

EVersion2 Oct 2005

A joint CIWEM & RSPB Conference

Water Framework Directive Series

The Water Framework Directive & Hydro-morphology Challenges and Implications

9 November, 2005

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Sponsors:

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This event is accredited for Continuing Professional Development under the CIWEM CPD Scheme

Organised by **CMS - Coastal Management for Sustainability**

Introduction

The Water Framework Directive requires Member States to identify, assess and control all major anthropogenic pressures on the water environment, including pressures on the physical structure of rivers and coasts. This is explicitly recognised in the development of 'hydro-morphological' quality elements as part of the scheme for assessing ecological water quality; and in the provisions of Article 11 laying out the range of basic measures Member States must establish in order to transpose and implement the Directive, which includes a requirement for measures to control hydro-morphological pressures.

Hydro-morphology in this context involves:

- Flow regime, water levels, velocity and tidal behaviour.
- The physical structure of water courses, lakes and coasts, including riparian and inter-tidal areas.
- Wetlands and other features that have significant influence over water body ecology.

The scale of the challenge posed by this requirement cannot be underestimated. The recent WFD characterisation process identified hydro-morphological modification as one of the most significant pressures on the water environment. Many have suggested that addressing this issue will require a paradigm shift in the way water bodies and wider catchments are managed. What is clear is that there are a wide range of implications arising from seeking to meet the obligations of the WFD.

This conference will highlight how the hydro-morphological requirements of the WFD will impact different sectors and the range of tools and approaches UK Agencies are using to assess the scale of modification and their impact on ecology. Themes covered will include:

1. Flood risk management
2. Water resources
3. Coastal Management, including coastal squeeze,
4. Catchment scale water body restoration and rehabilitation to achieve good ecological status
5. Land-use management
6. Application of derogations including Heavily Modified Water Bodies
7. The economics of WFD-hydro-morphology
8. The Programme of Measures.

As this list shows there are a wide range of sectors and stakeholders who will be affected by this work. Although the WFD may pose a major challenge to these groups, it also offers opportunities to build synergies and integrate their management through the River Basin Management Planning process.

The conference is also timely as it will come after the initial meeting of the European common implementation group that is looking at WFD-hydro-morphology issues. The UK will be co-leading this task with Germany and will be key in influencing its outcomes.

Aims and objectives of the conference

The aim of the conference is to fully explore the linkages between WFD, hydro-morphology and the challenge of developing a more integrated approach. **The objectives** of the conference are to:

- Brief and update delegates on the current interpretation and analysis of the hydro-morphological implications of the Water Framework Directive
- Describe the main outcomes of the considerable work that has been undertaken to date and the major challenges that are facing WFD implementation
- Highlight the issues arising from the current situation
- Given the scope of the implications for many stakeholders explore the next steps in addressing the challenges ahead.

Programme

09.00 Registration and Coffee

9.45 **Introduction and welcome to the Conference on behalf of CIWEM**

Robin Green Wardell Armstrong LLP and CIWEM President

Session 1

9.50 **Hydro-morphology: What does it mean for the WFD?** **Rob Cunningham**, RSPB

10.10 **Hydro-morphological modification and its impacts on ecology**
Nicola Melville RSPB

10.30 **The WFD & Hydro-morphology – Work to date and challenges ahead**
Roger Proudfoot Environment Agency

10.50 **Deployment of morphological standards for rivers** **Stuart Greig** SEPA

11.10 **Flood risk management** **Jane Rawson** Environment Agency

11.30 **Water Resources and hydro-morphology** **Dave Burgess** Environment Agency

11.50 Refreshments and Buffet

Session 2 Chair **James Wishart** MWH

12.30 **Rehabilitation and restoration of water bodies on a catchment scale:
Effective delivery of ecological status** **Alistair Maltby and Lucy Dugdale** Eden Rivers
Trust

12.50 **Land-use management, environmental stewardship** **Tony Burch** Environment Agency

13.10 **Application of derogations including Heavily Modified Water Bodies**
Dave Corbelli SEPA

13.30 **Economic issues arising from WFD and hydro-morphology** **Kevin Andrews** Defra

13.50 **The challenges of policy integration WFD & Hydro-morphology -
A *Making Space for Water* perspective** **Linda Aucott** Defra

14.10 Issues arising

14.15 Break 2 Sweet and refreshments

Session 3

15.00 **Discussion Key issues, priorities, organisations**

Chair **Ruth Allen** Ewan Group plc

Panel including Jane Rawson Environment Agency and Rob Cunningham RSPB

16.00 Close Refreshments

Hydro-morphology: What does it mean for the WFD?

