Implementing the Water Environment and Water Services (Scotland) Act 2003:

Proposals for environmental standards and conditions – phase 1

A Consultation

October 2006

FOREWORD

Scotland is in a strong position in terms of its water environment, as much of our surface water and groundwater is in very good condition. We also now have in place an integrated framework to protect and improve our water environment through the Water Environment and Water Services (Scotland) Act 2003 ("the WEWS Act"), which transposed the Water Framework Directive, and the Water Environment (Controlled Activities) Regulations 2005 ("CAR"), introduced earlier this year.

However, our water bodies are under pressure from a variety of uses. We need to ensure that water use is sustainable, in order to protect aquatic life, and also to safeguard resources for use in the future. The framework provided by the WEWS Act and CAR will be vital in ensuring that we can protect the quality of the waters we have, and where necessary and practicable, improve the status of those that are under pressure.

The key mechanism for delivering improvements to the water environment will be the river basin management planning process. This will identify the improvements to the water environment that it is technically feasible and proportionate to make, how and when these improvements can be made and, therefore, the objectives we expect to achieve in the period covered by the River Basin Management Plan.

The Scottish Executive is currently developing policy on two of the key components of the river basin management planning process:

- **The development and use of environmental standards to protect aquatic ecosystems; and**
- **The setting of appropriate environmental objectives through the river basin management planning process.**

These processes, although separate, are interdependent and inform each other. For that reason, the Executive is consulting simultaneously on proposals for these key components of the river basin management planning process.

This paper discusses the development of the first phase of environmental standards for the Water Framework Directive and how they support implementation of the WEWS Act.

The draft policy statement "*Principles for Setting Objectives in the River Basin Management Plan*" sets out how we will use the provisions in the Directive to set objectives which protect both the water environment and the continued sustainable use of this valuable resource. Copies of this document can be obtained from the Scottish Executive website at http://www.scotland.gov.uk/Publications/Recent or by contacting the Water Division – see details on page 1 of this paper.

We suggest you may wish to read these two papers together.

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PURPOSE

This paper forms part of a series of consultations on our detailed plans to implement the Water Environment and Water Services (Scotland) Act 2003 ("the WEWS Act"). The WEWS Act transposed the European Water Framework Directive (WFD) into Scots law and established a broad framework for the future management of our rivers, lochs, coasts and groundwaters.

This consultation paper sets out proposals for the introduction of a first set of environmental standards and conditions for the water environment in Scotland, to support implementation of the WEWS Act.

These proposed standards define the range of environmental conditions needed to support healthy aquatic life, such as oxygen levels, water flow conditions, concentrations of key chemicals and physical structure. Standards will underpin the setting of environmental objectives in the river basin management planning process.

This paper sets out three aspects of the introduction of these first proposed standards:

- the scientific basis for the proposed standards and conditions;
- how the proposed standards will be used – plans for their implementation in Scotland; and
- a provisional assessment of the likely costs and benefits of introducing the proposed standards.

We would welcome your comments on any aspect of this paper. Comments on the proposals should reach us at the address below **by 13 December 2006**.

We then plan to introduce the first set of environmental standards as soon as possible afterwards.

CONSULTATION ARRANGEMENTS

Please send your views and comments on the proposals in this paper to:

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Responses should reach us by 13 December. Earlier responses would be welcome.

INTRODUCTION

The Water Framework Directive (WFD) establishes a framework for the management and protection of Europe's water resources. The WEWS Act, which transposed the Directive into Scots law, made the Scottish Environment Protection Agency (SEPA) the competent authority for implementing and ensuring compliance with the Directive in Scotland. This includes responsibility for the preparation of River Basin Management Plans for managing our water environment.

The Plans will be developed through a 6-year cyclical process that will define appropriate environmental objectives for all water bodies in Scotland and set out measures to ensure that these objectives are met. In developing these Plans, we will aim to strike the right balance between **protecting and improving the water environment and other social, economic and environmental needs.**

The WFD requires us to set environmental objectives to protect the whole aquatic ecosystem. This brings a need to focus on the health of the plants and animals in the water environment, and not just the quality and chemistry of the water itself. It also requires that water bodies are not considered in isolation, but also in relation to other water bodies in a river basin district.

The WFD has two key objectives for all water bodies:

- to **prevent deterioration of the status** of all surface water and groundwater bodies; and
- to protect, enhance and restore all bodies of surface water and groundwater with the **aim of achieving 'good ecological and chemical status' in all surface water** and **'good chemical and quantitative status' in groundwaters by 2015**.

The Water Environment (Controlled Activities) Regulations 2005 (CAR), which were introduced earlier this year, will be a key tool in securing the protection and improvement of our water environment. These Regulations task SEPA with regulating activities which could pose a risk to the water environment, such as abstractions, impoundments, discharges and engineering works in freshwater. SEPA may impose authorisation conditions as needed to limit the risk of deterioration of status; to make improvements to the state of the water environment; to protect the interests of other users or to retain an appropriate level of environmental capacity for future sustainable development.

In order to set appropriate conditions, SEPA and other regulators must have robust standards that define the conditions needed to protect aquatic ecosystems. These include standards for water quality, water levels and flow conditions, chemical pollutants and the physical structure and condition of water bodies and shore zones. Since the natural characteristics and sensitivity of plants and animals vary between different water bodies, standards are being developed to reflect the different requirements of ecology in rivers, lochs, transitional (estuarine) and coastal waters. Smaller scale variations in ecology between different rivers are also taken into account. Separate standards are being developed for groundwaters.

The standards that are proposed in this paper have been developed on a UK-wide basis by technical experts using the best available scientific evidence. The standards and the methodology used to derive them have been subject to peer review. This approach provides us with a robust basis for identifying the specific numerical standards needed to protect our water environment.

This consultation paper presents proposals for the first set of UK environmental standards and conditions under the WFD. It gives information on the development of further standards (section B) and sets out more generally how environmental standards will be used in Scotland (section C). Section E summarises initial estimates of the potential costs and benefits associated with the first phase of standards. These first proposed numerical standards are set out in Annex A.

A – OVERVIEW: ENVIRONMENTAL STANDARDS AND THE WEWS ACT

The aim of the WEWS Act is to protect and improve the water environment while also supporting the social and economic interests of those who depend upon it.

To achieve this, the water environment must be looked at on a larger, river basin scale, rather than as individual rivers or lochs. Over the next few years, the process of **River Basin Management Planning** will begin. This is a risk-based process to manage water resources in each river basin district. This process will set environmental objectives for each water body and design programmes of measures to deliver them.

As all activities that pose a risk to the water environment are now regulated in Scotland under **CAR**, it is vital that any licence conditions set by SEPA reflect appropriate standards, in order to help deliver the environmental objectives set through the basin planning process.

Both regulation and basin planning will be supported by the environmental standards and conditions, which will allow SEPA to assess the current status of the water environment, and therefore to determine what actions are needed to meet our environmental objectives. Standards will also be used to monitor the status of waters, and to assess the effectiveness of measures aimed at their improvement. Thus the introduction of these environmental standards is a key step in our implementation of the WFD in Scotland.

The uses of environmental standards fall into four areas:

- Classification of water bodies – assessing their current and ongoing status;
- Objective-setting within river basin management planning;
- Regulation of water use under CAR; and
- Monitoring the achievement of our environmental objectives.

These areas are discussed in more detail below.

1. Classification

The WFD is much broader in its scope than previous legislation, and requires us to focus on both the ecological and chemical status of surface water bodies.

- Ecological status describes the degree to which human uses of the water environment have altered the structure and functioning of aquatic plant and animal communities. The Directive sets out five status classes: 'high', 'good', 'moderate', 'poor' and 'bad'. 'Good' ecological status means that human activities have had only slight impacts on the ecological characteristics of aquatic plants and animal communities.
- Chemical status describes whether the water contains safe levels of certain toxic chemicals that have been identified as of particular concern across Europe because of their toxicity, persistence and ability to accumulate in the bodies of plants or animals. These include the chemicals known as '**priority substances**' and '**priority hazardous substances**' as well as others identified under the Dangerous Substances Directive. The chemical classification is simple: water which contains too high a concentration of the listed pollutants cannot be classified as 'good'. The Directive therefore sets out just two status classes: 'good' and 'failing to achieve good'. Standards for these substances are being developed by the European Commission for use in all Member States.

The WFD requires us to aim to achieve at least 'good' status in *both* ecological and chemical terms. This is described in more detail below.

The Directive also requires us to consider the status of **groundwaters**, and requires groundwater bodies to aim for 'good' status in *both* quantitative and chemical terms. We expect to consult on proposals for groundwater standards and how they will be used during 2007 (see section D), so groundwater is not discussed in more detail here.

Standards and classification
The Directive requires that monitoring and assessment methods are developed to classify the ecological status of Scotland's surface water bodies.

The first step in this process is to identify characteristics of the ecosystems that can be monitored and related back to the Directive's descriptions of the ecological conditions expected for each status class. This means defining, for instance, the composition and abundance of fish, invertebrates and plant communities that would be found in different types of rivers, lochs, estuaries and coastal waters in the absence of even minor human disturbance. We can then determine the changes from those conditions that would be expected for water bodies at 'good', 'moderate', 'poor' and 'bad' status.

The second step is to look at the characteristics of the water environment that are needed by aquatic communities in the different status classes. These characteristics include:

- **physico-chemistry** – e.g. oxygen levels, acidity, temperature and the concentration of chemicals listed as **'specific pollutants'** in the UK (see section D). These substances are known to harm ecology and are of specific concern in the UK because they are discharged to the water environment 'in significant quantities'[1].
- **hydrology** – e.g. water flows and levels; and
- **morphology** – e.g. physical shape of the watercourse, bank vegetation.

The environmental standards discussed in this paper have been developed in conjunction with the biological classification methods. This is to ensure that the standards describe the environmental conditions needed by aquatic plants and animals at 'high' or 'good' status.

The composition of plant and animal communities in our rivers, lochs, estuaries and coastal waters varies with the characteristics of those waters. The environmental conditions needed to support these different communities can also vary. Consequently, most of the standards in this report are specific to particular types of waters.

Each environmental standard has been set at the **minimum level that the available scientific evidence indicates is necessary to protect aquatic plants and animals**. This means, for example, that if the environmental standard for 'good' status oxygen levels was failed, adverse impacts on the condition of aquatic animals or plants would be likely.

Uses of classification
SEPA will begin monitoring using the new biological tools from December 2006. However, several years' data will be needed to fully classify all Scotland's water bodies into the new WFD status classes. Classification decisions will take account of biological monitoring results as well as information on whether the environmental standards are being met. SEPA will produce as good a picture as possible of the status of our water bodies by December 2009, to form part of the first River Basin Management Plan, as required by the Directive.

