

## Inland Flooding Impacts

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### **Objectives of Paper**

The objectives of this paper are to consider issues and a way forward for managing potential impacts of climate change on inland and estuarine flooding.

This paper will not consider scale of changes in terms of increased storminess, flood flows and frequency, etc., as this is an issue for climatologists. Conor Murphy's paper has set out projected scenarios based on the emerging international scientific consensus, as published by the Intergovernmental Panel on Climate Change (IPCC) reports. The role of the OPW, as the Government's lead agency in the management of flood risk, is to take on board advice and the current range of estimates coming from climatologists, and to develop and implement policies and procedures for managing the potential change and, most importantly, the associated uncertainty.

### ***Challenges***

#### *Uncertainty*

The biggest challenge is the uncertainty associated with the climate change scenarios being developed by climate scientists. If we knew with confidence what was going to happen, it would be far easier to make the economic and other decisions related to investment in flood protection and risk management works, development planning, etc. The uncertainty requires policies to be implemented that are based on emerging scientific data and general assumptions about its impacts.

#### *Adaptability*

Adaptability is another key challenge that is intimately linked to uncertainty. We have to carry out the design of flood defences to current estimates of flows. It is necessary to make provision for anticipated from climate change impacts on the design parameters, if this approach is acceptable when measured against the various cost or environmental assessment criteria (the 'Precautionary' approach). We must ensure also that the construction works we carry out are as far as possible, adaptable at a future date, to cater for the anticipated as and when they materialise. The degree, cost and acceptability of this adaptability are now criteria against which the OPW assesses flood relief scheme options. The challenge is how to apply this (new approach – risk management) and to assess economic viability of defence schemes in face of the uncertainty.

#### *Design Standards*

The issue of design standards is related to the issue of uncertainty. For example the recently-completed Kilkenny flood relief scheme was designed to provide protection against the 1% flood. We don't know however, what level of protection the scheme will provide in 50 yrs,

and hence what works need to be planned and financed to maintain the design standard, and indeed whether it is economically viable to maintain this standard.

This topic is tied also into the concept of risk management (as opposed to protection measures) and to adaptability. As we move to a risk management approach in which the risk is most economically reduced and with a strong emphasis on adaptability of the constructed scheme to meet future change as it emerges, the concepts of fixed design standards is no longer relevant.

The adoption by the Government of the Report of the Flood Policy Review Group provides the framework to the OPW to change in a fundamental way how we approach the issue of flood protection.

Before looking in detail at this report and the OPW's Implementation Plan, I will look briefly at how other countries have approached the issue of flood risk management in the aftermath of the significant flooding experienced throughout the 1990s and early 2000s.

### **International Approach**

The issue of flood risk management is not unique to Ireland. It has been identified as an issue at EU and UN level. It is useful to take a brief look at developments in these organisations as a guidance to how we might best address the problems.

The significant flood events of the 1990s, the loss of life and the damage to property and the economy of several European countries, led to some fundamental examinations of the issue of flooding, its impacts, and the actions of human activity and development in floodplains.

#### **United Nations Economic Commission for Europe (UN ECE) document**

In 2000, the Economic and Social Council of the UN published a paper on Sustainable Flood Prevention,<sup>1</sup> which recommended

*“... measures and best practice to prevent, control and reduce the adverse impacts of flood events on human health and safety, on valuable goods and property, and on the aquatic and terrestrial environment”.*

It provided guidelines for flood prevention and protection and was a strategic rather than technical document. It set out some basic principles and approaches to sustainable flood protection, and advises that a change of paradigm is needed in the way we deal with flooding, shifting from defensive action against hazards to management of the risk.

This was more concerned with development in the flood plains rather than with the impact of climate change. It did however put the issue of development in areas at risk of flooding on the international agenda, and set the stage for the EU Water Directors to develop a Best Practice document.