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When the Government launched its first consultation on the Water Framework Directive (WFD), back in 2001, the preface spoke of “demanding water quality targets” having to be met by 2015. The belief that the WFD was just another piece of water quality legislation from Europe has been widely held although the NGO community was quick to point the implications of reaching Good Status reach far beyond tackling traditional pressures on chemical, faecal and sanitary quality.

One of the radical departures from previous regulatory approaches was the introduction of water body hydro-morphology as a factor implicated in achieving Good Status. By doing so, the WFD requires Member States to protect and/or restore the physical structure and formative hydrological processes of surface water bodies in order to support Good Ecological Status.

Of course, many morphological modifications provide real economic, social, and in limited cases, environmental benefits and a number of exemptions to the “Good Status” and “No Deterioration” objectives are provided for. However, their application requires economic justification taking into account environmental and resource costs. Where exemptions are applied, they must be justified and consulted on through the River Basin Planning Process. Thus, the Directive places a burden of proof on too those seeking exemptions.

Implementing the Directive in the UK poses some fundamental challenges for the regulator and the regulated. These include:

- Developing an understanding of interaction between physical modification, hydrology and ecological outcomes.
- Characterising river and coastal water bodies and identifying those “at risk” of failing to meet Good Status because of physical modification or flow regulation.
- Introducing a regulatory regime to protect and restore the physical structure and continuity of river, lake, estuarine and coastal water bodies.
- Developing an economic framework to evaluate the application of derogations to the “Good Status” and “No Deterioration” objectives.

Additional Information

Catherine Peacock (2003) *Rivers, Floodplains and Wetlands: Connectivity and Dynamics A review of the importance of connectivity and dynamics on biodiversity and the implications for definitions of reference conditions and good status*. RSPB Publication

Rob Cunningham, Ruth Davis, R (2004) *The Water Framework and Flooding: Implications for flood defence and coastal management policy in England & Wales*. RSPB Publication

Rob Cunningham, Ruth Davis, Ian Dickie and Joanna Kemp (2005) *Saltmarsh: Restoration Requirements under the Water Framework Directive*. RSPB Publication

All available from rob.cunningham@rspb.org.uk

Hydro-morphological modification and its impacts on ecology

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It is almost impossible to over-estimate the magnitude of river and catchment modification that has taken place in the UK and much of western Europe. Attempts to, constrain flooding, improve drainage and navigation and produce power have touched all but the smallest and remotest streams. If we want to understand what the Water Framework Directive mean by a "Reference", or "High Status" water body, or talk about restoring the hydro-morphology of rivers and their floodplains to improve its ecological status, we need to look to eastern Europe to find what this means in terms of the ecological functions and geo-morphological features of a semi-natural lowland river.

The case study used here helps visualise the features and function of the more natural extensive floodplains lost from the UK. It also highlights some issues to consider when seeking to re-naturalise the hydro-morphology of our rivers.

The Polesie Lowland is one of the last semi-intact floodplain wetland wildernesses left in Europe, situated in Ukraine, Belarus and Russia. The catchment of the Prip'yate River is 121,000km², nearly 10 times the size of the Thames. The lowland itself drops only 20 metres in 300km and is a globally significant natural area, lying on migratory routes and hosting globally threatened species including aquatic warbler, greater spotted eagle, great snipe and corncrake.

The flooding of the lowland typically starts in March, rising 5-10 cm a day until its peak in April. The flood slowly recedes to the main channel over a period of three to four months. The habitat is a mosaic of grasslands, reeds, mire and woodland affected a complex inter-action of topography, human activity and river currents. Currents through the backwater maintain areas of swamp and grassland, pools and oxbow lakes retain water as the floods recede.

