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Policy paper

Water sustainability and the implementation of the Water Framework Directive – a European perspective

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Abstract

Many resource demands are competing for available fresh water resources and have an impact on ecosystem sustainability. Within the European context the Water Framework Directive (WFD) is the main legislative instrument for water protection and requires member states to ensure water bodies (freshwater and coastal marine) achieve good ecological status by 2015. Member states must engage in a range of activities, including river basin management planning, to meet the aspirations of the WFD. These river basin management plans need to include objectives for each water body; reasons for not achieving the targets; and the programme of actions required to meet the goals that deliver good ecological status within a catchment. The multidisciplinary approach known as Ecohydrology supports this by promoting regulation of fundamental ecological processes. This paper illustrates how WFD and river basin management planning principles are applied using Scotland as the example.

Key words: Catchment management, sustainability, river basin management planning, Water Framework Directive.

1. Introduction

The need for policy responses to address climate change, water sustainability and food security is recognised worldwide. Here we focus on water and take a look at the water management strategy for Europe using Scotland's river basin management plan as an illustrative example.

Many of the international river basins across the world have no legally enforceable management framework however the European Union has developed a robust integrated water management plan supported by a legal framework called the Water Framework Directive (WFD). The WFD implementation is supported by the principles of the river basin management planning approach and ecohydrological principles (Zalewski 2010a, 2010b) which is designed to support member states in achieving good ecological status for the water bodies within their river basin districts. The plans must also ensure that the water bodies ecological status does not deteriorate by, for example, identifying ways to remove point source and diffuse pollution (Dunbar, Acreman 2001; Zalewski 2004).

The WFD was first published in 2000 and sets out some aspirational milestones for the participating

European countries. By 2003 each member state was required to transpose the WFD into state law and develop national systems. Following this the member state was duty bound to conduct pressure and impact analysis of river basins and economic analysis of water use by 2004. Between 2006 and 2012 each country was required to establish a monitoring programme, draft and adopt river basin management plans and implement a range of actions to achieve good ecological status in the water bodies by the target date of 2015.

As the WFD is a framework which needed to be transposed into state specific law it means that implementation varied across member states (Nixon 2003) and that an inter-calibration exercise was required to establish a definition of "good ecological status" enabling comparison across the different national systems. The initial inter-calibration was conducted between 2003 and 2007 during which 11 countries examined seven different types of aquatic ecosystems that lead to the development of a five point scale for ecosystem health. The work was developed through 14 expert groups (Geographical inter-calibration Groups (GIG)) and coordinated by The European Commission's Joint Research Centre in Ispra, Italy. The inter-calibration exercise is a work in progress which is being refined and updated as more data is being generated by the participating member states (Moe *et al*. 2008; Nõges *et al*. 2009; Hering *et al*. 2010). The five point scale ranges from "high ecological status" which reflects the condition of a water body that has had little or no impact from human activity and would be regarded as being a reference or benchmark. Assessment of the quality of the ecosystem is based on the extent of deviation away from the "high ecological status" reference conditions with "bad ecological status" demonstrating the highest impact of human or other activity on the ecology of a particular water body.

1.1. River Basin Management Plans

The river basin management plans have been developed to support the objectives of the WFD. The plans define a member state`s strategy for improving the ecological status of the water bodies within any given river basin district. Figure 1 shows the 110 river basin districts across Europe and is taken from the European Commission website. The figure demonstrates that some river basin districts cross borders of countries which emphasises the need for collaboration between member states to meet the objectives of the WFD. The river basin management planning approach actively encourages engagement of stakeholders coordinated through lead agencies in each country. The WFD and river basin management approach is designed to be discretionary and recognises the variability in ecological status across Europe. Each river basin management plan will be specific for the district that it covers, however the plans have common structure and should cover a range of adaptive and mitigation measures that address pollution concerns, flooding, drought and other impacting factors (for example, climate change, urbanisation, forest management and agriculture) that affect the sustainability of the water resources within the catchments of interest.

