# The river basin management plan for the Solway Tweed river basin district 2009–2015

# Strategic Environmental Assessment statement

| SEA statement – plan details | | | |
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| **Plan name** | **Solway Tweed river basin management plan (RBMP)** | | |
| **Responsible authority** | **The Scottish Environment Protection Agency (SEPA) and the Environment Agency** | | |
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| **Date** | **22nd December 2009** | | |

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# Introduction

## The Solway Tweed river basin management plan

River basin management plans (RBMPs) play a key part in delivering the objectives of the Water Framework Directive (WFD). SEPA and the Environment Agency are responsible for preparing the RBMP for the Solway Tweed river basin district (RBD), as a requirement of the Water Environment (Water Framework Directive)(Solway Tweed River Basin District) Regulations 2004 (SI 99, 2004).

The Solway Tweed RBMP sets the framework for protecting and enhancing the water environment from 2009 to 2015, although some commitments made in the plan may extend to 2021 or 2027. The first RBMP was published in December 2009. The overall objective of the WFD is to bring about effective co-ordination of water environment policy and regulation across Europe. To achieve this, effective RBMPs are required that identify environmental objectives which represent an appropriate balance between environmental, social and economic interests. Specific overarching objectives of the RBMPs are to:

- prevent deterioration and enhance the condition (status) of aquatic ecosystems, including wetlands and groundwater;
- promote sustainable water use;
- reduce pollution;
- contribute to the mitigation of floods and droughts.

At the heart of the RBMP is the programme of measures (actions) which need to be undertaken to maintain or improve the quality of water bodies to the level required by the WFD.

There are three broad categories of measures:

- **national measures** are applied across Scotland or England;
- **regional measures** occur across part of the river basin district (eg a measure to tackle a particular regional problem – the presence of invasive non-native species for example);
- **local measures** are developed in response to a specific issue, usually targeted at a particular water body or part of a water body.

## Strategic Environmental Assessment

Under the Environmental Assessment of Plans and Programmes Regulations 2004, the Solway Tweed RBMP requires a 'Strategic Environmental Assessment' (SEA) as part of its preparation. The purpose of SEA is to ensure that information on the environmental effects of a plan or programme is gathered and made available as the plan is prepared and implemented. SEA requires that SEPA and the Environment Agency;

- identify, describe and evaluate the significant environmental effects of implementing the RBMP and any alternatives;
- identify measures to prevent, reduce or as fully as possible offset any adverse effects;
- provide for early and effective opportunity to engage in preparation of the plan, through consultation;
- monitor the implementation of the plan to identify any unforeseen environmental effects and take remedial action where necessary;
- report all of the above in an environmental report (see section 3).

## Purpose of this SEA statement

The SEA statement is a statutory requirement under the Environmental Assessment of Plans and Programmes Regulations 2004. It sets out how the findings of the SEA have been taken into account and how views expressed during the consultation period have been taken into account as the Solway Tweed RBMP has been finalised and formally approved. The statement has been prepared in accordance with guidance set out in Chapter 7 of the Scottish SEA Toolkit[1] and the UK Practical Guide to the SEA Directive[2].

For further details about how the assessment was undertaken and its findings, please refer to the Environmental report. This is available via:

- www.sepa.org.uk/water/river_basin_planning.aspx
- SEA Gateway, SEPA, Environmental Strategy, Erskine Court, The Castle Business Park, Stirling, FK9 4TR
- Tel: 01786 452431

[1] Available at: www.scotland.gov.uk/Publications/2006/09/13104943/0
[2] Available at: www.communities.gov.uk/publications/planningandbuilding/practicalguidesea

## How environmental considerations have been integrated into the Solway Tweed RBMP

The purpose of the Solway Tweed RBMP is to set out SEPA and the Environment Agency's vision for the water environment until 2027. The RBMP sets out the actions needed to produce environmental benefits over the coming six years and over the longer term. The plan also covers those actions required to ensure that the following waters meet the required standards or maintain their quality if they already meet those standards:

- those waters protected for drinking or bathing;
- those waters supporting economically important freshwater fish or shellfish stocks;
- that are sensitive to nutrient enrichment or support habitats and species of international conservation importance.