[1] Annex VIII of the Directive includes an indicative list of pollutants that could be considered in this category. Member States have each produced a list of the specific pollutants they regard as significant issues in their country and which therefore need to be considered as part of the ecological classification. The UK list includes substances like metals, solvents and some pesticides.

As information on the ecological status of our water bodies is gathered, the scientific understanding of the environmental conditions needed to support the achievement of 'good' status is likely to improve. Where the information provided from classification or other sources suggests that an environmental standard for a water body type may be too stringent or too lax, we expect SEPA to coordinate a review of that standard and, if appropriate, come forward with proposals for revisions.

Revisions to environmental standards will be taken into account during updates of the River Basin Management Plans. **However, we do not propose to introduce new or revised standards during a planning cycle.**

Heavily Modified and Artificial Water Bodies (HMWBs and AWBs)
In some cases, substantial alterations made for activities like navigation, water storage, flood defence and land drainage will mean that a water body cannot reach 'good' ecological status. Where certain criteria are met, the WFD allows such water bodies to be designated as heavily modified water bodies (HMWBs). Other water bodies, such as canals, which have been created where no natural water body previously existed, will be designated as artificial.

More information on how these water bodies will be identified is set out in our paper on objective setting[2].

The objective for heavily modified and artificial water bodies is to aim to achieve 'good' ecological *potential* by 2015 rather than 'good' ecological *status*. Alternative objectives may be set where making the improvements needed for 'good' ecological potential would be technically infeasible or disproportionately expensive.

Water quality standards will usually be directly applicable to HMWBs. For example, environmental standards for toxic pollutants are not dependent on whether a water body is heavily modified or artificial.

Depending on the modifications or the artificial characteristics, the environmental standards for **water flows and levels** and for the **physical structure** of water bodies may not be directly applicable. A water body would not be designated as heavily modified if all such standards could be achieved without significant adverse impacts on the relevant use of the water body.

2. Objective setting and River Basin Management Plans

The WFD introduces a new process of water resource management in river basin districts. River Basin Management Planning (RBMP) will define specific environmental objectives for each water body and set out a programme of measures to deliver those targets. The effectiveness of the programmes of measures will be assessed through ongoing assessment of the ecological and chemical status of each water body, by monitoring biology and against the environmental standards.

Environmental standards underpin the objective-setting process, as they are fundamental in assessing risks to the status of the water environment and highlighting where action is needed, either to avoid deterioration or to achieve 'good' ecological status. The standards can indicate the type and extent of any problems, as well as the sort of actions that might be effective in delivering improvements or preventing deterioration.

[2] Available from: http://www.scotland.gov.uk/Publications/Recent or by contacting the SE Water Division – see page 1.

However, it is important to bear in mind that the Directive provides **flexibility to apply alternative, less stringent, objectives**, **or to extend deadlines, where the achievement of 'good' status by 2015 would be disproportionately expensive or technically infeasible**. Therefore the objective-setting process will involve detailed consideration of social and economic factors, as well as of environmental priorities.

More detailed information about this process is set out in our paper on objective setting[2].

SEPA will work with water users to develop a River Basin Management Plan for the Scotland River Basin District and for the Solway Tweed River Basin District (jointly with the Environment Agency) by December 2009. The programmes of measures that are designed in this process must be operational by December 2012.

3. Regulation through CAR

Since 1 April 2006, activities in Scotland which pose a risk to the water environment, including abstractions, impoundments and discharges as well as engineering works in freshwater, must be authorised under CAR. SEPA will use the WFD environmental standards to support the setting of conditions for CAR licences and to assess the capacity of the water environment to accommodate new water use activities without harming the ecology.

Review of existing licences
SEPA aim to begin a prioritised review of licences issued under CAR from January 2007. This review will consider the type of activity, its impact and the licence conditions that were initially applied. The review will aim to prevent deterioration in water status and where necessary, to drive improvement, although it may of course not always be possible to achieve 'good' ecological status in a given water body.

SEPA will manage pressures on the water environment with two key aims in mind: **to prevent deterioration of status** and **to deliver improvements.** Use of the proposed standards to work towards these two aims is discussed in more detail in section C.

4. Monitoring

The Directive requires SEPA to develop a risk-based monitoring programme for the WFD from the end of 2006. SEPA will ensure that adequate monitoring sites are in place to assess the state of the water environment over time, targeting and prioritising those water bodies that are at risk of failing to meet the Directive's objectives. Monitoring will help to identify whether actions taken to improve the water environment are effective, and to monitor achievement of our environmental objectives.

By monitoring the range of conditions – physico-chemistry, hydrology, morphology, and levels of pollutants – relative to the defined standards, SEPA can identify where existing pressures or changes in a water body are likely to become harmful to aquatic life. Monitoring this range of conditions gives information about the likely cause and scale of a problem, and so can indicate the type of remedial actions that could be used to reduce an impact on the biology. Monitoring information will support both the RBMP process and the regulation of water use in Scotland.

B – DEVELOPING ENVIRONMENTAL STANDARDS – KEY PRINCIPLES

In January 2006, the UK administrations set out the key principles underpinning the approach to the introduction of environmental standards and conditions in the UK[3].

1. Separation of science and policy

Scientific development

In the UK, the main work of developing proposals for environmental standards is being carried out by the UK Technical Advisory Group for the WFD (UKTAG). This is a partnership of technical experts from the UK environmental protection and conservation agencies, as well as some partners from the Republic of Ireland.

UKTAG has considered a huge volume of scientific evidence from field studies and scientific literature. This information demonstrates how aquatic ecology responds to changes in a range of environmental conditions, such as water quality, water levels and physical aspects of water bodies, as well as concentrations of key chemical pollutants.

UKTAG published proposals for the first standards for a ten week external stakeholder review in February 2006. UKTAG subsequently published a revised report in September with its recommendations for the first set of standards, along with a document responding to the key comments received during the review[4].

Policy approach

This consultation paper sets out the Executive's proposals for the first set of environmental standards for the WFD (see section C), based on UKTAG's recommendations. It also includes proposals for how the standards would be used in Scotland. Section E discusses a *preliminary* UK-wide assessment of the potential costs and benefits associated with the implementation of these proposals. The assessment was carried out by independent consultants, commissioned by the UK Governments.

This clear separation of science and policy has been adopted to emphasise that the flexibility to set less stringent objectives on grounds of disproportionate costs or technical infeasibility is an integral part of implementing the WFD. Costs of implementation will depend on the objectives set in the RBMP process. Since 'good' status will not always be required, costs are not determined solely by the standards that are introduced.

2. Phased introduction of environmental standards

Environmental standards will be introduced in a series of phases, as it is vital that they are based on robust science:

- **First phase:** This paper sets out proposals for the first set of standards, including some elements of water quality, water resources and morphological conditions. These standards are likely to be introduced in Scotland **in late 2006** by a Ministerial Direction to SEPA. Section C sets out more information about the proposals and how the standards would be used in regulation.
- **Second phase:** Proposals for the second set of standards will be consulted upon during 2007, leading to introduction of a second set of standards **later in 2007**, again by a Ministerial Direction. This phase is likely to include more of the water quality and water resources standards that are not included here, as well as proposals for groundwater and for some of the chemicals that are significant issues in UK surface waters – classed as 'specific pollutants' (see section D).

[3] Statement available from http://www.scotland.gov.uk/Resource/Doc/1057/0021699.pdf
[4] Papers available from UKTAG website: http://www.wfduk.org/stakeholder_reviews/Standards_Jan_2006/

- **Later phases:** Further standards will be developed as scientific data becomes available from monitoring and from work at a European level. These standards may not be available in time for effective introduction in the first cycle of RBMP, but many may be available for the second cycle. All proposals for standards will be published for consultation before they are introduced.
- **Classes below 'good':** To date, the priority has been to define the threshold between 'good' and 'moderate' status – the minimum standard needed to achieve 'good' ecological status. However, the Directive also requires that deterioration in water status is prevented, and hence standards are also needed to define the conditions that would protect biology in the lower ecological classes – 'moderate', 'poor' and 'bad'. Work is ongoing to define the boundaries between these status classes in terms of environmental standards.
- **Chemical classification standards:** In addition, standards for the most toxic pollutants, including those classed as 'priority substances' and 'priority hazardous substances' by the EU, are being developed by the European Commission, rather than by individual Member States. These standards will form the basis of the chemical classification (see earlier text).

This phased approach reflects our desire to ensure that all available scientific evidence is considered in developing the standards. For some standards, more data is needed, either from monitoring or new research, before a robust standard can be proposed.

Equally, it is important that standards are proposed and introduced as early as possible where there is enough evidence to support robust standards. As set out earlier, environmental standards are needed to underpin classification, regulation and the RBMP process under the Directive. Timely introduction will therefore give businesses sufficient time and certainty to plan for the future.

Introducing the standards in phases does not mean that there will be any increased risk to the water environment. The proposed standards *augment* the protection provided by the standards and controls already in place under existing legislation. Until new standards are developed and introduced under the Water Framework Directive, SEPA will continue to use existing standards, such as those already used in the Scottish Rivers Classification Scheme.

3. Compatible approach across Europe

The Water Framework Directive applies to all states in the European Union and similar processes are being carried out to develop environmental standards in the other Member States. In parallel with this work, the European Commission is leading an **'Intercalibration' exercise** to ensure that systems for assessing 'good' ecological status are compatible between countries.

The first phase of this exercise is due to report shortly. This initial phase has only considered assessment methods for a few aquatic species. Although there has been considerable progress in some areas, there is currently not enough information available to develop full guidance for all groups of species. Further phases of Intercalibration will be needed to compare the assessment methods for the full range of plant and animal species that need to be considered in our water bodies.

Experts from the UK have been, and will continue to be, involved in Intercalibration, and our proposals reflect the current results across Europe. This means that standards have only been proposed where we are confident that there is enough information about the outcomes of Intercalibration to propose robust thresholds. However as increased understanding emerges from this exercise, it is expected that some refinement of the proposed UK standards and conditions will be needed.

C – ENVIRONMENTAL STANDARDS PHASE 1 – DETAILED PROPOSALS

This section lists the elements for which standards are being proposed in this first phase, and outlines in more detail how we propose SEPA will use them to manage pressures on the water environment.