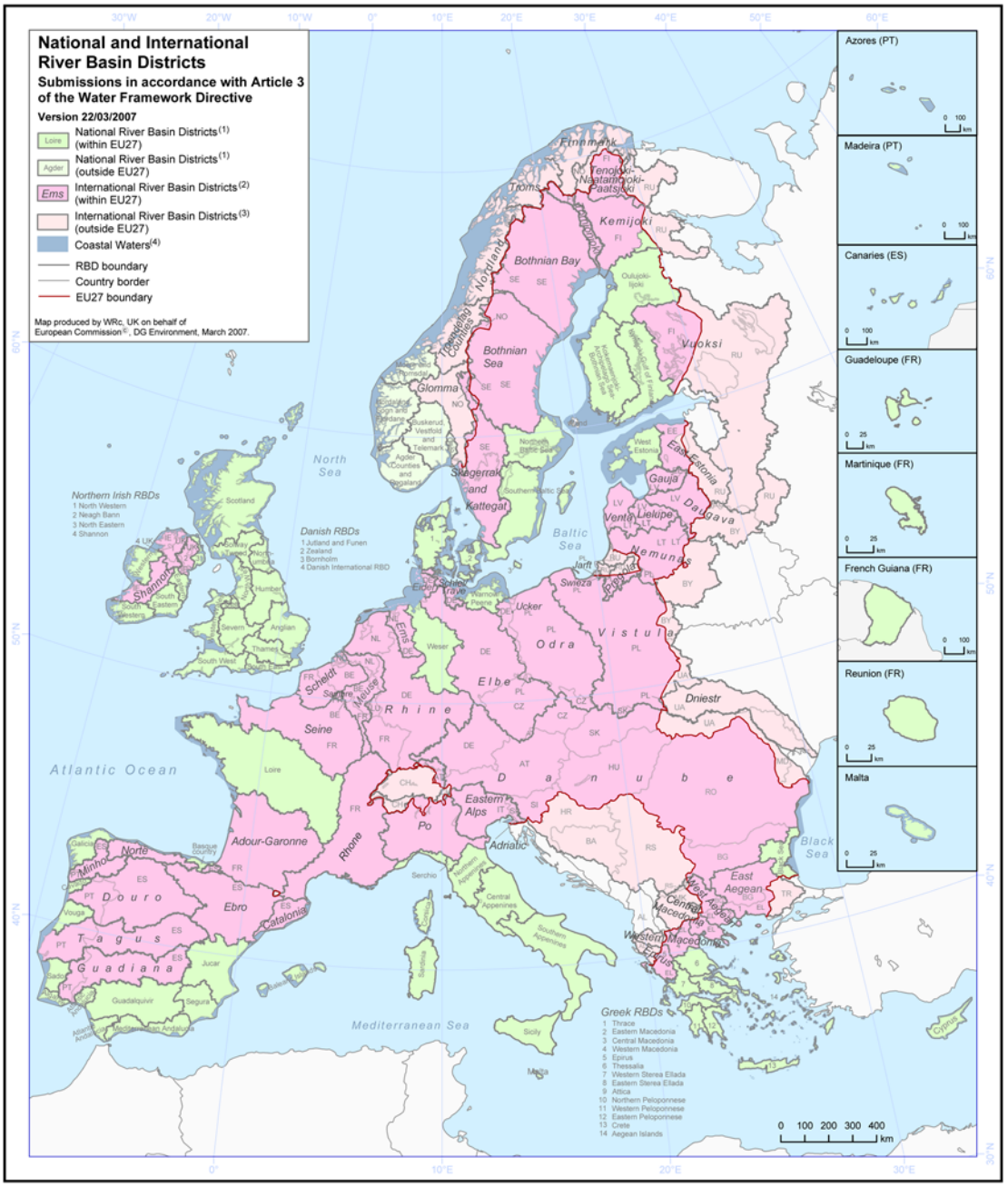
The river basin management plans need to be continually monitored, modified and improved to ensure they remain relevant as the catchments respond to active management, climate change impact and commercial activity. With this in mind the planning process should be regarded as cyclical and is representative of a continuous improvement process rather than a single planning event. Figure 2 represents the typical planning cycle used to promote continuous improvement.