## European Union (EU):

Following significant flooding in mainland Europe in the mid 1990s and early 2000s, the Water Directors of the EU published a document entitled *Best Practices on Flood Prevention, Protection and Mitigation*<sup>2</sup>. This document extends and updates the UN/ECE document discussed above, and importantly it set the groundwork for an EU Directive on flooding.

### *Floods Directive*

The opening paragraph of the proposed EU Directive on the assessment and management of flood risks states that

*“The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community.”*

The main requirements of the Directive are:

- To undertake a preliminary flood risk assessment
- To prepare flood hazard maps and flood risk maps
- To establish flood risk management plans coordinated at the level of the river basin district
- To coordinate the application of this Directive and that of the *Water Framework Directive*.

## UK:

### *Foresight Report*

The Foresight report (2004)<sup>3</sup> was commissioned by the UK Dept. of Trade and Industry, and published in April 2004. In his preface to the report the UK Chief Scientific Advisor to HM Government Sir David King says

*“There are two key messages. Firstly, continuing with existing policies is not an option – in virtually every scenario considered, the risks grow to unacceptable levels. Secondly, the risks need to be tackled across a broad front. Reductions in global emissions would reduce the risks substantially. However, this is unlikely to be sufficient in itself. Hard choices need to be taken – we must either invest more in sustainable approaches to flood and coastal management or learn to live with increased flooding.”*

### *Making Space for Water*

Following the flooding of the 1990s and particularly the severe floods of autumn 2000, the Minister with responsibility for flood risk in the UK, requested the President of the Institution of Civil Engineers to set up a Commission to undertake a technical review of approaches to river flood defence and make recommendations for flood risk management in the future. In Nov 2001, the ICE in the UK published, "Learning to Live with Rivers".

The Department for Environment Food and Rural Affairs (DEFRA) is the designated lead Government department for flood defence and coastal protection in the UK. DEFRA is leading the development of a new cross-Government Strategy for Flood and Coastal Erosion Risk Management, 'Making space for water'<sup>4</sup>, in close consultation with stakeholders. This is taking a holistic approach to management of risk from all forms of flooding (river, coastal, groundwater, surface run-off and sewer) and coastal erosion and is seeking to make sure that the programme helps deliver sustainable development.

### *Stern Report*

The recent Stern Review<sup>5</sup> on the Economics of Climate Change concludes that it is beneficial to invest now in mitigation measures, as the consequences of not doing so will be significantly more costly.

### **Others**

These are reflected in other jurisdictions also. Several countries have put in place an integrated approach to floodplain management. The Netherlands has put in place a "Making Room for the River" policy document, which aims, in the light of climate change to accommodate ever-higher extreme discharges without resorting to their traditional methods of raising dyke crest levels. There is a strong environmental awareness dimension to the policy also. In Canada, floodplain management incorporates an integrated approach to protecting the floodplain from further damages. It entails dealing with existing flooding problems and eliminating increases in the level of potential damage from further development. Both Australia and New Zealand are using the flood plain management planning approach to the dealing with the problem of development.

In all these jurisdictions, the impacts of climate change are influencing how they deal with development in and near floodplains.

### **Flood Policy in Ireland**

In November 2002 the Minister of State announced that a review of national flood policy would be carried out and established a Group of relevant stakeholders to develop a holistic and effective State response to flooding in the future.

The Report of the Flood Policy Review Group was informed by the Water Director Best Practice document and the UN/ECE document. It was accepted by Government in September 2004, and OPW were assigned as the lead agency in the implementation of the new policy. In

addition to setting out the responsibilities of the OPW, the Report also set out the responsibilities in the area of flood management of other Authorities; Dept. of Communications, Marine and Natural Resources (DCMNR); the Dept. of the Environment, Heritage and Local Government (DoEHLG), and the Local Authorities. A copy of the report is available on the OPW website<sup>6</sup>.