1. Standards proposed in this paper

Proposed standards – Phase 1			
Water Quality			
Indicator	**Water body**	**More information**	**Main pressures**
Dissolved oxygen	Rivers, lochs, transitional, coastal waters	Low levels of dissolved oxygen (high BOD) can result in death of many species.	• Discharges of organic material, e.g. from sewage treatment works, storm overflows, agricultural slurry, silage liquor. • Enrichment by nutrients results in lower oxygen levels through *eutrophication* (see below).
Biochemical Oxygen Demand (BOD)	Rivers only	**BOD** is a measure of the amount of dissolved oxygen used up in a sample of water or effluent over a set period of time. Oxygen is used up when micro-organisms break down organic material in the water. BOD can reflect pollution by organic compounds – high BOD discharges cause a lot of oxygen to be removed from water.	
Ammonia	Rivers only	Ammonia is toxic to some forms of aquatic life, and is sub-lethal to others. Ammonia is formed during the decay of organic wastes containing nitrogen, including vegetable and animal wastes.	• Discharges of organic material, e.g. from sewage treatment works, storm overflows, agricultural slurry, silage liquor.
Acid Conditions	Rivers (pH) Freshwater lochs (ANC)	Acidic water can be toxic to many forms of aquatic life. **pH** is a measure of the concentration of hydrogen ions (H^+) in the water, formed when an acid dissolves. Acidic water has a low pH (lot of H^+ ions). pH 7 is defined as neutral. **Acid Neutralising Capacity (ANC)** is an indicator of acidity that also considers a loch's *sensitivity* to acidity (based on the geology) and its *ability to cope* with additions of acid (due to the presence of organic acids that can soak up some of the H^+ ions).	• Acidic rainfall, caused by air pollution.
Salinity	Freshwater lochs only	Many freshwater plants and animals are sensitive to increased salt levels.	• It is unlikely that significant pressures, risking failure of the proposed standard, will occur in the foreseeable future.

Nutrients – phosphorus	Rivers only	High nutrient concentrations affect the biological balance in water, and can contribute to *eutrophication* – very high plant and algal production. Eutrophication causes a number of problems including: • 'Blooms' of blue-green algae which can be toxic. • Major reductions in dissolved oxygen, harming other aquatic life. Nitrogen and phosphorus are the main nutrients needed by plants. In fresh water, the natural ratio of phosphorus to nitrogen is generally low, so plant growth is limited by the amount of phosphorus available. Any increase in phosphorus concentrations causes rapid plant growth.	Point source and diffuse discharges containing phosphorus, including: • agricultural and forestry runoff, particularly including fertilisers; • water treatment plants; • aquaculture.

Water Resources

Indicator	Water body	More information	Main pressures
% change from natural flow	Rivers	Minimum water levels are needed for aquatic life all year round. Additional protection is particularly important at key times – spring and early summer for aquatic plants; late summer and early autumn for invertebrates and fish. Where abstraction takes place from a loch, the ecological impact in the outflow watercourse (downstream) is often larger than in the loch itself.	• Abstractions, e.g. for public water supply, industry, energy generation and agriculture. • Impoundment of water behind dams and weirs that reduce downstream flows.
% change from natural inflow	Freshwater lochs		

Morphology

Indicator	Water body	More information	Main pressures
% change from natural conditions	Rivers only	Ecology can be affected significantly by changes in the physical structure or shape of a water body. Engineering and development works can affect water bodies directly, e.g. by destruction of habitats on river banks or loch beds, and more indirectly by altering flow patterns and water levels. For rivers, WFD standards must consider: • River depth and width variation; • Structure and substrate of the river bed; • Structure of the riparian zone (banks).	• Engineering and construction works, e.g. dredging, strengthening of banks, straightening channels, building structures (such as bridges and piers) with in-channel supports.

The next sections of this paper outline the key implications of our proposals and how SEPA will use them, including an example of how water resource standards may be used.

The proposed numerical standards themselves are set out in Annex A. The elements likely to be included in the second phase in 2007 are listed in Section D. More information on the proposed standards and the process behind their development can be found from the UKTAG website, www.wfduk.org.

2. Implications of the proposals

Water quality (see page A2)
SEPA's existing classification schemes are based on standards for water quality, including all of the proposed elements except salinity. The new proposals are similar to these existing standards, but more closely matched to the natural variations in ecology in that they are type-specific: different thresholds are set for different types of river or loch. Existing standards do not differentiate between river or loch types.

The key differences from existing standards are for:

- **Ammonia (rivers):** two different river standards are proposed in place of the single existing ammonia standard (see typology in Annex A). A more stringent standard is proposed for upland (above 80m), low alkalinity rivers, although there is no change for lowland, high alkalinity rivers. Available monitoring information indicates that in Scotland, an additional 200km river length (~0.8% of the 25,000km monitored length) would be defined as at risk of failing the proposed standards.
- **Phosphorus (rivers):** the proposals define standards for three types of rivers instead of the single existing standard (see typology in Annex A). More stringent standards are proposed in low alkalinity rivers, but a less stringent standard is proposed in high alkalinity rivers. Available monitoring information indicates that the distribution of 'at risk' length would change to focus primarily on low alkalinity rivers. However, *overall*, very little additional river length (~30km: under 0.1% of the monitored length) would be defined as at risk. This would mean better targeting of resources to those water bodies where the ecology is judged to be most at risk from raised nutrient levels.
- **Oxygen levels (rivers):** the proposals define dissolved oxygen (DO) and biochemical oxygen demand (BOD) standards for two types of rivers (see typology in Annex A). For upland, low alkalinity rivers, the proposed DO standard is more stringent than the existing standard. However, the impact of this change is expected to be minimal overall as the proposed BOD standard, which SEPA uses to determine whether action is needed, is not altered by the proposals. In lowland, high alkalinity rivers, the proposals slightly relax both BOD and DO standards. Available monitoring information indicates that in Scotland the *overall* length of river at risk of failing the standard would decrease slightly.
- **Salinity (freshwater lochs):** A standard is proposed for salinity, in line with the Directive's requirements (see Annex A). No standard has previously existed in Scotland. However, SEPA considers it highly unlikely that any lochs in Scotland would be at risk of failing this standard. Therefore, the proposed standard is unlikely to have any significant implications for Scotland, or drive action in the foreseeable future.

Water resources (see page A12):
Until CAR was introduced, Scotland had no comprehensive controls for abstractions or activities that alter water flow. The standards proposed in this paper are therefore new in Scotland. They aim to protect ecology from extremely low flows by restricting the permitted changes from natural flow patterns (see example at the end of this section). The standards are similar to the risk criteria used in the 'Article 5' risk assessments, so no significant changes are anticipated in the number of water bodies predicted to be at risk in Scotland.

Morphology (page A17):
Engineering or construction works in freshwater have only become regulated in Scotland this year, with the introduction of CAR. A new decision-supporting framework is proposed here, as a tool to support the initial assessment of new applications for engineering or construction works in rivers. This is the first framework of its kind to be introduced in the UK. It aims to enable all decisions about new applications for such works in rivers to be made on a consistent basis. It will provide a consistent mechanism to identify the relatively low-impact proposals that could be carried out without compromising the ecology of the water body. An additional detailed assessment will still be required for all applications that would have a significant impact on the water body morphology. This additional assessment will inform the selection of measures to minimise harm to the environment and to promote efficient and sustainable use of the remaining capacity.

3. How SEPA will use the proposed standards

As outlined in section A, SEPA will use its regulatory powers to manage environmental capacity in a way that protects and, where necessary, improves the water environment, whilst ensuring that sustainable uses of these waters can continue and flourish.

Assessing current conditions against the environmental standards – for water quality, water resources, morphology and pollutants (when introduced) – will determine **the available capacity of each water body to accommodate further activities or developments without harming biology.**

Where there is significant remaining capacity, this means that, for instance, part of a river could accommodate some changes, such as reduced water flow or alterations to the banks, without compromising the status of its ecosystem. However, where there is very little or no available capacity, one or more standards are close to failure, or have been failed. The existing pressures on that water body therefore between them pose a risk of it not achieving 'good' ecological status.

The environmental standards set out in Annex A are intended to help define this capacity of surface water bodies to accommodate alterations to their characteristics, without those alterations posing a significant risk to the status of the plants and animals they support.

Taking action to improve the status of the water environment

We expect SEPA to consider requiring action to improve the status of the water environment where it is confident that, without such action, there is a significant risk of failing to achieve the relevant environmental objectives.

SEPA will have the necessary confidence that there is a significant risk where:

- monitoring or modelling data provide a high level of confidence that an environmental standard identified as needed to support the achievement of 'good' status or another relevant objective is being failed; or
- biological monitoring results provide a high level of confidence that the ecological quality of the water body is currently worse than that required to achieve 'good' status or another relevant objective; or
- the weight of evidence overall, including, where relevant, evidence such as compliance records and histories of incidents, provides a high level of confidence that there is a significant risk that 'good' status or another relevant objective will not be achieved unless appropriate improvement action is taken.

Where SEPA does not have high confidence, it may nevertheless consider and support low cost actions that all parties are willing to take where such actions will increase the likelihood that 'good' status, or other relevant objectives, will be achieved.

In so far as it is practicable and relevant, SEPA will also ensure that the improvements it requires of operators of controlled activities:

- are sufficient to prevent deterioration of status being caused in the future by any fluctuations in environmental quality that cannot readily be controlled;
- provide capacity for future development where development is currently constrained because of the lack of environmental capacity; and
- stop or reverse trends resulting from the cumulative impacts of controlled activities before capacity is exceeded.

Where a water body is found to be at risk, SEPA will consider what practical measures could be taken to address that risk. In many cases, it may be possible to adopt relatively low cost measures to reduce the impact of an activity. In other cases, more significant actions may be needed to address the risk. An example of how SEPA will apply the proposed standards follows this section.

SEPA will not seek improvements to the status of water bodies that would be technically infeasible or disproportionately expensive.

Actions to improve the status of the water environment are more likely to be proportionate when one or more of the following circumstances apply:

- an environmental standard is clearly failed over a wide area;
- the actions required to make the improvements have low cost or comprise established good practice measures;
- there is evidence of significant biological impacts; or
- the improvements will contribute to achieving a number of environmental, social or economic objectives.

Taking action to protect the water environment

We expect SEPA to use its powers to prevent controlled activities from causing a failure of an environmental standard. Exceptions to this may be allowed in specific circumstances provided for in the Directive, as outlined in our paper on objective-setting[2].

Unless these specific circumstances are met, SEPA will refuse authorisations for applications to undertake controlled activities that are likely to cause a failure of an environmental standard.

SEPA will normally be expected to grant authorisation for activities that do not cause an environmental standard to be failed, provided that granting such authorisations would not:

- cause fluctuations in environmental quality that are difficult to control, and so risk subsequent deteriorations in status;
- compromise the achievement of other environmental objectives, including those for Protected Areas (such as Natura 2000 sites or areas identified to protect drinking water sources);
- unnecessarily constrain future development through inefficient use of environmental capacity; or
- have significant adverse effects on the interests of other users of the water environment.

