter duration.

A regression analysis approach to past ground water levels has also proven useful in predicting flood events. Having established from a particular minimum point and the amount of rainfall received in the period up to the next maximum point, it is possible to use this approach to forecast the time and ground water level of the next maximum if the time of the previous minimum point and the amount of subsequent rainfall is known. This model could be used as the first stage of a tiered model of flood prediction, although it is currently only in the early stages of development.

Brian Adams closed by reporting that results from jacking tensiometers at Patcham and East Ilsley have confirmed that Patcham behaves as a multi-tiered system whereas East Ilsley behaves as a continuum. It is known that water tensions (or suction) in the unsaturated zone of -50hPa or above leads to water flow in the fractures of the chalk matrix. At Patcham the tensiometers showed rapid flow with regular readings above -50hPa. At East Ilsley the potentials are usually less than -50 hPa thus leading to slower water flows. Improved knowledge of the behaviour of the unsaturated zone should lead to better flood prediction.

4. Benefits to end users

4a. The Environment Agency – John Ellis
John Ellis briefly explained the role of the Environment Agency as the environmental watchdog for England and Wales, with particular responsibility for the management of water resources (including aquifer protection and the granting of extraction licenses) and flood risk management.

He indicated that the Flood 1 project would be especially helpful for the Agency's Water Resources work in Groundwater Modelling, Aquifer Protection and Abstraction Licensing.

He noted in particular that the existing groundwater models used by the agency have relatively little information relating to the unsaturated zone.

For aquifer protection purposes, the Agency defines Groundwater Protection Zones around public supply and potable private sources. These define the controls needed to protect the aquifer against potentially polluting operations. A better understanding of the way groundwater moves through the unsaturated zone to the water table would help in defining these protection zones and assessing risk to sources.

The Environment Agency is also responsible for granting licenses for water extraction, and must ensure that such extraction does not harm the environment or infringe upon the rights of existing extractors. Again, a better understanding of the mechanisms governing groundwater flow in the unsaturated zone and how this influences groundwater levels is important.

It is therefore hoped that FLOOD 1 will be able to provide improved understanding of the hydrogeological processes to help in these areas of the Agency's work.

4b. The Environment Agency – Ian Tripp

Ian Tripp gave a number of examples of the impact of recent flooding events with a particular focus on the 2001 flood which affected at least 60 towns and villages and over 300 properties (possibly as many as 500). In many areas this was the largest groundwater flood event on record. The impact of other contributory factors such as rainfall and river flow was also considered.

It was noted that whilst the measures which people can use to protect their homes are relatively limited, their effectiveness is much improved when longer warning periods can be given, and it is hoped that FLOOD1 data will improve the prediction models.

The Environment Agency, in addition to its supervisory role, also has a duty to provide information on flooding and to support communities in developing strategies for dealing with flooding. It is hoped that more accurate data will be available as a result of the FLOOD1 project.

4c. Southern Water – Mike Packman

Mike Packman noted the support which Southern Water has given to the FLOOD1 project, including providing core samples and making geophysical logging data, conceptual models and extraction data available to the team. Flow logs and CCTV information has also been provided.

Mike Packman demonstrated the lack of uniformity between different samples of chalk. Providing a wider stratigraphical range of core samples has enabled the team to better understand the natural variation in chalk over a wide area.

Southern Water also has an interest in predicting droughts and the role of the unsaturated zone is considered vital in improving understanding.

In order to underline the importance of preserving groundwater sources it was noted that 70% of average daily water supplied by Southern Water comes from groundwater sites, with 108 operational sources (at least 88% of which are on chalk). 70% of groundwater sources require purification only indicating the relative purity of the water, although it was noted with concern that this represents a considerable decrease in the amount of water of this purity which can now be extracted from groundwater.

Climate Change predictions for 2020, while not directly applied to Brighton, indicate the likelihood of increased recharge during winter months (increasing the risk of flooding and pollution of the groundwater) and decreased recharge in the summer (resulting in increased drought).

The successful management and protection of aquifers requires a better understanding of groundwater behaviour and it is hoped that the work of FLOOD1 can help with this.

The risks to groundwater from cryptosporidium pollution (particularly from cow excrement) were briefly highlighted.

At this point the meeting adjourned for refreshments.

5. General discussion

At this point the meeting was opened to questions and comments from end users.

(1) Graham Birch (Network Rail) asked whether the charts indicating extended flooding, did in fact indicate extended flooding or the delayed onset of flooding. In response Anne Williams noted that these figures can be influenced by whether the monitoring points are upstream or downstream of the spring. The simple model used at present to predict flooding does not currently take account of the unsaturated zone.