In summary the policy outcome is stated as:

*To minimise the national level of flood risk to people, businesses, infrastructure and the environment, through the identification and management of existing, and particularly potential future, flood risks in an integrated, proactive and catchment-based manner.*

In effect, it will require

- Development of the policies and frameworks necessary to enable effective flood risk management,
- Development of operational programmes to manage existing risk in a cost-effective, integrated and pro-active manner, and
- Development of the strategic information monitoring and analysis programmes that are critical to enable the implementation of the operational programmes noted above and for informed decision-making and the effective management of flood risk.

The policy introduced a shift away from solely structural or constructed flood defence measures to non-structural measures, emphasizes a risk management approach in particular the management of future risks that may arise from development or climate change.

I will return to this later, but I would like first to outline the OPW's implementation plan under our new responsibilities.

To give effect to the co-ordination role of the OPW in implementing the policy, OPW has established an Inter-Departmental Co-ordination Group to oversee and monitor the implementation of the new Policy at a strategic level. The membership of this Group comprises those organisations for which a significant role was identified within the Policy Review Report.

Bi-lateral and tri-lateral discussions between principal stakeholders, such as the OPW, DoEHLG and DCMNR, Met Éireann, EPA have taken place to ensure effective data management, co-ordination and communication between these organisations.

To meet the OPW's own responsibilities under the policy, we have developed also a number of work programmes. I have included a brief description and update of each programme in the Appendix to this paper. I would like here to outline some of the more relevant ones for the topic of our discussions today.

## **OPW Work Programmes**

### ***Catchment Flood Risk Management***

Underlying the policy is a fundamental shift in the way we deal with flood risk and is reflected in our Catchment Flood Risk Management Programme. The objective of the programme is to develop and implement an integrated, pro-active and catchment-based approach in line with international best practice to ensure effective management of existing and potential future flood risks

Under the Programme, it is intended to carry out Catchment Flood Risk Assessment and Management Studies Plan (CFRAMS) for each river Catchment. The output from these studies will be a Flood Risk Management Plan (CFRMP) that define existing and foreseeable flood hazards and risks within a catchment and the methods, mechanisms, policies and proposals for managing the hazards and risks.

The CFRMP includes examination of ‘most likely future scenario’ in terms of risk, and management options for dealing with the risk identified. It is important to note that climate change is considered at every stage of the CFRAM process.

We have begun this process with pilot studies on the River Lee and the River Dodder. There is an informative website for the Lee project for anyone seeking further information<sup>7</sup>.

### ***Flood Mapping***

The objective of the Flood Hazard Mapping Programme (FHMP) is to identify areas of land at risk from flooding and disseminate this information in a clear, effective and efficient manner to provide the flood risk information necessary to empower planning authorities, the public and other stakeholders to make informed flood risk management decisions. It is, therefore, an essential foundation for many aspects of the policy implementation.

The first phase of the programme, which was completed during 2006, had two aspects:

- (a) The development of the Internet based GIS system to provide easy access to flood information.
- (b) The collection and verification of information in relation to past flooding incidents from more than 40 Local Authorities and other State agencies.

The website for the historic floods was launched in October 2006<sup>8</sup>.

The mapping exercise is continuing and the next stage is to develop predictive flood envelopes for a number of flood probabilities, which includes mapping of the most likely future scenarios to provide information on extent and depths (and in some instances velocities) of flooding that might occur in future.

Such future scenarios are, again subject to uncertainty and the publication of such information will have to be handled sensitively.

The predictive mapping gives rise to some issues that are tied to the uncertainty dimension referred to earlier. I will return to the topic of uncertainty later in the paper.

### ***Planning & Development Management***

Planning and Development Management that is sensitive to the issue of flood risk and appropriate to it is critical to management of future risks. The Planning and Development Act (2000) allows Planning Authorities to refuse planning permission without compensation for developments at risk from flooding. To support this approach, guidelines are being developed; a process that is overseen by a steering group of the OPW, DoEHLG and DCMNR. It is expected that the guidelines will issue in early 2008, and will be comparable to the recently published PPS25 in the UK<sup>9</sup>.