Each member state is required to submit monitoring data that demonstrates compliance with the plans. The monitoring data submitted is collated through the European Commission's Joint Research Centre in Ispra, Italy under the WISE (Water Information System for Europe) initiative. A summary of the monitoring data can be found on the WISE website. The data generated feeds into a WFD "fitness check" which assesses the implementation of WFD and river basin management plans, suggesting modifications and actions needed to ensure sustainability and successful implementation of the framework. In addition to this there is a great deal of interest in how effective the WFD has been in delivering water sustainability through a range of academic studies (Lyashenko, Protasov 2003; Zalewski 2004; Van Gils 2005; Lyche Solheim *et al.* 2008; Brack *et al.* 2009; Zalewski *et al.* 2009; Hering *et al.* 2010; Zalewski 2010a).

2. River basin management planning in Scotland

This paper has summarised some of the concepts that support a common framework for water management policy in Europe with the objective to securing sustainable water resources that support good ecological status across the river basin districts (Breymeyer 2007). To illustrate application of the principles of the WFD and river basin planning approach we examine the experience in Scotland.

Scotland accounts for around one third of the United Kingdom's land mass and holds approximately 90 per cent of the freshwater resources. The population of Scotland is close to five million with an average water consumption of 153 litres of water per person per day. Scotland is covered by two river basin districts; the Scottish river basin (Fig. 3) and



Footnotes:

1) Map based largely on submissions of digital River Basin Districts (RBDs) from EU Member States and Norway.

2) Some of the international RBDs shown on this map were not identified as being international by the Member States, i.e. the Adour-Garonne, Rhone and Seine in France; the Vistula in Poland; the Kemijoki and Vuoksi in Finland.
Both the German Eider and Schlei/Trave RBDs are shared with the Danish International RBD.
Part of the Italian Eastern Alps RBD is shared with the Slovenian Adriatic RBD.
It is understood that the Tornionjoki international RBD in Finland is shared with Sweden, most likely with part of the Bothnian Bay international RBD. As the Bothnian Bay covers several river catchments, the Tornionjoki and Bothnian Bay have been kept separate in this map.
The delineation of the Finnmark RBD between Norway and Finland is currently under review.

3) These are the boundaries of the river catchments extending beyond the EU27 border. They have been derived from the Catchment Characterisation and Modelling (CCM) database, developed by the Joint Research Centre (JRC), except the boundaries for the Danube international RBD which were supplied by the International Commission for the Protection of the Danube River (ICPDR).

4) Coastal waters are defined in the Water Framework Directive (WFD) as extending 1 nautical mile from the coastline. However, some Member States have included a larger part of their coastal waters within the RBD boundaries.

Fig. 1. Map of European River Basin Districts (reproduced from the European Commission website).

the Solway/Tweed river basin. This paper covers the Scottish river basin management plan however similar principles have been applied to the Solway/Tweed river basin management plan.

As with other European countries, the plans are produced, monitored and reported through a lead agency, in the case of Scotland this is the Scottish Environment Protection Agency (SEPA). SEPA have promoted an integrated approach to the planning process which has been delivered through stakeholder engagement that includes other government agencies, land owners and other users of the catchments. Following on from the development of the plans, SEPA, through a consultation process, built a strategy which facilitates delivery. The strategy is built around three approaches, legislative, incentives and education. Figure 4 shows how these three areas help support coordinated action.