Graham Birch questioned the impact of marl layers in this process. Rory Mortimore noted that a greater understanding of the geological evolution of the areas may increase understanding, and Mike Packman noted that it is interesting to consider the impact of groundwater reaching geological layers formed when sea levels were higher and which may therefore have more fissures.

It is hoped that FLOOD1 will be able to provide further answers to these questions.

(2) Lindsay Frost (Lewis District Council) argued that the most important result for local authorities is a model showing when and where groundwater will break surface, its impact on key infrastructure, and the possible precautions which can be taken. A model which could give several days notice would be extremely helpful.

(3) Martin Eade (Brighton and Hove City Council) noted that research on the severity and duration of flooding events is important, and that while FLOOD1 has opened up an interesting area of research, wondered if there is going to be a follow on project?

Rory Mortimore responded that no single research project can provide all the answers and hopefully the FLOOD1 project will be able to produce models to make predictions in different types of areas. Both Rory Mortimore and Mike Packman supported extended deployment of the field equipment beyond the duration of the FLOOD1 project to collect data and continued co-ordination between the work of the BRGM in France and whoever takes over the UK sites.

Brian Adams (BGS) noted that there is no immediate prospect of further EU funding for a follow-up project. He noted an interesting development in the Pang Valley site where a drought event one season led into a flooding event the following year, as an example of where other research can interact with the FLOOD1 project. Mike Packman stressed the importance of frequent data as monthly or even weekly sampling often misses out key events which can have a significant impact when fed into a larger model. Rory Mortimore recommended that FLOOD1 data be linked to a real time website. Raymond Coe stressed that there is interest in future work and argued that a future project funded under Interreg IV may be possible.

(4) James Rhodes (Patcham resident) stated that he knows a resident in Patcham who takes water readings from a well in his garden and uses the information to warn other residents of the possibility of flooding. James Rhodes asked the panel if there was any value in such amateur involvement.

The BGS representatives responded that they take such efforts very seriously and that a considerable amount of information relating to groundwater flooding has been gathered by amateurs.

(5) Graham Birch (Railtrack) asked whether the team had taken account of the flooding records compiled by the late D. B. Reynolds relating to the Folkestone and Dover rail network. Colin Warren (Halcrow Group) observed that it is difficult to use such datasets unless detailed information on the geology of the area is also available. The FLOOD1 team noted that the budget is limited and that they are not able to look deeply into data not immediately relevant to their aims and objectives. Indeed, the

data from industrial sponsors (e.g. Channel tunnel) has not yet been considered in detail, and the workload on the two full-time members of the team should be borne in mind.

Mike Packman noted that the dissemination of the results of the FLOOD1 project was likely to inspire research into other related areas such as railway flooding.

(6) Richard Allitt (Consultant) informed the panel that his consultancy does a lot of work related to flooding and asked the panel whether the models developed by the project would be able to give very precise data (e.g. related to individual dwellings) as to where flooding is likely to take place. Ian Molyneux responded that this will not be possible and that the FLOOD1 data, while increasing the knowledge of flooding, will not be able to replace individual surveys on properties or eliminate the risk of flooding.

It was noted that parish records often provide extremely valuable clues as to past flooding events, often mentioning individual dwellings, which may prove useful. Richard Allitt argued that these records would not be of much use in areas where there has been no previous development. Rory Mortimore and others noted that this is true although very often memory of past flooding events is lost. It was also noted that sites are often affected by surrounding development.

(7) John Hall (Black and Veatch) asked the panel what they regarded as groundwater flooding and asked if it was regarded that the emergence of ephemeral streams was evidence of groundwater flooding events?

Ian Molyneux noted that chalk catchments behave differently but that high rainfall intensity can factor in to groundwater flooding in some areas. In response to John Hall's concerns about the difficulty in forecasting flooding based on groundwater alone, Ian Molyneux observed that it is possible to measure and forecast the response by different catchments to different circumstances if enough information is known. Mike Packman observed that, in his experience, significant changes in flooding behaviour represent changes in the chalk.

6. Closing comments

Raymond Coe closed the meeting and noted the value of the FLOOD1 project in developing predictive models.

He advised attendees that a technical forum will be held at the University of Brighton in July 2008 which may be appropriate for those with a scientific background. Further details of the technical forum will be available nearer the event.

A French End Users meeting is also due to be held which may be of interest to French speakers.

Rory Mortimore noted that the project is beginning to produce results and stressed again the importance of a greater understanding of the unsaturated zone.

Raymond Coe thanked all attendees for coming. The meeting closed at 7:00 p.m.