### ***Summary***

In summary the approach taken to implement the new policy of Government, is in line with developments elsewhere in Europe and the UK. The approach meets the criteria set out by the Best Practice document published by the EU Water Directors and that outline in the UN/ECE document and allows future risks to be assessed and plans developed to deal with them in an effective manner.

With little change in our current approach, I expect that Ireland will meet our obligations under the forthcoming EU directive.

### **What Remains to be Undertaken**

A number of challenges are still to be faced to ensure that the risk management approach is embedded in not only the OPW work but in other bodies such as planning authorities and in the mind of the public at large.

### ***Planning and Development***

The CFRAM process described above, when implemented, will provide a risk management approach to development in a catchment. Existing and likely future flood risk will be identified and should be used by planning authorities in preparing Development Plans, Local Area Plans and deciding on individual planning permissions in their areas. The issue then is to build public support and confidence in the decision-making process and in the outputs from the CFRAMS.

This awareness of the flood risk, and the potential future increases in risk due to climate change are important issues in the planning and development process. However, an important (and difficult) task is to change perceptions that potential impacts of climate change on flooding are seen as significant considerations in policy and decision-making. This is applicable at all levels, from central Government (including policies, such as planning guidance, and financing), through local authorities (e.g., planning and permitting or refusing development) to the developers and the public (should they pursue a course of action in face of potential future threat?)

There are a number of policy issues in the area of planning and development control to be discussed and decided. They are related to the uncertainty challenge discussed above. How do we delineate floodplain areas? How do we enforce a 'no development' policy in floodplain areas of very high risk? To base the delineation of floodplain areas on our present estimates of a 1% or 0.5 % flood is to ignore the climate changes predicted. However to base them on the worst climate change scenarios may be difficult to justify and to win support at a local level. While adaptability is likely to be key to managing this issue, it would be interesting to hear the views of this audience on the matter.

#### *Flood Prediction and Drainage Design methodologies*

At present flood prediction methodologies are based on where possible a historic record of flows from a river gauging site, calibrated from flood events that have occurred over the period of the hydrometric record. The process assumes that records are a sample from a statistically stationary population of flood events and that in effect the future will be statistically similar to the past. Clearly in the climate change scenarios emerging, this assumption is invalid. New methodologies will have to be developed to allow engineering calculations and estimates to be made of flood levels for particular probabilities.

This area of work is an important one when the estimates are used in conjunction with flood maps to delineate floodplain areas, particularly when the issue of restricting classes of development in areas at risk of flooding is under consideration.

#### *Mitigation of Climate Change Impacts*

There are a number of methods that can be utilised to mitigate the impact of climate change. The use of Sustainable Drainage (SuDS) incorporated into new developments to limit the discharge from those developments to streams and rivers to the pre-developed level of flow. This would have the dual effect of limiting the flood potential of the development and protecting ground water levels.

A second issue is the use of catchment wide land use planning to reduce flood risk in centres of population. The use of wetlands, of bog restoration or of setting aside upstream areas of land to act as flood storage would also have the effect while reducing flood levels, of improving the wildlife and biodiversity of a river catchment. Such solutions have the benefit that even with increased rainfalls the flood peak may be kept at or below its present level and the risk to populated areas reduced.

There are, of course a range of issues to be examined before bringing forward such solutions. The issue of the effectiveness of such solutions requires research and evidence of their performance to demonstrate their effectiveness. The farming community may take issue with the idea of using farmlands to protect urban areas. The issue of landowner agreement, land purchase or compensation for the use of the lands may be contentious.

A third issue where the impacts of flooding may be mitigated is the to improve the resilience of buildings design and construction to the effects of flooding. The Association of British

Insurers (ABI)<sup>10</sup> has issued guidance for homeowners on the issue. Their website offers says that the guidance provides

- *options to improve a property's resistance to damage*
- *investigates whether investing in more resilient repairs, can result in a cost saving over time*
- *the relative risk associated with different commonly used types of floor and wall construction in their resistance to flood water penetration.*

It is an issue that may overlap with our Building Regulations area of responsibility and may be worth further investigation.