The coordinated approach to action applies to many different areas that include marine and coastal activity, aquaculture and freshwater fisheries, agriculture, sustainable transport, land use planning, sustainable food management and surface drainage, water supply, biodiversity conservation, bathing water and programmes for reducing pollution by agricultural Nitrates. The principle legislative instrument used to control activity in Scotland is the Water Environment (Controlled Activities) (Scotland) Regulations 2005. Among other things, these regulations apply to activities liable to cause water pollution, water abstraction, water impoundment and new engineering alterations to the beds, banks and shores of rivers and lochs. SEPA have adopted a practical approach to implementing the legislative framework by adopting a series of mechanisms that can be applied to activities depending upon the scale and impact. So for low impact activities, general binding rules can be applied. As the activity on the catchment becomes more significant (higher impact or larger scale) then registration may be necessary which requires a greater commitment in terms of monitoring and supervising the activity. Finally, if necessary, the activity may need to be licenced which leads to an even greater degree of monitoring and supervising to ensure that the environment and ecosystem are not adversely affected.

In addition to the legislative powers SEPA have designed processes around the supply of robust monitoring data that will inform stakeholders, through consultation, which leads to active involvement during the implementation phase of the action plans. This coordinated approach to stakeholder engagement is both top down, taking into account discussions at the European Commission through to national and local government groups, while taking a bottom up approach by working with land users and local communities. To ensure that this approach is effective SEPA have worked with other government agencies (for example, Scottish Water, Scottish National Heritage, Forestry Commission and local authorities) to set up a range of participative groups that start with a national advisory group which feeds into area groups. The area groups inform area forums that are locally based and work within the communities to identify and deliver the required actions.

Let us now consider the size of the challenge that Scotland faces in delivering the objectives of the WFD by 2015. Table I summarises the condition of water sources in Scotland in 2008. The table identifies 3095 water bodies in the Scottish river basin, of which 65 per cent are defined as having good ecological status or better. This means that around 35 per cent require some intervention to improve the ecological status to a more acceptable level. It is clear that the river basin management plan must deliver improvements and set objectives and target dates that reflect the complexity of the catchment management issue identified in each area groups boundary. Table II outlines the proposed timetable for delivering the enhancements needed to improve the ecological status of the relevant water body.

Fig. 2. River basin management planning cycle (reproduced from the Scottish River Basin Management Plan).

Table II highlights that while the aspirational WFD objectives are to meet good ecological status for water bodies by 2015, practical and economic factors mean that progress towards this target of good ecological status will need more time. In fact, in Scotland, we are setting a target date of 2027 to get close to 100 per cent compliance with the WFD objectives. Table 3 presents the targets by sector. This table demonstrates that gains must be made across all activities but pollution prevention will provide the biggest contribution to achieving the targets. Each activity has an associated plan of action that is integrated back into the overall action plan. So, for example, Scottish Water has a number of measures contained within a technical expression which define the actions required to contribute to the river basin management plan. These actions include activities such as improvements to waste water operation and compliance, water studies, improvements to sewer outfalls and fish pass studies. SEPA recognise that the water environment needs to support economic growth, drinking water requirements and cultural activities all of which need to be sustainable and be considered within the actions plans. The improvement plans are built upon ecosystem services principles which are underpinned by ecosystems properties and new management practise that take into account hydrological considerations. This then supports the need to create a robust ecosystem that has the capacity to meet the United Nations Millennium development goals. In order to achieve this, dual regulation is needed to improve the water resources, biodiversity and ecosystems services that benefit society. This approach is at the centre of the ecohydrology principles (Zalweski 2010b). Ecohydrology takes into account the interplay between hydrology and ecology. The Scottish river basin management plans take into account the impact on the carrying capacity of the ecosystem with respect to