Although the Polesie Lowland remains Europe's largest floodplain wetland complex, it is not untouched. Traditional management, such as grazing and hay cutting, forestry can provide positive benefit for birds and other species. However, more recently large-scale drainage has encroached on the floodplain. The construction of polders has reduced the floodplain width from 30km to 10km in places, damaging the ecology of the drained area and the remaining floodplain and reducing its area by 40%. For instance, drainage has led to the loss of key fish spawning areas while the increased depth of flooding in the remaining floodplain has had impacts on wet woodland, nutrient transport and channel "flushing", and the breeding habitats of globally threatened bird species. It has also affected communities downstream by increasing the frequency and depth of flooding.

The Belarus Government in association with the BirdLife partner in Belarus are now taking action to re-naturalise parts of the polders. The approach proposed is akin to the managed re-alignment sites that we have on estuaries. The schemes ranged from 4000ha to 257ha. The extent of agricultural change varied from site to site. The following bullets summarises the key issues to consider when seeking to restore or re-naturalise floodplain areas. They highlight that it's not just a matter of putting a few breaches in existing flood banks.

- Adequate flow of water through the site for example linking breaches to old channel features; removing sluices and culverting or breaching inner banks – this is important for helping to flush the site and keeping areas open

- Currents through breaches should not stop fish accessing the site to spawn
- Adequate links to channels outside the re-alignment site and a good network of channels within to stop fish becoming stranded when the water levels drop
- Sufficient higher areas within the re-alignment area to provide more shallow flooded areas – sites with old floodplain features such as channels and islands were the best sites
- Local people still have access for management activities such as hay-cutting and finding new uses for floodplain products such as scrub cutting for biomass to encourage appropriate management
- Adequate links to areas of existing biodiversity – it will be very difficult to restore the full ecosystem and biodiversity of a natural floodplain like Pripjat, but the biodiversity we have needs to have access to new sites
- Sufficient scale of re-alignment to restore geo-morphological processes such as creation of back channels and floodplains pools
- Sufficient hydrological links between restoration areas
- Extreme events can access channels and pools in the restoration areas to clear vegetation and bring nutrients to more isolated pools within the floodplain
- Good understanding of overall hydrological effects and the flood regime that it is possible to restore for that particular river basin

WFD & Hydro-morphology – Work to date and challenges ahead

Roger Proudfoot

Environment Agency

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The specifics of how to manage hydromorphological pressures under the WFD are of significant concern across Europe. In the UK context, it provides a significant challenge in developing new policies and processes, new areas of scientific understanding and new regulatory powers; yet at the same time provides opportunity to improve an integrated approach in historically separate management areas.

As the Competent Authority for WFD Implementation in England and Wales the Environment Agency has progressed a number of work areas to improve understanding of what is required to address the hydromorphology pressure.

Using the best available information, the first round of **characterisation and risk assessment** gave us an insight into the shape and risks associated with water bodies. This initial characterisation identified that the hydromorphological pressure is one of the most significant facing England and Wales. This is a common theme across many Member States according to Article 5 reports returned in March 2005. The task ahead is to review of this initial characterisation and where possible, to work with stakeholders to improve the hydromorphological risk assessments to inform the first River Basin Management Planning round. There has been strong progression of **classification methods** for assessing the status water bodies based on hydromorphology. Alongside this work there are current projects operating with SEPA and co-ordinated by UKTAG in determining the alternative status targets that may apply to Artificial and Heavily Modified Water Bodies.

Ongoing work has also identified other significant challenges to the management of hydromorphology under the WFD. These include:

- A comprehensive scientific understanding of how hydromorphological change effects the ecological condition of a water body
- How to address areas of hydromorphological pressure where there are no current controls or powers to assist mitigation
- The complexity of monitoring for hydromorphological impact and success of mitigation measures
- The wide variation of management response that will be required for lake, TRAC and river water bodies
- How currently existing mitigation measures within the Environment Agency and elsewhere map across to WFD Hydromorphological requirements
- The significant and differing stakeholder interests in how hydromorphology is addressed in the context of the WFD

Considering the complexity and large scope of issues that relate to the hydromorphological pressure and it's management. The Environment Agency has developed a project to co-ordinate the development of work to completion and act as a focus for stakeholder and interested parties.