#### *Adequacy of existing defences*

There are significant flood defence assets in existence in various parts of the country. Where the OPW have carried out a capital works scheme these assets are known and maintained. This is not the case everywhere. In order to record such assets, as part of the CFRAMS process the OPW intends to develop a Flood Asset Register, identifying those walls, embankments etc. that are providing a level of flood protection. The task then will be the assessment of the level of protection the assets provide and how they will perform in the light of predicted changes.

#### *Engineering skills*

The engineering skills in the specialist areas of hydrology and river engineering that are required to meet the needs of society was identified in the UK by the ICE as a critical issue in meeting future requirements.

#### ***Conclusion***

In conclusion, I think it is fair to say that the recent review of flood policy and the implementation plan developed on foot of Government's approval of the review have put our approach to dealing with flood risk in line with the latest development across Europe. There is much still to be done but the direction is I believe the correct one and I look forward to the discussions at the workshop to hear how we might improve our efforts.

## **Appendix**

### **OPW Work Programmes**

This appendix outlines briefly each of the 15 programmes and the current state of progress in each.

#### ***Flood Studies Update Programme***

The objectives of the Flood Studies Report Update Programme (referred to as the Flood Studies Update - FSU) is to review and revise the 1975 Flood Studies Report, making use of the significantly increased volume of hydrological data and improved analysis tools now available, and to provide stakeholders with improved datasets and methodologies for estimating flood flows.

A number of research and development contracts required to implement the Programme were let in 2006, mainly to academic institutions within Ireland. Other commissions will be awarded during 2007. The Programme is due for completion in 2008.

#### ***Strategic Hydro-Meteorological Review Programme***

The objectives of this programme are to identify the long-term needs for flood-related hydro-meteorological data in Ireland, and to plan and develop a network of gauging stations and associated monitoring and management systems that will meet these needs. The review remit does not extend to low flows, water quality or water resources as these issues are addressed through the Water Framework Directive, but will need to be borne in mind during the review process.

A commission for a study that will examine existing data collection networks and recommend a strategy for filling any information gaps identified was placed in 2006 and it will be completed in 2007.

#### ***Research and Development Programme***

An outline structure of a research and development framework for flood risk management related studies e.g. the impact of climate change has been prepared, and it is expected that commissioning of projects will begin towards the end of 2007.

#### ***Flood Hazard Mapping Programme***

The objective of the Flood Hazard Mapping Programme (FHMP) is to identify areas of land at risk from flooding and disseminate this information in a clear, effective and efficient manner to provide the flood risk information necessary to empower the public and other stakeholders to make informed flood risk management decisions. It is, therefore, an essential foundation for many aspects of the Policy implementation.

The first phase of the programme, which was completed during 2006, had two aspects:-

- (a) the development of the Internet based GIS system to provide easy access to flood information.
- (b) The collection and verification of information in relation to past flooding incidents from more than 40 Local Authorities and other State agencies.

The website was launched in October 2006. Since its launch more than 12,000 users have visited the site and it continues to receive more than 100 visits on average per day. Feedback has been generally very positive and it has prompted users to contribute valuable additional flood information. The website will be enhanced during 2007 and additional flood information will continue to be added to it.

The website will also be used to display mapping showing predicted flood extents that will be generated over the coming years as part of the Flood Risk Management Programme.

### ***Flood Risk Management Planning Programme***

The objective of the Flood Risk Management Planning Programme is to develop for River Basins throughout the country Flood Risk Management Plans (FRMPs), where a significant flood risk exists or could arise, that define existing and foreseeable flood hazards and risks within a catchment and the methods, mechanisms, policies and proposals for managing the hazards and risks in a sustainable, integrated, pro-active and holistic manner.