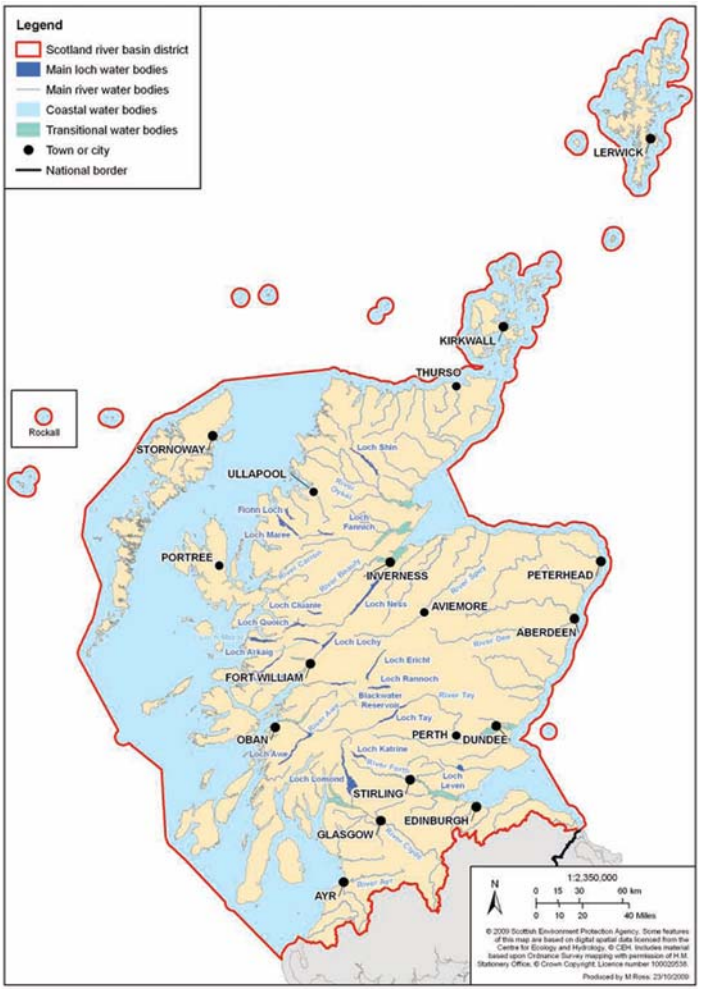


Fig. 3. The Scottish River Basin District (taken from the Scottish River Basin Management Plan).

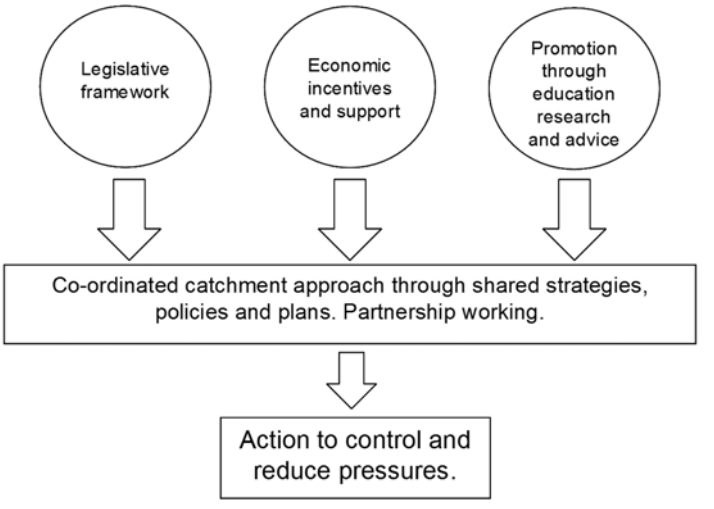


Fig. 4. Coordinating work to ensure action.

nutrients, biology and pollutant loads. Agencies such as the forestry commissions are managing the estates to reduce the impact of eutrophication, increasing forests and providing buffer zones. The plans include working with the farming community and horticulturalists to improve uptake of nutrients into plant biomass which further helps to reduce the flow of nutrients into the water course. There are many further examples of activity (bio-energy production, employment opportunities, constructed wetlands, for example) within the river basin management plan which demonstrate the application of the ecohydroloical principles that support the implementation of the WFD (Zalweski 2010b).