In granting authorisations, SEPA will impose the conditions it considers necessary to ensure new activities do not cause a failure of an environmental standard, though exceptions may be made in specific circumstances, as explained above. These steps are important to avoid risking deterioration of status of any water body, or jeopardising the future achievement of the environmental objectives for any water body. SEPA will take any necessary and appropriate action to encourage and enforce compliance with authorisation conditions, in order to prevent environmental standards being failed. SEPA will also use its powers to prevent unauthorised activities from causing environmental standards to be failed.

SEPA will develop rules for applying the standards to water bodies. This will require SEPA to define the appropriate scale over which a standard would have to be failed in a water body for the failure to affect the status of the water body.

Example: application of standards for river flows

River ecology can be particularly vulnerable during periods of low river flows. Low flows occur naturally during periods of low rainfall and flows can be very low during summer droughts. The proposed standards set out the degree to which river flow can be reduced further during low flow periods without significantly increasing the risk to aquatic plants and animals. The standards can therefore be used to determine the volume of water that could be abstracted at these times without risking harm to the ecology.

As with all the proposed standards, SEPA will follow these steps:

1. Identify which water bodies are at risk of failing the standards. New information on abstraction volumes from the CAR regime will refine the estimates in the 'Article 5' characterisation reports.
2. Identify which activities are contributing to the risk in each water body.
3. Initiate reviews of the authorisations for the relevant activities. If the operator considers that the necessary improvements would be disproportionately expensive:
    - Advertise the review to enable third parties to express their views to SEPA on the implications of improving the flows in the affected water body or bodies;
    - Determine whether the operators responsible for those activities have considered the most cost-effective options for reducing the impact of their activities;
    - Determine whether achieving the flow standards for 'good' status by 2015 would be disproportionately expensive.
4. If achieving the flow standards for 'good' status by 2015 would be disproportionately expensive or technically infeasible, identify what improvements could be feasible and proportionate and over what timescale they could be made.
5. Vary the conditions of authorisation for the relevant activities accordingly.

In the case of river flows, options to reduce impact might include:

- looking at efficiency – can losses be reduced, e.g. by recycling, addressing leakage and wastage?
- considering flexibility in supply or the potential to make arrangements with other abstractors:
    - – is there scope to change or rotate abstraction locations in low flow periods?
    - – is there scope to change the timing of abstraction?
- considering alternative sources of water:
    - – build 'offline' storage e.g. artificial pond, filled during winter for use during low flows
    - – use mains supply as a 'top-up' or alternative in low flow periods
- considering flexibility in business:
    - – is there scope to switch processes away from high-demand operations during low flows?

Extremely low flows – 'Hands-off' restrictions

Where a water body is near the limit of its ability to accommodate abstraction in low flow periods, SEPA is unlikely to grant a new licence for abstraction during these periods. However, the water body may be able to accommodate new abstractions during higher flow periods. Therefore, SEPA may grant a new licence, but set conditions restricting abstraction to high flow periods only. This is sometimes called a 'hands-off' flow restriction, since the operator would have to stop or reduce abstraction when river flows fall below a specified level.

As well as identifying low flow standards, UKTAG recommended that, when the volume being abstracted exceeds 25% of the QN98 (low flows that, on average, only occur for 2% of a year), a 'hands-off flow' condition should be put in place and restrictions applied to the amount of water that can be abstracted (see Annex A).

However, the need to consider such restrictions in Scotland will be very rare. For the vast majority of river water bodies in Scotland, if the volume being abstracted is less than the UKTAG low flow standard, it will also be less than 25% of the QN98.

The few water bodies where this is not the case are typically steep, spate rivers which rise and fall rapidly in response to rainfall. The need to consider hands-off restrictions beyond those needed to achieve the UKTAG low flow standard will therefore be very rare. Where they do arise, SEPA will consider the costs involved in imposing any restrictions as well as the ecological risks.

D – SECOND PHASE OF STANDARDS

Depending on the progress of UKTAG work and the availability of additional information, proposals for a second set of environmental standards during 2007 are likely to include:

Proposed standards – Phase 2	
Water Quality	
Indicator	**Water body**
Temperature	Rivers, lochs, transitional and coastal waters
Nutrients – nitrogen	Transitional and coastal waters possibly – if amended
Nutrients – phosphorus	Freshwater lochs
Transparency	Lochs, transitional and coastal waters (rivers not required)
Water Resources	
Indicator	**Water body**
Compensation flows	Rivers
Freshwater flows into estuaries	Transitional and coastal waters
Morphology	
Indicator	**Water body**
% change from natural conditions	Frameworks for lochs and for transitional and coastal waters
Specific Pollutants	
Substance **[Priorities that can be developed for the first RBMP cycle will be selected from this list]**	
Group 1 Aluminium, Chromium, Diazinon, Phenol, Copper, Iron, Tetrachlorethane, Arsenic, Cyanide, Manganese, Toluene, Chlorine, Cypermethrin, Permethrin, Zinc **Group 2** 2,4 dichlorophenol, Linuron, 2,4 dichlorophenoxyacetic acid (2,4-D), Mecoprop, Dimethoate **Other chemicals from the Dangerous Substances Directive List II** (Those subject to UK regulation (1997 & 1998) and still in use.) 4-chloro-3-methylphenol, Bentazone, Fenitrothion, 2-chlorophenol, Biphenyl, Malathion, 1,1,1-trichloroethane, Chloronitrotoluenes, Triphenyltin, 1,1,2-trichloroethane, Dichlorvos, Xylenes	
Groundwater	
Quality **Quantity**	

Following a consultation, a second set of standards is likely to be introduced in Scotland during 2007 and will be used in the first cycle of RBMP.

E – SUMMARY OF REGULATORY IMPACT ASSESSMENT (RIA)

It is important that the economic implications of implementing these standards are assessed as far as possible at this stage. However, **until specific objectives have been set for each water body, it is not possible to accurately assess the true costs and benefits associated with implementing the WFD**. **The key economic assessment will therefore be the one which will accompany the draft River Basin Management Plan in 2008**.

Environmental standards for the WFD are being developed and introduced on a UK-wide basis, and this consultation exercise will be mirrored in the other UK regions. An initial assessment of the potential costs and benefits associated with implementing these first standards – a Regulatory Impact Assessment (RIA) – has therefore been carried out for the UK as a whole. The assessment was carried out by independent consultants Risk and Policy Analysts (RPA), who were jointly commissioned by the administrations in England, Northern Ireland, Scotland and Wales.

RPA submitted their draft report to the UK Governments in September. This draft is being considered by the UK Governments and we expect it to be published once it has been through the due approval process. In the meantime, this paper includes here a summary of the RIA and the consultants' estimates of the costs associated with the introduction of the proposed standards, to inform your consideration of our proposals.

1. Approach used in the RIA

Assessment of the costs associated with implementation relies on the specific objectives that are set for each water body. At this stage in the implementation of the WFD, this process has not yet been carried out, and so the RIA has tried to estimate *ranges* of potential costs and benefits that might be associated with implementing these standards, to allow for some of the flexibility available in setting objectives.

The RIA report aims to assess the additional costs associated with implementing the proposed standards relative to those incurred through continuing existing practices. It compares two options:

- Option 1 (baseline): continue with existing practices; and
- Option 2: introduce the standards proposed in this paper and use them to implement the WFD.

The RIA has sought to identify the degree of improvement that would need to be made to achieve each standard for 'good' status. The report is based on the 'Article 5' estimates of risks to water bodies that were drawn up in 2004[5]; existing monitoring data, and other information such as water industry investment plans.

However, the Article 5 characterisation reports represent only a snapshot in time and as those assessments were contemporary best estimates, based on available data, they are likely to overestimate the number of water bodies at risk.

It is clear that achieving 'good' status in all water bodies by 2015 will not be possible, and that alternative objectives or extended deadlines will be used in some of our water bodies. Therefore, the RIA attempts to quantify the impact of the *range* of potential objectives and measures that could be

[5] Available from SEPA website: www.sepa.org.uk/publications/wfd/index.htm

put in place through River Basin Management Planning. This has been done by considering three scenarios:

- Scenario 1: all water bodies are set an alternative, less stringent objective and no measures are taken to deliver improvements or to prevent deterioration;
- Scenario 2: 50% of all water bodies are set an alternative, less stringent objective with no measures taken; 50% of all water bodies are required to meet 'good' status for all standards; and
- Scenario 3: all water bodies are required to meet 'good' status for all standards.

While scenarios 1 and 3 are unlikely to be realistic options, they have been used within the RIA to illustrate the *maximum potential range* of impacts on regulators and operators.

Due to the difficulties of assessing costs at this stage, the RIA assumes that scenario 2 incurs half the costs and benefits of scenario 3. In practice, costs and benefits are not directly proportional to the number of water bodies that are set the target of 'good' status. The true costs and benefits of meeting 'good' status will depend on how far each water body is from meeting the standard, and the choice of measures that are available in each case. Once the specific objectives and programmes of measures have been set out in the basin planning process, it will be possible to assess the actual costs and benefits far more accurately.

2. RIA Discussion

Assumptions and uncertainties

As explained above, the consultants have calculated costs and benefits in the report by estimating the 'gap' between existing conditions and the standards for 'good' status in each water body.

RPA acknowledge a number of assumptions and uncertainties associated with the calculations in the report. Key examples are:

- The 'gap' is assessed using the 'Article 5' characterisation reports, which need to be refined in the light of more recent data, as discussed above. It is therefore probably overestimated.
- All costs and benefits are calculated on the basis of a 'standard' water body and catchment, rather than using specific data on the actual rivers or lochs that are at risk. This is a useful starting point, but natural variation in the characteristics, such as size, catchment use, remoteness or type, of the actual water bodies affected in each case could have significant impacts on the estimated costs and benefits.
- The RIA only considers the risk of not achieving 'good' status and therefore the costs and benefits associated with measures to achieve 'good' status. The RIA does not consider costs or benefits from measures undertaken to prevent deterioration in status.
- Compliance costs are based on published sources, and not derived from discussion with the affected sectors. The consultants made assumptions about which measures might be used to deliver improvements and the costs of carrying them out.
- A linear relationship has been assumed between the amount of change needed to meet a standard and the costs of making this change. In many cases, this will result in an overestimate of costs.
- The compliance costs associated with implementing riverine phosphorus standards rely on data about phosphorus concentrations in rivers, rather than more exact data on the levels of reduction required in individual rivers to meet the proposed standards. They are therefore likely to be overestimates.