The Solway Tweed RBMP has been prepared with these aims in mind and, as a result, environmental considerations are seen as being at the heart of the plan. However, SEA offers the opportunity to be able to systematically test the environmental effects of the plan, particularly in those areas beyond its immediate water-based focus.

Environmental considerations have been integrated into the plan through the following ways:

**Plan preparation**
SEPA and the Environment Agency (EA) have prepared the RBMP in a way that cuts across many of our environmental protection activities. Accordingly, we are seeking to integrate the RBMP and its objectives, actions and targets into our day to day activities (eg regulation of emissions). This affords a very high degree of integration, as well as ensuring that all environmental considerations are core to delivery of the RBMP.

**Environmental expertise**
Preparation of the RBMP and the Environmental Report was informed by a very comprehensive range of environmental expertise available to SEPA and the EA from our wide environmental protection duties and from external partners with expertise in the water environment. Expert involvement has ensured that environmental considerations have been built into the preparation process.

**Stakeholder involvement**
Preparation of the RBMP was informed by the wide range of stakeholder groups represented on the National Advisory Group (NAG) and two area advisory groups (AAGs) that cover the Solway Tweed River Basin District. The NAG and AAGs advise on and support the preparation and implementation of the district plan and the area management plans respectively. (The latter are geographic supplementary plans to the river basin plan.) Area advisory groups also set up area forums to enable anyone with an interest in the water environment to learn more about river basin planning and contribute and comment on the RBMP.

**Strategic Environmental Assessment (SEA)**
Through the SEA, environmental effects have been identified and where appropriate/possible mitigation measures put into place (see the 'Mitigation' section below). The way the SEA environmental report has been taken into account is also detailed below.

**Consultation**
The draft RBMP was subject to a six month consultation and, where appropriate, environmental considerations expressed by respondees have also been incorporated into the plan. A summary of responses received and how they have been taken into account is available[3].

[3]Solway Tweed RBMP Summary of responses is available at www.sepa.org.uk/water/river_basin_planning.aspx

## How has the Environmental Report been taken into account?

The SEA Environmental Report found that, overall, the Solway Tweed RBMP is likely to lead to very positive effects for the environment, particularly in relation to water, but also for biodiversity, population and human health and soil. This was unsurprising given the key objective of the Solway Tweed RBMP is to provide a framework for the protection and enhancement of water bodies in the river basin district. The report did identify a few areas where the Solway Tweed RBMP could be enhanced. Mitigation measures have been identified to take these forward.

The results of the assessment are described in detail in the SEA Environmental Report[4], in particular in the completed matrices in the appendices of the main report. The key findings and mitigation measures are summarised below.

The impacts were assessed for the baseline case (ie what would have happened without the RBMP), then for the proposals in the draft RBMP (as at December 2008) and finally for the alternative of continued improvement (an enhanced option presented in the draft RBMP). The significant environmental effects, due to the similarity of the measures in the options are broadly alike. All the options produce significant positive effects for biodiversity, flora and fauna, and for water. The potential effects are summarised by topic below.

### Positive effects

The assessment found that the draft Solway Tweed RBMP may potentially result in a very large number of positive and significant environmental effects. In summary, the key positive environmental effects found were:

### Biodiversity, flora and fauna

- Measures to address diffuse pollution and point source pollution will improve water quality, reduce eutrophication and therefore have benefits for aquatic ecosystems.
- Water efficiency measures could potentially result in more water being available for aquatic ecosystems and for greater dilution of pollutants.
- Controlling the rate and timing of abstraction will reduce biological stress (especially during low flow periods) and also provides the additional benefit of a more ‘natural’ hydrological regime.
- Measures to improve morphology will lead to direct improvements for aquatic and riparian habitats.
- Measures to deal with invasive non-native species will likely lead to direct biodiversity benefits in the areas affected.