Websites:

Environment Agency WFD pages: <http://www.environment-agency.gov.uk/business/444217/444663/955573/?version=1&lang=e>

UKTAG: <http://www.wfduk.org/>

Sniffer: http://www.sniffer.org.uk/sniffer_overview.asp

A morphological impact assessment tool to support WFD implementation

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Use of information presented

The development of UK-wide classification methods and environmental standards that aim to meet the requirements of the Water Framework Directive (WFD) is being sponsored by UK Technical Advisory Group (UKTAG) for WFD on behalf its member and partners.

The information presented has been developed through a collaborative project, managed and facilitated by SEPA, Environment Agency and SNIFFER, and has involved the members and partners of UKTAG. It provides background information to support the ongoing development of the standards and classification methods.

Whilst project outputs are considered to represent the best available scientific information and expert opinion at the stage of completion of the work, it does not necessarily represent the final or policy positions of UKTAG or any of its partner agencies.

Abstract

This presentation summarises the outputs from a recent SEPA/EA work programme. The overarching aim of this project was to develop a simple, practical decision support framework for determining, whether:

- (i) A new river engineering activity on, or in the vicinity of, a surface water is liable to result in a deterioration in ecological and morphological quality;
- (ii) The extent of existing morphological alteration within the affected reach is likely to be compatible with the achievement of good or high morphological and ecological status.

The project was to cover direct morphological alterations- i.e. engineering works and other activities on or in the vicinity of rivers- and to consider how alterations to the surrounding landscape affect channel reaches and the ability for channels to absorb further.

The decision support framework outlined in this presentation centres on a set of Environmental Standards that aim to protect geomorphological processes and forms, and ecological integrity. These environmental standards represent current best estimates of the amounts of engineering activities, or combinations of activities, that can be permitted while still maintaining geomorphological and ecological integrity.

To support assessment and identification of these Environmental Standards, a Morphological IMPact Assessment System (MImAS), which is underpinned by an appreciation of how geomorphic processes create dynamic morphological features and habitats that support biological communities and species has been developed. The principle assumption being that an assessment of impacts on biologically and ecologically relevant features and processes promotes protection of both morphological and ecological conditions.

MImAS is a modular tool developed to help characterise the physical condition of rivers. The tool provides the basis for setting and applying Environmental Standards that can be applied to inform river engineer regulatory decisions and WFD morphological status classification. MImAS comprises five integrated, but independent, modules that provide information to allow:

- (i) Identification of channel sections that display similar morphologic and geomorphic properties, support similar habitats and biological communities, and respond to pressures in similar and predictable ways,
- (ii) Assessment of the cumulative impact of different engineering activities on relevant geomorphological properties of identified channel sections, and
- (iii) Determination of critical thresholds of impact that can be used to set morphological status boundaries and thus provide a basis for the setting of environmental standards.

The five modules combine to determine the total impact on a given section of channel. In terms of scoring, the impact assessment is underpinned by the concept of 'system capacity'. In summary, this concept assumes that rivers have a 'capacity' to absorb impacts, and that anthropogenic activities within rivers or in the surrounding landscape, exhaust some of a systems available capacity. Environmental Standards define permissible levels of impact on a systems available capacity that are compliant with WFD status classification boundaries.

In the first iteration of the environmental standards and MImAS, there has been a requirement to define a set of expert judgment-based environmental standards. These standards will represent best available knowledge of the amount of alteration, defined through MImAS, to a river channel that can be permitted within different morphological classification boundaries. Over time, the WFD monitoring programme and ongoing research will provide empirical datasets that can be used to validate and/or calibrate these standards, and/or the qualitative data sets underpinning MImAS.