Projects currently in progress under this Programme include:

- Lee Catchment Flood Risk Assessment and Management Study (A major pilot study that commenced during 2006 and will be completed in early 2008)
- Dodder Catchment Flood Risk Assessment and Management Study (OPW-funded project being managed in partnership with Dublin City Council)
- Tullamore Flood Risk Assessment and Management Study (localised study being undertaken internally by OPW that will be completed in 2007)
- Portarlington Flood Risk Assessment and Management Study.

A framework agreement to provide aerial surveys for future studies will be awarded in 2007.

### ***Flood Forecasting & Warning Programme***

Pilot Flood Forecasting and Warning Systems are currently being developed for three towns where OPW flood protection schemes depend on the erection of defences when flooding is predicted (Clonmel, Mallow and Fermoy). These systems will be implemented during 2007, in conjunction with the relevant Local Authorities. The possibility of developing a national flood warning system is under consideration and will be dependent on the priority to be accorded to different aspects of the flood risk management programme.

### ***Emergency Response Development***

This Programme will produce a template for Local Authorities in relation to flood risk related aspects of their emergency plans.

During 2006 research into practice in other countries was carried out and development commenced of a draft template for use in Mallow, Clonmel and Fermoy in connection with proposed flood Relief Schemes for those towns. It is expected that these will be completed in 2007.

### ***Public Awareness Programme***

Public Awareness/Preparedness is aimed raising the awareness of those in areas at risk as to what to do before, during and after a flood. An initial national Public Awareness campaign, featuring information leaflets, media notices and a dedicated website, [www.flooding.ie](http://www.flooding.ie), had been launched in 2005.

During 2006 the campaign was built upon, with a second national media campaign, updated literature and website, and also focusing attention on risk areas, through targeted distribution of information leaflets, billboard placement etc.

In 2007 an assessment of the effectiveness of these campaigns will be carried out with a view to refining future campaigns.

### ***Planning & Development Management***

This programme will result in the preparation of detailed guidance for planners, developers and other stakeholders relating to flood risk issues to be considered in relation to development.

A contract has recently been placed for a commission to develop the guidance material and it will be completed in early 2008. The project will be overseen by a team comprising representatives of OPW, Department of the Environment and Local Government and the Department of the Marine and Natural Resources.

### ***High-Risk Channel Designation***

Preliminary consideration of a policy and procedure for designating for maintenance by OPW high-risk channels that are not currently OPW's responsibility commenced in 2006. These will be developed during 2007.

### ***Prioritisation Systems***

An outline framework for prioritisation of Flood Policy programmes and activities / projects within programmes has been developed. It will be further developed during 2007.

### ***Asset Database & Management Programme***

The development of a defence asset database that will provide a basis for future maintenance programmes has been included in the contract for the Lee Catchment Flood risk Assessment and Management Study that will be completed in 2008. Asset data collection will be

undertaken through similar studies undertaken as part of the Flood Risk Management Programme.

### ***Review of Legislation***

During 2007 a detailed review of existing legislative provisions will be carried out to determine whether changes are required to underpin implementation of the Flood Policy.

### ***Communications Programme***

This programme aims to ensure that the various stakeholders in the area of flood risk management input on an ongoing basis to the implementation of the National Flood Policy. During 2006 various bi-lateral and multi-lateral meetings took place, with the following other Departments, Local Authorities and other bodies:

- Department of Communications, Marine and Natural Resources;
- Department of Environment, Housing and Local Government;
- Department of Agriculture and Food;
- Shannon RBD
- Dublin City Council
- County and City Managers' Association

A formal communications strategy will be developed in 2007.

### ***Flood Response Development***

Proposals in relation to formalising OPW's procedures for providing logistical assistance to Local Authorities or other state agencies during flooding and ensuring that valuable flood data is captured, was prepared. The procedures will be refined during 2007.

## Disclaimer

This paper was prepared by Tony Smyth, for presentation at a workshop on “Ireland at Risk”, to stimulate discussion on the potential issues relating to flooding. The views expressed are those of the author.

## Acknowledgements

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an executive summary may be downloaded from:

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