Benefits
The report concludes that the introduction of standards is likely to result in direct benefits including:

- reduced treatment needs (and therefore costs) of drinking water;
- greater availability of water as a resource;
- protection of economically significant species;
- protection and enhancement of aquatic wildlife;
- recreational use of waters;
- protection of surface waters and dependent terrestrial ecosystems, including improved amenity value;
- better targeting of measures to areas where there are clear environmental benefits;
- greater coherence of water legislation;
- greater clarity and transparency leading to greater accountability; and
- greater information from increased monitoring.

Indirect benefits are also anticipated, for instance those related to reductions in eutrophication as nutrient levels drop.

The consultants attempted to quantify some of these benefits for water quality. For water resources, they felt there was not currently enough data available to assess the environmental benefits of the proposed water resource standards. Since the morphology standards will only be used to assess *new* applications, RPA felt that the direct environmental benefits are hard to predict.

Costs
Three different types of costs have been estimated in the report:

- Administration costs (incurred by regulators) – these include the costs of site investigations and reviewing authorisations. The costs are related to the standards that are introduced, but not linearly. This is particularly true for diffuse pollution, which is likely to be addressed largely through national measures, rather than by measures in individual water bodies. Costs are not dependent on the objectives that are set, as the same amount of work will be done to assess options and set objectives, whatever decision is made. The report assumes costs are incurred from 2006 to 2009.

- Operational monitoring costs (incurred by regulators) – these are costs for monitoring of sites at risk. In most cases, little change in the operational monitoring costs is expected between option 1 (existing practices) and option 2 (introducing the proposed standards), as the Directive allows grouping of water bodies for monitoring, and the use of modelling. The consultants also assumed that the costs would be identical for all options and scenarios until the basin plan is in place, and so only included annual costs from 2012 onwards. It is not certain how the true costs will compare with this last assumption.

- Compliance costs (incurred by operators) – these are the costs of implementing measures to meet the standards. In the report, costs are assumed to be proportional to the amount of change needed to meet the standard. In practice, costs will depend on the specific objectives set, and so can only be assessed accurately after the objective-setting process. The report assumes costs are incurred from 2009 or 2012, depending on the measures.

The following table compares the costs calculated by the consultants for option 1 (continuing existing practices) and option 2 (introducing the proposed standards).

The consultants assumed that no administration or compliance costs were associated with scenario 1 (alternative objectives set for all water bodies). The table therefore includes only two columns for each option in the table below, demonstrating how the consultants' cost estimates vary with the number of water bodies required to meet 'good' status for all standards.

The costs in the table are not annual values – the estimated costs are totals, incurred over 30 years from 2006 (presented in 2006 prices).

Summary of potential costs for Scotland (£ million [1] – estimated to be incurred over 30 years, starting in 2006 [2])					
Standard	**Type of cost**	**Continue existing practices (Option 1)**		**Introduce proposed standards (Option 2)**	
		50% water bodies to meet existing standard (scenario 2)	**All water bodies to meet existing standard (scenario 3)**	**50% water bodies to meet proposed standard (scenario 2)**	**All water bodies to meet proposed standard (scenario 3)**
Rivers BOD/DO	Admin	0.08	0.08	0.07	0.07
	Monitoring	0.07	0.07	0.06	0.06
	Compliance	0.50	0.99	0.35	0.71
Rivers acid conditions	Admin	0.03	0.03	As for option 1 – standards being retained	
	Monitoring	0.03	0.03		
	Compliance [3]	Not assessed			
Rivers phosphorus	Admin	0.03	0.03	0.03	0.03
	Monitoring	0.15	0.15	0.16	0.16
	Compliance	107	278	101	141
Rivers ammonia	Admin	0.03	0.03	0.04	0.04
	Monitoring	0.06	0.06	0.08	0.08
	Compliance	1.67	3.33	2.83	5.66
Lochs DO	Admin	No costs as no formal standard - linked to eutrophication (nutrient levels)		Included in work to address nutrient pressures	
	Monitoring			0.05	0.05
	Compliance			Not possible to assess - linked to eutrophication (nutrient levels)	
Lochs salinity	Admin	Possible infraction proceedings		0	0
	Monitoring			0	0
	Compliance	No standard		0	0
Lochs acid conditions	Admin	0.005	0.005	0.01	0.01
	Monitoring	0.08	0.08	0.08	0.08
	Compliance	1.6 – 5.6	1.6 – 5.6	0.7 – 5.6	0.7 – 5.6
Rivers water resources	Admin	Possible infraction proceedings		0.05 – 0.10 Maybe also cost of investigations	
	Monitoring				
	Compliance	Not assessed			
Lochs water resources	Admin	Possible infraction proceedings		0.01	
	Monitoring			No increase on existing costs	
	Compliance	Not assessed			
Rivers morphology	Admin	Possible infraction proceedings		Development of a database	
	Monitoring				
	Compliance	Not assessed			

[1] Present Value costs - calculated on 2006 costs, discounted at 3.5% over 30 years from 2006.

[2] Costs are estimated over different periods:

- administration costs for 3 years from 2006 (year 0) to 2009 (year 3)
- operational monitoring costs from 2012 (year 6)
- compliance costs from 2009 (year 3) or 2012 (year 6)

[3] Existing compliance costs cannot be estimated due to lack of data on rivers at risk.

Summary of cost implications:

Water quality

- In most cases **for water quality** standards, there is no significant difference between the costs calculated by the consultants for the two options. This reflects the fact that a high proportion of Scotland's water bodies are not at risk, and also that in most cases, the proposed water quality standards are similar to those used in SEPA's existing classification scheme.

- The consultants did not calculate compliance costs for the proposed dissolved oxygen standards for lochs. This is because achievement of the standard is so closely linked to eutrophication pressures from high nutrient levels. Scotland also has no existing standard for comparison.

- The RIA highlights that the issues of most significance in Scotland are likely to be tackling riverine phosphorus and ammonia levels (see table above and Annex A). High levels of either of these pollutants are harmful to aquatic life. High phosphorus levels can contribute to many problems through eutrophication (see earlier table). Tackling phosphorus levels would help the many plants and animals that rely upon good water quality to thrive. As well as contributing to a healthier aquatic environment, actions like these that improve our water environment can help to encourage greater use of water bodies for recreational and commercial activities. RPA estimated an increase in costs for ammonia because the proposed standard in upland, low alkalinity rivers is more stringent than the existing threshold, although in other rivers, no change is proposed. For phosphorus, the proposed standards would result in better targeting of resources and a net reduction in compliance costs. The consultants concluded that improvements are most likely to be delivered by two sectors: agriculture and Scottish Water.
    - **Agriculture**: the issues of nutrient enrichment will largely be tackled through a national diffuse pollution strategy, which is currently in development. The costs of implementation will depend on the objectives set during basin planning.
    - **Scottish Water**: compliance with the WFD was considered as part of the *Quality and Standards 3* process[6] and requirements to address this issue were incorporated into the objectives that Ministers set Scottish Water for the period 2006-2014[7].

- The consultants' estimated compliance costs for riverine phosphorus are the highest in the report. RPA concluded that the proposals would not increase overall compliance costs: higher costs are predicted for achieving existing standards. The proposals will allow better targeting of resources to those water bodies where ecology is judged to be most at risk from raised nutrient levels.

- RPA estimated that no costs would be associated with introducing the proposed loch salinity standard, as no lochs in Scotland are expected to be at risk of failing it.

Water resources and morphology

- There are no existing regulatory comparisons for either the proposed **water resource** standards or **morphology** framework. No compliance costs have been estimated for the water resource standards, due to the lack of available data. Similarly, the morphology framework is entirely new, and will only be used to assess *new* applications. RPA therefore felt that it was not possible to assess the associated compliance costs. However, since no regulatory standards are currently in place, continuing existing practices for water resources and morphology would risk infraction by the European Commission. The costs of infraction are not quantified in the RIA.

- The RIA does not quantify the costs of developing tools to apply the morphology framework.

[6] Details available from http://www.scotland.gov.uk/Topics/Environment/Water/17583/PolicyStatements
[7] The Scottish Water (Objectives for 1 April 2006 to 31 March 2010) Directions 2005: available from http://www.scotland.gov.uk/Resource/Doc/1057/0022201.pdf

F – CONCLUSIONS

This paper proposes the first set of environmental standards to be developed for the implementation of the Water Framework Directive in the UK. The standards have been developed on a UK-wide basis after careful assessment of current scientific data. We are therefore confident that the proposals in this paper are supported by robust scientific evidence and will provide appropriate protection for aquatic ecology at 'good' status. Introduction of these environmental standards on a UK-wide basis will provide consistency for all water users across the UK.

Introduction of environmental standards is a key stage in implementing the WFD in Scotland:

- Standards underpin the **objective-setting process** within basin planning. They will provide the basis for assessing risks to the water environment and determining what action would be needed to prevent deterioration of status or to achieve 'good' ecological status.
- The standards are vital to the **regulation of water use** in Scotland. They will provide a basis for SEPA to determine new applications and to review licence conditions for existing authorisations under the Controlled Activities Regulations (CAR), which came into force earlier this year.
- Ongoing **monitoring** of water conditions against the range of standards will help to assess risks to the water environment. It will also contribute to identifying where measures are effective in delivering our environmental objectives, and hence will support both regulation and basin planning.

This paper also summarises a Regulatory Impact Assessment (RIA) carried out by independent consultants on a UK-wide basis. It is important to recognise that until the objective-setting process has been carried out, this report can only give a broad estimate of the economic implications of the standards. The costs of implementing measures will depend on the specific objectives and actions that are agreed during the objective-setting process. The key assessment of the costs and benefits associated with implementing the WFD in Scotland will therefore be the RIA which accompanies the draft River Basin Management Plan in 2008.

The proposals in this consultation paper include thirteen elements, relating to aspects of water quality, water resources and morphology in surface waters:

- **For water quality**, the proposed standards are similar to those SEPA has been using to drive improvements in the past. The proposed standards would bring regulation in line with the latest scientific thinking, as type-specific standards are proposed to replace the existing single standards for all river (or loch) types. This will result in better targeting of resources at water bodies where the ecology is at most significant risk. Thresholds in some river types have increased while others have decreased.
- The issues of most significance in Scotland are likely to be tackling riverine phosphorus and riverine ammonia levels. The RIA concluded that improvements in both ammonia and phosphorus levels are most likely to be delivered by two key sectors: agriculture and Scottish Water. Agricultural issues will be tackled primarily through the development of a national diffuse pollution strategy, including a set of general binding rules. Requirements for Scottish Water to address WFD compliance were incorporated into the objectives that Ministers set in the *Quality and Standards 3* process for the period 2006-2014.
- Introduction of the proposed riverine phosphorus standards is expected to result in only a minimal increase in the number of water bodies at risk, but importantly, better targeting of resources at those water bodies where the ecology is judged to be most at risk from raised nutrient levels. The impacts of a proposed change in the dissolved oxygen standard for some

rivers are expected to be minimal, as the proposals do not change the related BOD standard. A new salinity standard is proposed for lochs, but no failures are expected in Scotland.