Flood Risk Management

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The WFD is a major driver for fully integrated river basin management and it includes important indicators as to how flood risk management should be implemented. The wording of the Directive assumes that the benefits of integrating flood defence and water quality disciplines are recognised. The catchment-scale approach (already adopted by Flood Risk Management with the programme of CFMPs and SMPs) encourages broader consideration of the underlying causes of floods and droughts. Further, whilst there is undoubtedly a primary focus on achieving good water quality, the framework for alternative objectives and the clear provision to take economic and social considerations into account together enable Member States to balance the needs for flood risk management with achieving the necessary ecological improvement.

In March 2005 reports on each river basin were produced, including an analysis of its characteristics and a review of the impact of human activity on the status of the water bodies (1). Taken across England and Wales, by number, 42% of river water bodies, 77% of coastal waters and 91% of estuary waters are at risk of failing good status as a result of 'morphological pressures', including the presence of defences. This exercise has clearly demonstrated that the WFD is not a simple 'water quality' issue, and that it will drive us to manage activities across the whole catchment in order to deliver physical, chemical and ecological quality.

In order to justify ongoing flood risk management activity and any new proposals that have the potential to affect achieving the aims of the directive (including 'no deterioration'), our work will need to pass the tests of the directive in the same way as any other proposal. While some catchment-scale flood risk management policies may help to deliver the aims of the directive, others may not, and at an operational level the way in which we design and implement our work has the potential to impact on ecological status. Inherent to our work on the directive is the link between ecological status and hydro-morphological change – an area of scientific uncertainty. When assessing the potential for mitigation measures to combat the impact of our work on the wider environment, we need to ensure they are cost effective and will help achieve the objectives for that water body.

1. For reports on each river basin, see
www.defra.gov.uk/environment/water/wfd/article5/index.htm

Hydro-morphology and Water Resources: setting environmental standards for river flow to control water abstraction

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Sustainable management of water resources should include as much consideration of how much water should be left in a river to maintain a healthy ecology, as what might be taken out to meet human needs. This balance is reflected within the Water Framework Directive by the inclusion of river flow within the hydro-morphological elements to be considered when setting environmental standards to support good ecological status.

To date, the Environment Agency has used an environmental weighting method to derive the environmental standards for river flows for use within its Catchment Abstraction Management Strategies (CAMS). These methods were derived over six years ago and before the publication of the WFD. They include consideration of the physical characteristics, fisheries, macrophyte and macro-invertebrate communities to derive "hands off" flows river at river abstraction points.

These methods broadly reflect the elements used to derive the environmental standards listed within the WFD. As such, detailed work is now in hand to see how CAMS methods may be adapted to accommodate the hydro-morphological elements listed within the WFD. This will take into account the results of recent research and development work completed for the UK Technical Advisory group. It will also take into account the experience gained to date in completing CAMs to date and over a wide range of catchment conditions. The overall aim will be to adapt methods to inform the next cycle of CAMS running 2007 to 2013.

Rehabilitation and restoration of water bodies on a catchment scale: Effective delivery of ecological status

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Whilst it is widely acknowledged and indeed demanded by the Water Framework Directive, that a catchment scale approach to freshwater management be adopted, obtaining the data with which to make practical management decisions and deliver good ecological status at this scale still proves problematic. In terms of achieving good ecological status a fundamental data requirement is a catchment scale survey detailing habitat availability and quality.

The Eden Rivers Trust and Durham University are currently evaluating the contribution technological advancements in remote sensing, Geographical Information Systems (GIS) and ecological survey techniques such as electrofishing can make to the assessment of river habitat condition at this scale. Results will be presented demonstrating how these techniques are being employed to develop a new targeted catchment management system for the River Eden, in Cumbria. We will explain how data on habitat features such as bank erosion due to stock poaching, channel shading, channel slope and diffuse pollution risk are collected and analysed and how this data is now being implemented in connection with data on salmonid populations to guide management decisions regarding habitat restoration at a catchment scale.

