ISSUE STUDY 1

DATA & MODELLING

FARMING FLOODPLAINS for the FUTURE

Computer modelling is utilised by a wide range of environmental disciplines, including hydrology and flood management. During the course of the Farming Floodplains for the Future project, appropriate flood modelling techniques were used or trialed. It was deemed that these tools could potentially fulfil two roles :-
1) Provide an overview of hydrology and flood risks, and therefore inform the targeting of the work of the project.
2) Inform the design of schemes on specific sites and establish potential impacts.

Within the catchments covered by the project, the only pre-existing hydraulic model is for the Rivers Sow and Penk (extending from their respective 'head of main river' to downstream confluence), built for the Environment Agency and updated following the summer 2007 floods. This comprises a 1-dimensional model capable of showing flows over time and therefore the timing and extent of flooding. The model is well calibrated, using extensive real data collected from a series of stations located through the system (that have been recording for between 10 and 40 years), and is therefore deemed reasonably accurate. Beyond these two major river channels, no other flood models exist, even on key tributaries designated by Defra as 'main river'[1] .

Appraisal of this model proved useful in confirming areas at greatest risk of flooding, identifying areas to target the project's work, and providing quantification of the scale of the issue to be addressed - see section 3 of the Farming Floodplains for the Future final report. The model has also been effective in assessing the impact of individual schemes on sites falling within its parameters (for example it has been possible to assess the benefit of re-planting floodplain woodland in the middle reaches of the River Sow (see Case Study 8 – Fieldhouse Farm)). However, for sites associated with tributaries and headwaters, any models deemed potentially appropriate would have to be specifically built.

Any model is only as 'good' as the data used to construct it – the poorer and less accurate the data and the more specific the site to which it is applied, the more 'uncertainty' is associated with the output of the model, and this is where the use of models became increasingly problematic for the Farming Floodplains for the Future project. Topographical data for the 'main river' corridors is generally good, with extensive LIDAR[2] data (although even this does not exist for the most upstream of sites). However, there is virtually no gauged data of water levels or flows, with the project lacking the resources, especially time, to be able to collate a robust body of baseline data. This in itself does not preclude the construction of models, but they have to be reliant on standardised figures based on catchment characteristics such as rainfall, slope, geology and soils, land use etc. The result is increasing 'uncertainty' – in the worst case scenario, two different approaches to the modelling of one site resulted in an 8-fold difference in predicted peak flood flows. In other words such modelling is not deemed sufficiently accurate at field / farm scale to effectively inform scheme design.

The question therefore is whether this is deemed to have hindered the project and its delivery. Throughout, Farming Floodplains for the Future has sought 'common sense' solutions that are sustainable and work with the natural environment. Consequently designs have simply drawn on site visits, topographical data, the knowledge and observations of the landowner, and the skills and experience of the project officer. In no situation is it felt that the design of a scheme has been overly compromised by the lack of a model. Admittedly, taking an 'informed' rather than 'detailed design' approach means that the delivered scheme may not necessarily be 'right' first time (e.g. a spillway may in reality overtop more frequently than anticipated). However, the low-tech approach adopted by Farming Floodplains for the Future means that alterations are straightforward (e.g. piling earth onto a spillway to increase its height) – arguably the hundreds of pounds required to get a contractor back onto site is more cost effective than commissioning a computer model (even a simple model can cost £3000+). [A note of caution at this point : where Environment Agency consent is required for a scheme that is proximate to and may present a risk to properties, the Agency may insist on some basic modelling to support a consent application.]

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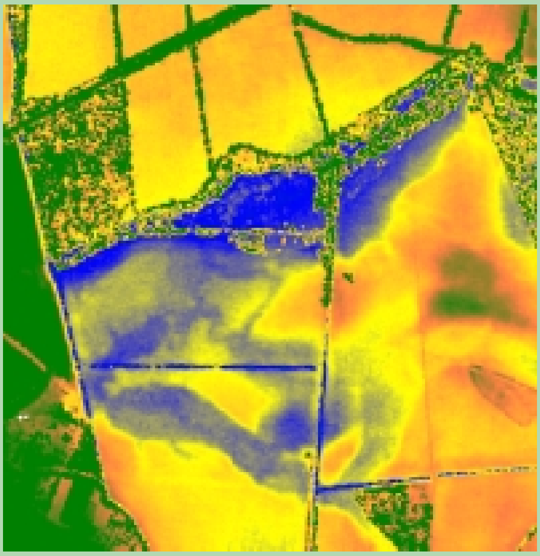
[1] Generally larger streams and rivers of strategic importance, but also including smaller watercourses of local significance
[2] Light Detection and Ranging – a form of flown remote sensing providing accurate topographical data

Although there are issues relating to the use of models, Farming Floodplains for the Future experience has shown that good topographical / levels data, whether LIDAR where this exists (see Box 1) or the result of simple site-specific survey, is invaluable in informing the design process. This includes determining feasibility and acceptability – for example, what seemed an ideal opportunity to attenuate water in a small valley on the Seighford Estate (to the north west of Stafford) was dropped when the levels showed that the storage of any meaningful volume of water would require the construction of bunds exceeding 2 metres in height. Such is the value of this data that the project eventually invested in a laser level, which has also proved invaluable in guiding and checking implementation of works on the ground.

In terms of assessing the impacts of the Farming Floodplains for the Future project, levels surveys have been used to estimate volumes of water storage created on sites. However, the lack of accurate modelling tools means that it is not possible to determine the frequency at which storage will be utilised or by how much downstream flow is slowed. It is believed that this can only be achieved through the long term monitoring of sites (see Issue Study 2: Monitoring).

Box 1: LIDAR Data

The accuracy and therefore potential usefulness of LiDAR data is demonstrated below. In the LiDAR image, the colours correspond to ground heights (blue being the lowest, grading through to orange at the highest). The aerial photo to the right shows the same site during a flood event, with the standing water closely correlating with the lowest lying ground.



Conclusion

In conclusion, it is recommended that where there is a pre-existing model, particularly one that is well calibrated, this be utilised, both to inform wider targeting and for site specific design (although the latter will also require site investigation / ground truthing). Where no such model exists, the value of specifically commissioning a new model has to be questioned. While a broad scale catchment model *may* be of value at the outset of a new project, anything at a smaller scale is unlikely to be beneficial, particularly if good topographical data is available or can be collated – taking the Farming Floodplains for the Future approach, the funds could arguably be better spent furthering delivery on the ground.