- Standards for **water flow in rivers and water levels in lochs** are proposed for the first time. Until CAR was introduced earlier this year, there were no comprehensive controls in Scotland for abstractions or activities that alter water flow. The proposed standards aim to protect ecology from extremely low flows by restricting the permitted changes from natural flow patterns. The consultants writing the RIA concluded that there is currently not enough information to estimate the associated costs. The impact of the proposed standards will depend on the specific objectives that are set for each water body.
- A decision-supporting framework is proposed as a tool to make initial assessments of new applications for activities that may impact on the **structure or shape of a river**. Such works in freshwaters have only this year become regulated with the introduction of CAR. The framework proposed in this paper is the first of its type to be introduced in the UK, and should enable all initial assessments of these new applications to be made on a consistent basis. Detailed risk assessments will still be needed where proposals are expected to have significant impacts on ecology.

We would welcome your comments on any aspect of this paper.

ANNEX A: PROPOSED STANDARDS AND CONDITIONS – DETAIL

This Annex sets out the numerical proposals for the first set of environmental standards and conditions for the Water Framework Directive. The proposed standards are compared with existing standards where they exist.

More information on the methods used to develop the standards, and the information on which they are based, can be found from the UKTAG report, or from the technical documents which support it. These documents can be found on the UKTAG website at www.wfduk.org .

The earlier part of this consultation paper summaries these proposals, and sets out proposals for their use in Scotland (see section C).

The proposed standards are set out in three sections in this Annex:

1. **Water quality (physico-chemistry)** – for rivers, lochs, transitional and coastal waters;
2. **Water resources (hydrology)** – for rivers and lochs only; and
3. **Physical shape (morphology)** – for rivers only.

Typologies

Ecology in water bodies can vary with factors like geology and altitude or loch depth, and so the biological responses to some external pressures, like nutrient conditions, may also vary between different types of river, or different types of loch.

UKTAG has investigated where variations in the characteristics of water bodies affect the sensitivity of the ecological communities to external factors. UKTAG has therefore set standards at different values for different types of a given water body, to reflect the varying needs of the ecology. These *typologies* are set out at the beginning of each section in this Annex.

General notes to tables:

'High'	refers to the boundary between 'good' and 'high' classes: for 'high' ecological status, water must equal or better the standard.
'Good'	refers to the boundary between 'moderate' and 'good' classes: for 'good' ecological status, water must equal or better the standard.
5-percentile	This refers to the value in a dataset where 5% of all the dataset are equal to or below the value (i.e. 95% of the dataset are higher). For standards, this would mean that, for instance, oxygen levels must not drop below the defined standard for more than 5% of the time.
10-percentile	Similarly, this refers to the value in a dataset where 10% of all the dataset are equal to or below the value (i.e. 90% of the dataset are higher). Here, this is used to mean that to meet e.g. the 'good' dissolved oxygen standard, oxygen levels must not drop below the defined standard for more than 10% of the time.
90-percentile	This refers to the value in a dataset where 90% of all the dataset are equal to or below the value (i.e. 10% of the dataset are higher). Here, this is used to mean that to meet e.g. the 'good' BOD standard, BOD levels must not be higher than the defined standard for more than 10% of the time.

Water quality: physico-chemical conditions

Standards have been developed for a number of indicators of water quality in each of the four main types of surface water bodies: rivers, lochs, transitional waters (estuaries) and coastal waters, matched to biology.

This section sets out:

- Typologies used to classify rivers and lochs for water quality standards
- Details of the proposed numerical standards for the following conditions:

Water quality standards proposed in this paper			
Standard	**Rivers**	**Lochs**	**Transitional and coastal waters**
Oxygenation	**Dissolved oxygen and biochemical oxygen demand (BOD)**	**Dissolved oxygen**	**Dissolved oxygen, including fundamental intermittent standards**
Ammonia	**Total ammonia**	Not required by WFD	Not required by WFD
Acid conditions	**pH**	**Acid neutralising capacity (ANC)**	Not required by WFD
Salinity	[future]	**Conductivity**	[future]
Nutrient conditions	**Soluble reactive phosphorus**	[future]	[future]

Rivers - water quality

1. River typologies for water quality

Overall:
For water quality, rivers are divided into types depending on their altitude and alkalinity:

Table A1: Basic typology for rivers

Site Altitude	Alkalinity (as mg/l $CaCO_3$)				
	< 10	**10 to 50**	**50 to 100**	**100 to 200**	**> 200**
Under 80 metres	Type 1	Type 2	Type 3	Type 5	Type 7
Over 80 metres			Type 4	Type 6	

When developing standards, UKTAG found that some types of river responded in similar ways, and so proposed standards for groups of these river types, as set out below.

Oxygenation and ammonia:
Standards are proposed for two broad types of river. These correlate quite well with those currently used by the environment agencies, including those for the Freshwater Fish Directive (FWFD).

Table A2: River typology for oxygenation and ammonia

Proposed types	Existing types
Upland and low alkalinity (types 1,2,4,6)	Salmonid†
Lowland and high alkalinity (types 3,5,7)	Cyprinid‡

† **Salmonid** waters can support salmonid ('game') fish, i.e. salmon, trout and whitefish.

‡ **Cyprinid** waters can support cyprinid ('coarse') fish, which include carp, barb, roach, and chubs.

NB In any case where a lowland, high alkalinity water body is a salmonid river, the proposed standards for the upland, low alkalinity river will apply. This is because fish are more at risk from low dissolved oxygen standards than invertebrates, and so require tighter standards.

Acid conditions:
The proposed standards are identical for all types of rivers.

Nutrient conditions:
The proposed standards are based on four different river types.

Table A3: River typology for phosphorus		
Site Altitude	**Alkalinity (as mg/l $CaCO_3$)**	
	< 50	**> 50**
Under 80 metres	Type 1n	Type 3n*
Over 80 metres	Type 2n	Type 4n
* There were concerns during development of the standards about some of the sites used to define the '3n' standards. Therefore the proposed standards for type '4n' will be used for type '3n' as well, until more data has been collected to allow reassessment of this classification.		

2. Oxygenation standards – dissolved oxygen and biochemical oxygen demand (BOD)

Table A4: Dissolved oxygen (% saturation) – rivers

Proposed standard (10-percentile)			**Existing standards**			
River type	**High**	**Good**	**River Type**	**High** (10-percentile)	**Good** (10-percentile)	**FWFD** (5-percentile)
Upland and low alkalinity (types 1, 2, 4, 6)	**80**	**75**	**'Salmonid waters'** (types 2, 4, 6)	**80** [a]	**70** [a]	**65 – 75** [b]
Lowland and high alkalinity (types 3, 5, 7)	**70**	**60**	**'Cyprinid waters'** (types 3, 5, 7)			**45 – 55** [b]

[a] Standards for the highest two classes in the existing Scottish Rivers Classification Scheme.

[b] Freshwater Fish Directive (FWFD) standards are defined in mg/l dissolved oxygen (4 mg/l salmonid, 6 mg/l cyprinid), but have been transposed into % saturation values for comparison with the proposed standards.

Table A5: Biochemical oxygen demand (BOD) (mg/l) – rivers

Proposed standard (90-percentile)			**Existing standards** (90-percentile) **[All river types]**	
River type	**High**	**Good**	**High**	**Good**
Upland and low alkalinity (shaded boxes above – types 1, 2, 4, 6)	**3**	**4**	**2.5***	**4***
Lowland and high alkalinity (white boxes above – types 3, 5, 7)	**4**	**5**		

* Standards for the highest two classes in the existing Scottish Rivers Classification Scheme.

3. Ammonia standards

Table A6: Total ammonia (mg/l) - rivers

Proposed standard (90-percentile)			**Existing standards** (90-percentile) **[All river types]**	
River type	**High**	**Good**	**High**	**Good**
Upland and low alkalinity (types 1, 2, 4, 6)	**0.2**	**0.3**	**0.25***	**0.6***
Lowland and high alkalinity (types 3, 5, 7)	**0.3**	**0.6**		

* Standards for the highest two classes in the existing Scottish Rivers Classification Scheme.

4. Acid condition standards – pH

No new standards have been proposed in this paper – the existing standards used in SEPA's classification system will be retained for the first cycle of River Basin Management Planning.

Table A7: Acid condition (pH) – rivers	
Proposed (and existing) standard [All river types]	
High (5- and 95- percentile†)	**Good** (10 percentile†)
≥ 6 to ≤ 9 (i.e. range 6 – 9 inclusive)	≥ 5.2

pH a measure of the concentration of H^+ ions – a low pH represents a lot of H^+ ions and therefore very acidic water. A pH of 7 is defined as neutral. Acidic water has a pH below 7; alkaline water has a pH over 7.

† To meet the proposed 'good' standard, a river cannot have a pH lower than 5.2 for more than 10% of the time. To achieve the proposed 'high' standard, water pH cannot be lower than 6 for more than 5% of the time, or higher than 9 for more than 5% of the time.

5. Nutrient condition standards – Phosphorus

The tables below compare the proposed standards with:

Table A8: values used under the Water Framework Directive for classification or characterisation purposes – also measured as soluble reactive phosphorus

Table A9: guidelines proposed by the Environment Agency and Countryside Council for Wales as part of a process of reviewing permit conditions to meet the requirements of the Habitats Directive – measured as *total* reactive phosphorus.

Table A8: Soluble reactive phosphorus (µg/l) – rivers

Proposed standard (annual mean†)			**Standards used for characterisation** (annual mean†) **[All river types]**		
River type	**High**	**Good**	**High** [a]	**Good** [b]	
1n	**30**	**50**	**20**	Sil [c] **40**	**100** [e]
2n	**20**	**40**			
3n*, 4n	**50**	**120**		Cal [d] **100**	

* see comments in 'typology' descriptions above

† annual mean is the average of all measured values during a year

a 'High' value used for characterisation and classification under WFD

b 'Good' value used for characterisation under WFD

c 'Sil' refers in WFD characterisation (Article 5 report) to a river in a siliceous-typed section (i.e. flowing over rock with high silica content, such as sandstone) – low alkalinity river.

d 'Cal' refers in WFD characterisation (Article 5 report) to a river in a calcareous-typed section (i.e. flowing over rock with high calcium content, such as limestone) – high alkalinity river.

e Existing standard in the Scottish Rivers Classification Scheme – applied to all rivers

Table A9: Reactive phosphorus (µg/l) – rivers					
Proposed standard (annual mean) – *soluble* reactive P		**EA guidelines for meeting Habitats Directive** (annual mean) – *total* reactive P			
High	**Good**	**River type**	**Natural (mid-High)**	**Guideline (mid-Good)**	**Threshold (just above Moderate)**
20-50	**40-120**	**Head waters**	**0-20**	**20-60**	**40-100**
		Most rivers	**20-30**	**40-100**	**60-200**
		Large rivers	**20-30**	**60-200**	**100-200**
The 'Natural' level is an estimate of water quality with no human impact.					