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Land-use management, environmental stewardship

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The drainage of precipitation from the soil to the sea is a process which has three basic components. There is the physical process by which the water moves from the surface of the land to the sea via surface and sub-surface pathways or systems. There is the quantity of water held within or moving through this system. There is the quality of the water in this system. This conference recognises that the physical management of this process and the system is more important to the achievement of good ecological status or potential than some would have imagined.

The use to which land is put (forestry, agriculture, woodland, urbanisation etc) and the way in which land and soil are managed (soils structure, soil degradation etc) affect the generation of run-off. In turn this affects soil erosion, sedimentation in watercourses, aquifer recharge, flooding and water logging, and in turn these affect people and wildlife. On the other hand the way in which the drainage process is physically managed affects water levels and consequently the use to which land can be put.

None of this is new, what is new or perhaps is being rediscovered is the need to manage this process from the soil to the sea. The question is...How can society take a strategic overview of the management of this physical process to ensure water levels, at all states of flow, are appropriate for the different uses to which society wants to use land and water courses?

Heavily Modified & Artificial Water Bodies

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Heavily Modified Water Bodies (HMWB) are bodies of water which as a result of physical alterations by human activity are substantially changed in character and cannot, therefore, meet the Water Framework Directive objectives of Good Ecological Status.

These physical alterations are a result of a range of activities such as navigation, drinking-water supply, hydropower generation and flood protection all of which play an important role in contributing to sustainable development targets and strategies.

Instead of Good Ecological Status, the environmental objective for HMWB and for AWB is good ecological potential (GEP), which has to be achieved by 2015. The designation of HMWB is not an opportunity to avoid achieving demanding ecological and chemical objectives, since GEP is an ecological objective which may often, in itself, be challenging to achieve.

The presentation aims to give an overview of:

- The HMWB identification and designation process;
- Update on work to date in UK including case study illustrations of what HMWB designation actually means;
- Overview of the proposed EU Common Implementation Strategy activity on Hydromorphology;
- Identification of next steps and considerations for "new" HMWB/AWB's.

Economic issues arising from WFD and hydro-morphology

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Economics is at the heart of the Water Framework Directive. It plays a role in most aspects and will need to be relied upon to ensure the Directive is implemented in a cost-effective and proportionate way. This presentation will look at the economic issues associated with the WFD and hydro-morphology. Hydro-morphology raises some specific issues which will need to be considered in undertaking the economic analysis for the WFD. Defra recently completed a scoping study of economic issues within Transitional and Coastal Waters, themselves heavily impacted by morphological changes. The results of this scoping exercise can be used to give a viewpoint on the types of economic issues that arise in considering hydro-morphology. In theory all these issues can be dealt with by the economic analysis methodologies being developed by the Collaborative Research Programme on River Basin Management Planning Economics (CRP). In practice, however there are real issues with timing and in particular aligning the work done on designating water-bodies, identifying cost-effective measures and assessing disproportionate costs. Further work is needed, building on previous pilots, to identify practical solutions to these problems.

The challenges of policy integration WFD and Hydro-morphology – A Making Space for Water perspective

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“Making Space for Water” is the banner under which the government is taking forward a new strategic and holistic direction for flooding in England following sustainable development principles. Recent flooding incidents, such as the serious events in 1998 and 2000 and more recently in Carlisle, and the Foresight *Future Flooding* report, have highlighted the need for Government to develop a comprehensive, integrated and forward-thinking strategy for managing future flood and coastal erosion risk in England. This was why the Government published the *Making Space for Water* consultation document in July 2004 and undertook a wide range of consultative activities including workshops, stakeholder meetings. The outcome from this consultation is the *Making Space for Water -First Government Response* published in March 2005. This document contains an exciting programme of work across several different aspects of flood and coastal erosion risk management, including how we assess risk, how we approach urban drainage issues, how we manage coastal flooding and erosion and how we raise awareness and provide support for those at risk. The talk will explore the direction of travel of the Making Space for Water Action Plan and links for adapting to climate change and meeting the new requirements of the Water Framework Directive and contributing to the implementation of the Directive’s programme of measures.

Making Space for Water reports are available on:
<http://defraweb/environ/fcd/policy/strategy.htm>