Monitoring and reporting of progress against the plans is of importance to ensure that there is a common understanding of how each part of the plans contributes to improvement. Through the local, national and European forums, alternative actions may also be identified as a consequence of new data and information becoming available. In addition to the SEPA led planning process, the Scottish government has set up a centre of excellence for water science research which is led by the

Table I. Condition of the Scottish River Basin in 2008.

2008 condition	Number of water bodies			
	All water bodies	Surface waters		Groundwater
		Natural, non-heavily modified	Heavily modified or artificial	
High/maximum	423	421	2	N/A
Good	1576	1158	203	215
Moderate	489	424	65	N/A
Poor	409	262	78	69
Bad	198	133	65	N/A
Totals	3095	2398	413	284
Proportion good or better (%)	65	66	50	76

Table II. Proposed phased improvement targets within the Scottish River Basin catchments.

	Proportion of water bodies in a good or better condition (%)			
	2008	2015	2021	2027
All water bodies	65	71	77	98
Rivers	56	63	71	97
Lochs	66	71	77	98
Estuaries	85	85	85	98
Coastal waters	94	97	98	99
Groundwater	76	85	88	94

Table III. Proposed phased improvement targets within the Scottish River Basin Catchments by activity.

Pressure	Activity responsible for pressure	Number of water bodies adversely affected			
		2008	2015	2021	2027
Pollution	Agriculture	345	229	114	7
	Sewage disposal	208	162	90	1
	Other (acidification, abandoned mines)	115	94	67	42
Abstraction and impoundment	Drinking water supply	107	81	65	0
	Agricultural irrigation	100	86	64	0
	Hydropower	125	94	90	8
	Other (eg. aquaculture; drinks manufacture)	95	85	71	0
Alterations to beds, banks and shores	Urban land uses and urban flood protection	45	43	31	0
	Agriculture	125	93	52	0
	Forestry	93	87	47	0
	Legacy of past engineering activities	33	27	24	0

James Hutton Institute. This centre will coordinate a strategy for science research that includes all aspects of the hydrological cycle, catchment management, ecology and ecosystems services. The output of the centre will inform a range of initiatives including the WFD objectives.

In 2012 Scotland will have implemented the measures identified in the first planning cycle and the work programme and timetable for the second planning cycle will be published. By 2013 the next round of pressure and impact studies of the river basin districts will be complete with the second river basin management plan published in 2014.

Conclusion

The WFD provides an integrated framework for water resource management that provides a standard set of guiding principles across Europe with the objective of achieving good ecological status by 2015 (Zalewski 2010b). River basin management plans have been developed to support delivery of the WFD. It is recognised that implementation of the WFD will vary across member states due to the complex nature of each river basin districts ecosystem, economics, culture and other factors such as climate change. Ecohydrology offers a multidisciplinary approach and helps define a proactive dual regulatory framework (Newman *et al.* 2006; Zalewski 2010b). In Scotland, river basin management plans are in place and coordinated through SEPA. The river basin management planning approach is cyclical with the objective to continually improve and adapt as new data and information are collated. The process for developing the plan has involved stakeholder groups from industry, government and local communities. Monitoring the implementation of the plans is being done through area action groups with information being shared between the groups and a national working group. The plans themselves are based on an integrated multidisciplinary approach which is very much aligned to the ecohydrological principles taking into account nutrient loading, pollution reduction and biological activity to support improvements in the carrying capacity of the ecosystem (Zalewski 2010b). Scotland hopes to achieve the aspirations of the WFD by 2027.

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Additional resources

European River Basin Districts: http://ec.europa.eu/environment/water/participation/index_en.htm
Water Information System for Europe: http://water.europa.eu/
Scottish River Basin Management Plans: http://www.sepa.org.uk/water/river_basin_planning.aspx
Implementation of the WFD in Scotland: http://www.scotland.gov.uk/Publications/2010/04/15102201/2