Lochs - water quality

1. Loch typologies for water quality

Overall:
A number of factors have a significant influence on the ecology of lochs, including geology, depth and altitude. However, for the water quality standards proposed in this paper, only very simple groupings of lochs are used.

Oxygenation:
Standards are proposed for two loch types, based on the species of fish they naturally support:

Salmonid waters – can support salmonid or 'game' fish, i.e. salmon, trout and whitefish.

Cyprinid waters – can support cyprinid or 'coarse' fish, which include carp, barb, roach and chubs.

Salinity:
A single standard is proposed for all lochs.

Acid conditions:
A single standard is proposed for all lochs.

2. Oxygenation standards – dissolved oxygen

Table A10: Dissolved oxygen (mg/l) – lochs									
Proposed boundary (mean in July-August) **[All loch types]**					**Standards currently used by Swedish Environment Protection Agency**				
Loch type	High	Good	Moderate	Poor	O_2 rich	Moderately O_2 rich	Moderately O_2 deficient	O_2 deficient	~ no O_2
Salmonid	**9**	**7**	**4**	**1**	**≥ 7**	**5**	**3**	**1**	**<1**
Cyprinid	**8**	**6**	**4**	**1**					

3. Acid condition standards – Acid Neutralising Capacity (ANC)

The table below compares the proposed boundary standards with the standards for acidity currently used by SEPA.

Table A11: Acid Neutralising Capacity (µ equivalents /l) – lochs								
Proposed standard [All loch types]		**Existing standards [b] [All loch types]**						
High	**Good**	**Baseline ANC_0**	**Present ANC_t**					
			≥ 40	**39 to 20**	**19 to 0**	**-1 to -20**	**-21 to -40**	**< -40**
> 40	**> 20 [a]**	**≥ 40**	**b. 1**	**b. 2**	**b. 2**	**b. 3**	**b. 3**	**b. 4**
		20-39		**b. 1**	**b. 2**	**b. 3**	**b. 3**	**b. 4**
		0-19			**b. 1**	**b. 2**	**b. 3**	**b. 4**

[a] where other evidence demonstrates that the loch had a historic (pre-industrial) value below 20, UKTAG recommends that 0 is used.
[b] The existing SEPA scheme uses a look-up table. The current ANC value (ANC_t) is compared with a baseline value for that loch (ANC_0) to assign a band (class) from 1 to 4. The table shows how changes in the ANC_t value relative to the baseline ANC_0 value are related to band assignment.

4. Salinity standards – conductivity

Table A12: Salinity – lochs (reported by proxy as µ siemens /cm)
Proposed boundary (annual mean) **[All loch types]**
Good
1,000

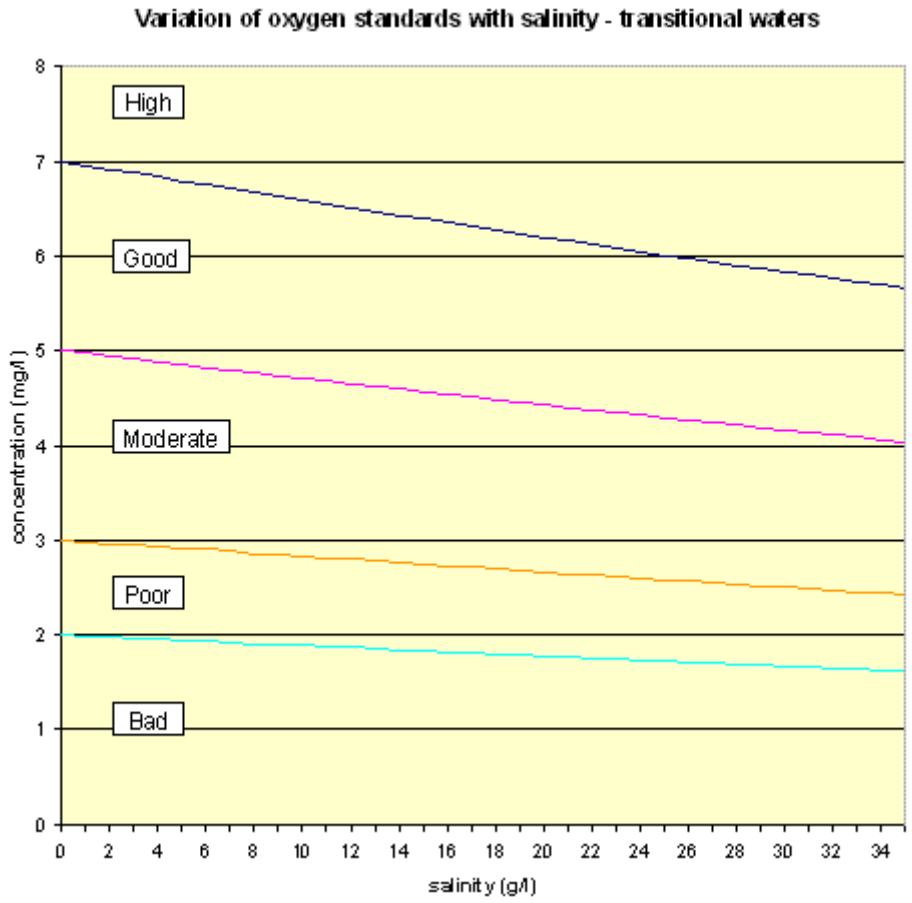
There are no existing standards for salinity levels in Scottish lochs.

Transitional and coastal waters - water quality

1. Oxygenation standards

Table A13: Dissolved oxygen (mg/l) – transitional /coastal waters			
Proposed standard (5-percentile)			
Status	**Freshwater**	**Marine**	**Description**
High	**7**	**5.7**	Protects all life-stages of salmonid fish
Good	**5 – 7**	**4.0 – 5.7**	Resident salmonid fish
Moderate	**3 – 5**	**2.4 – 4.0**	Protects most life stages of non-salmonid adults
Poor	**2 – 3**	**1.6 – 2.4**	Resident non-salmonid fish, poor survival of salmonid fish
Bad	**2**	**1.6**	No salmonid fish. Marginal survival of resident species
These proposed standards take into account recent studies on fish oxygen requirements. These found that an upper limit of 7 mg/l is enough for most requirements, but most resident fish species are stressed when only 2 mg/l available.			

Dissolved oxygen varies with salinity. Table A13 sets out proposed standards for dissolved oxygen in saline marine waters and in freshwaters. Values for transitional waters with intermediate levels of salinity should be read from the graph below.



Intermittent Standards

Additionally, UKTAG recommended the use of standards for intermittent discharges. These are proposed to protect transitional and coastal waters from extreme events that can cause prolonged periods of low oxygen, which can cause serious damage to biology[8].

Return periods define the minimum period allowed between episodes of low oxygen concentration – e.g. the dissolved oxygen level should not fall below the threshold level for more than one 6 hour tidal cycle in any 6 year period for 'good' status. Oxygen levels must remain above the threshold concentration for the rest of the time.

Table A14: Dissolved oxygen (mg/l) for action on intermittent discharges – transitional and coastal waters		
Proposed Intermittent Standard (5-percentile)		
Status	**Minimum dissolved oxygen** (mg/l)	**Return period** (years)
Good	**2**	**1 in 6**
Moderate	**2**	**1 in 3**

[8] For more information about these standards, refer to scientific documents available from UKTAG website, www.wfduk.org.

Water resources: hydrological conditions

Standards have been developed for water flow conditions in rivers and in lochs, matched to biology.

Water resources standards proposed in this paper		
Standard	**Rivers**	**Lochs**
Water flow	**% change from natural flow**	**% change from natural inflow**

Proposed numerical standards for flow conditions in both rivers and lochs vary with water body 'type', as discussed earlier. The typology used to classify rivers and lochs for water resources are defined in the next sections, followed by the numerical standards that are proposed in each case.

Rivers - water resources

1. River typologies for water resources

Overall: for water quality, rivers are divided into types depending on the underlying geology, catchment gradient and altitude:

Table A15: River typology – for water resource standards

Type			Gradient (m/km)	Altitude (m)	Description
A	Clay and/or chalk; low altitude; low slope	**A1**	0.8 ± 0.4	36 ± 25	Predominantly clay. SE England, E Anglia, Cheshire plain
	Eutrophic†; silt-gravel bed	**A2***	Slightly steeper 1.7 ± 0.8	Low altitude 55 ± 38	Chalk catchments; predominantly gravel beds; base-rich
B	Hard limestone and sandstone; low-medium altitude; low-medium slope; typically mesotrophic† with gravel-boulder or pebble-cobble bed	**B1**	4.1 ± 9.9	93 ± 69	Hard sandstone, calcareous shales. Predominantly S and SW England and SW Wales
		B2	Shallower than B1 2.7 ± 10.7	71 ± 58	Predominantly NW and E Scotland
C	Non-calcareous shales, hard limestone and sandstone; medium altitude; medium slope; oligo-mesotrophic† with pebble, cobble and/or boulder bed	**C1**	5.4 ± 6.5	101 ± 84	Hard limestone; more silt and sand than C2; mesotrophic†
		C2	Steeper than C1 7.3 ± 10.8	130 ± 90	Non-calcareous shales; pebble bedrock; oligo-mesotrophic†
D	Granites and other hard rocks; low and high altitudes; gentle to steep slopes; ultra oligotrophic†	**D1**	Medium gradient 11.3 ± 15.6	93 ± 92	Oligotrophic†, substrate finer than D2 (including silt and sand); more slow flow areas than D2
	Oligotrophic† with cobble, boulder, bedrock and/or pebble bed	**D2**	High gradient 25.5 ± 33	High altitude 178 ± 131	Stream order 1 and 2 bedrock and boulder; ultra-oligotrophic†; torrential

* Split into A2 (headwaters) and A2 (downstream) to reflect different sensitivities of chalk rivers.

† These terms are all measures of the biological productivity of the water.
Oligotrophic waters are unproductive**; eutrophic** waters are highly productive**; mesotrophic** waters lie in between.

This typology is based on some existing classifications. It is similar to that used by the Environment Agency in England and Wales, as part of their Resource Assessment and Management (RAM) Framework. Some river types have been grouped together, where it was thought to be difficult to reliably distinguish them on the basis of summarising high level catchment data.

2. Water flow standards – percent change from natural conditions

Table A16: Water flow (% permitted change from natural flow) – rivers					
'High' Status					
River type	**Season**	**Flow decreasing ⇒**			
		Flow > QN95		**Flow < QN95**	
ALL	**ALL**	**Up to 10**		**Up to 5**	
'Good' Status					
River type	**Season**	**Flow decreasing ⇒**			
		Flow > QN60	**Flow > QN75**	**Flow > QN95**	**Flow < QN95**
A1	**Summer: Apr-Oct**	**30**	**25**	**20**	**15**
	Winter: Nov-Mar	**35**	**30**	**25**	**20**
A2 (downstream), B1, B2, C1, D1	**Summer: Apr-Oct**	**25**	**20**	**15**	**10**
	Winter: Nov-Mar	**30**	**25**	**20**	**15**
A2 (headwaters), C2, D2	**Summer: Apr-Oct**	**20**	**15**	**10**	**7.5**
	Winter: Nov-Mar	**25**	**20**	**15**	**10**
Salmonid spawning and nursery areas (not chalk rivers)	**Summer: Apr-Oct**	**25**	**20**	**15**	**10**
	Winter: Nov-Mar	**20**	**15**	**Flow > QN80 10**	**Flow < QN80 7.5**
In cases where flow is artificially increased, e.g. by transferral of water between water bodies, or discharge of treated water to a watercourse, the proposed standards should be applied to changes in the *actual* flow, not the original flow.					

'Hands-off' restrictions

UKTAG also recommends 'hands-off' restrictions to protect extremely low flows, where the natural flow is at or below QN98 levels. UKTAG recommends that, for these low flows, **if the total actual flow is less than four times the maximum removal volume permitted by the proposed standard, no abstraction would be permitted.** (This means no abstraction would be permitted for QN98 or smaller flows where the maximum reduction in flow allowed by the proposed standard – e.g. 15% from natural flow in an A1 river, see Table A16 above – is over 25% of the total flow.)

As discussed in section C, the need to consider such restrictions in Scotland will be very rare. For the vast majority of river water bodies in Scotland, if the volume being abstracted meets the proposed standard for flows less than QN95, it will also be less than 25 % of the QN98 volume. The few water bodies where this is not the case are steep, spate rivers which rise and fall rapidly in response to rainfall.

Lochs - water resources

1. Lochs typologies for water resources

Overall: For water resources, lochs have been classified according to six different parameters:

Table A17: Lochs typology for water resources

Tier	Units	Categories					
Geology	As UK lakes typology (UKTAG 2003)	Peat	Low Alkalinity	Moderate Alkalinity	High Alkalinity	Marl	Brackish
Mean depth	(m)	Very shallow (Sh) < 3			Deep (D) ≥ 3		
Altitude	(m)	Lowland < 200		Mid-altitude 200 to 800		High-altitude ≥ 800	
Size (loch area)	(ha)	VS/S 1 to 50			L/VL ≥ 50		
Season		Summer Feb – Sept			Winter Oct – Jan		
Basin form*	$V_d = 3D_{mean}/D_{max}$	Vex (VCx/Vx) < 0.67			Lin (Scx/L/C) ≥ 0.67		

* For further information on these typologies and calculations, see UKTAG papers at www.wfduk.org.

2. Water inflow standards – percent allowable deviation from natural net inflow

Table A18: Water inflow (% maximum permitted change from natural inflow) – lochs

'Good' Status

Geology	Altitude*		Low				Mid				High			
	Size*		Small		Large		Small		Large		Small		Large	
	Basin form*		L	V	L	V	L	V	L	V	L	V	L	V
	Depth*	Season												
Peat	Deep	Summer	15	15	15	10	15	15	15	10	15	15	15	10
		Winter	15	15	15	10	15	10	10	10	12	10	10	10
	Very shallow	Summer	15	10	10	10	15	10	10	10	15	10	10	10
		Winter	15	10	10	10	10	10	10	10	10	10	10	5
Low Alkalinity	Deep	Summer	30	25	25	25	30	25	25	25	30	25	25	25
		Winter	20	20	20	20	20	20	20	15	20	15	15	15
	Very shallow	Summer	25	25	25	25	25	25	25	25	25	25	25	25
		Winter	20	20	20	15	20	15	15	15	15	15	15	15
Medium Alkalinity	Deep	Summer	20	20	20	20	20	20	20	20	20	20	20	20
		Winter	20	20	20	20	20	20	20	15	20	15	15	15
	Very shallow	Summer	20	20	20	15	20	20	20	15	20	20	20	15
		Winter	20	20	20	15	20	15	15	15	15	15	15	15
High Alkalinity, Marl	Deep	Summer	30	25	25	25	30	25	25	25	30	25	25	25
		Winter	30	25	25	25	25	25	25	25	25	25	25	25
	Very shallow	Summer	25	25	25	25	25	25	25	25	25	25	25	25
		Winter	25	25	25	25	25	25	25	25	25	25	25	20
Brackish	Deep	Summer	20	20	20	20	20	20	20	20	20	20	20	20
		Winter	30	25	25	25	30	25	25	25	25	25	25	25
	Very shallow	Summer	20	20	20	15	20	20	20	15	20	20	20	15
		Winter	25	25	25	25	25	25	25	25	25	25	25	25

* Abbreviations refer to the typology on the previous page.
Standards have not yet been developed for 'high' status.

Comparison

The standards that have been used to *characterise* lochs and assess risks from abstraction under the WFD allow between 15 and 25% of the natural inflow to be abstracted, depending on the level of flow (see below). Reports of the characterisation carried out in 2004 can be obtained from the SEPA website: www.sepa.org.uk/publications/wfd/index.htm.

Table A19: Inflow characterisation standards (% reduction of natural inflow) – lochs

Sensitivity to flow	Flow decreasing ⇒		
	At QN50	At QN70	At QN95
All categories	25	20	15

Physical shape and structure: morphological conditions

A decision-supporting framework is proposed for use in rivers, based on expert opinion of the impact of morphological changes on river ecology, and supported by numerical thresholds. The proposed framework considers the impact of new applications for engineering or construction works as a percentage change from natural conditions. The framework applies to all rivers, as it includes a module for river type.

This is the first holistic framework to be used for regulation in the UK and should ensure consistent initial assessment of new applications for engineering and construction works that would impact on river morphology. Such works in freshwater have only been regulated in Scotland since April 2006, with the introduction of CAR. In the past, SEPA has used River Habitat Surveys to describe the existing morphological condition of rivers. SEPA also used a type-specific framework for assessing the environmental risk associated with engineering works, to inform responses to consultations on development proposals.

The risk assessment criteria included in the proposed framework were used for the 'Article 5' characterisation analyses carried out in 2004 to identify water bodies at risk of failing to achieve 'good' status.

1. River morphology framework

The approach to assessing the appropriate level of morphological change that can be accommodated in a river is to:

1. Set numerical limits for the maximum acceptable percentage use of a river's capacity that support 'high' and 'good' ecological status: see table below.

Table A20: Morphology – maximum reduction in capacity (%) – rivers

Zone	Maximum permitted reduction in capacity (%)	
	High	Good
Channel†	5	15
Bank and riparian‡	5	15

† 'channel' includes 'river depth and width variation' and changes in the 'structure and substrate of the river bed', as defined by the WFD.
‡ 'bank and riparian' includes changes in the 'structure of the riparian zone', as defined in the WFD.

2. Establish a decision-support framework to identify whether a proposal is either:

- likely to be sustainable by the river in question, without causing damage to ecology; or
- likely to threaten the ecological balance of the watercourse.

The proposed framework has five modules, as set out in Table A21. Users select from a list of options to create a picture of the specific river conditions and the proposed activities in each case. The user enters the appropriate information for the stretch of river in question for each of the modules (attributes, type, sensitivity, pressure) and the model then calculates the capacity used.

Table A21: Decision support framework: morphology change – rivers		
Module		**Description**
1	**Attributes:** descriptions of the watercourse's existing condition: effectively a picture of 'what needs to be protected'.	A list of attributes has been produced, which includes features that either • directly support aquatic biology, such as the structure and extent of riparian (riverside) vegetation; or • control the physical environment on which ecological communities depend, such as the slope of the channel, or rate of channel migration.
2	**Channel type:** a classification of the physical shape and structure of the section of the river in question.	Reaches have been classified into a series of six morphological types (A to F) that each respond in a particular way to an external pressures. These types incorporate the ability of a watercourse to accommodate change and also to recover from the external change. Only six types have been defined at present, so this is a simplification of the possible responses.
3	**Ecological sensitivity**: a classification of how sensitive the ecology in that part of the river is to an external pressure.	Sensitivity is classified in three levels, which are considered in terms both of *resistance* to change (the ability to accommodate it) and *resilience* (the ability to recover from change). The model considers the probability of a pressure causing a change in the morphology of the watercourse, and then what impact these changes in attribute would have on the biology.
4	**External pressure:** a classification of the external pressure that is proposed.	A list of twenty potential pressures has been compiled, including activities such as 'hard' bank protection (such as strengthening river banks with concrete), building bridge piers and dredging. The pressures are considered in terms of the probability of them affecting the river morphology and the scale of that impact. Activities such as protecting banks cause local effects, but dredging a bed has a far more extensive impact.
5	**Scoring system:** this incorporates the information from the first four modules to calculate a numerical score for the proposed work.	An **Activity Impact Score** (0 to 2) is calculated for each attribute in turn, using the information about the pressure, channel type and ecological sensitivity of the reach in question. **Activity Impact Score (0 to 2)** = ecological impact x morphological sensitivity x chance of impact x zone of impact (local or extended) Scores are averaged for each attribute within zones. These scores are then used to calculate the amount of capacity used by a pressure in a specific river type, using the equation: **Capacity used (%)** = Activity Impact Score x *Activity Footprint (%)*

This process is carried out twice:

1. to the existing watercourse, to calculate the impact of any existing structures in the river, and therefore the available capacity for more work; and then
2. for the proposed work, to calculate the additional impact of the proposals.

The capacity used is compared with the percentage thresholds for 'high' and 'good' ecological status (5% and 15%: see Table A20), to assess whether the watercourse has spare capacity to accommodate morphological change, and then whether the proposed works are feasible, or are likely to risk a deterioration in status, and a risk to the ecology.

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