### Population and human health

- Measures to reduce diffuse and point source pollution will help to protect human health through reducing pollutant loads to protected areas such as drinking waters and bathing waters.
- Water efficiency measures could potentially result in more water being available for the dilution of pollutants and hence provide additional protection for protected areas.
- Some measures may improve access to waters in the river basin district (RBD), particularly where measures to improve water quality will enable greater access for bathing or other recreational pursuits.
- Water improvements may increase amenity value of water bodies in the RBD.

[4] The Solway Tweed RBMP Environmental report is available at www.sepa.org.uk/water/river_basin_planning.aspx

### Water

- All of the measures in the RBMP are designed to address a pressure that is adversely affecting a water body and to improve its ecological status. Accordingly, all measures are designed to produce positive effects on the water environment in the water bodies to which they apply.

### Climate factors

- Many measures will result in positive effects, particularly in relation to sustainable flood management, mitigation of floods and droughts, and to climate change adaptation.
- Greater efficiency in water use may reduce the volume of water that has to be treated, which may result in some energy and greenhouse gas emission savings.
- Measures relating to abstraction and flow regulation in particular may have positive benefits for the management of floods and droughts.

### Cultural heritage

- The majority of measures are not likely to have significant effects on cultural heritage.

### Landscape

- The majority of measures are not likely to have significant effects on landscape, although measures to improve downgraded water bodies (especially where they have been physically changed) will have positive landscape effects at the local level.

### Material assets

- Measures aimed at increasing water-use efficiency (eg leakage reduction) could result in better use of water and, as a result, better use of other resources such as energy.
- As a result of the above, it is possible that this could delay the need for additional new infrastructure.

### Soil

- Improvements in water quality caused by measures that tackle diffuse and point source pollution may result in improved soil quality as fewer pollutants will be deposited on land.
- Measures relating to abstraction and flow regulation may also lead to benefits for soils by reducing erosion by floods or soil loss through drought.
- Measures to improve morphological conditions of channel banks, shorelines, riparian zones and wetland habitats will help to improve infiltration rates, reduce run off and therefore contribute to reducing erosion.

### Potential adverse effects

The main SEA topics under which the draft RBMP options have been assessed as having potential adverse impact were:

- biodiversity, flora and fauna – through transfer of impacts from one location to another;
- population and human health – through possible changes in water supply output;
- water – through transfer of impacts from one location to another;
- climate factors – through increased energy consumption and greenhouse gas emissions;
- material assets – through increased waste production.

## Mitigation

The following mitigation actions were identified in the environmental report. These will generally be implemented as the Solway Tweed RBMP is taken forward, although some measures have already been implemented through changes to the wording of the plan, prior to its formal adoption.

### Table 1: Mitigation measures

| Potential adverse effect and recommended mitigation measure identified in environmental report | How this has/will this be taken into account as the plan is finalised and implemented |
|---|---|
| Relocation of environmental pressures<br>There is potential for environmental effects to be experienced by water bodies as an indirect consequence of a measure on another water body (eg where an effluent discharge is relocated or abstraction point moved). | While the risk of this is possible, this should be addressed by the fact that:<br>▪ evaluation of the effects of measures at project level and as part of consenting processes (eg Controlled Activities Regulations in Scotland) will take place;<br>all water bodies will still be required to meet the standards set within the RBMP and should not be allowed to deteriorate. |
| **Increased energy use**<br>Increases in energy use and associated emissions were identified from measures associated with additional treatment, storage and/or pumping of water prior to discharge.<br><br>There is little that the plan can do directly to reduce these impacts. However, promotion of renewable sources of energy, and of energy-efficient infrastructure should be encouraged. Measures should also be implemented with consideration of national strategies on climate change. | Mitigation of these effects will largely come through consideration of individual applications of measures.<br><br>SEPA and the Environment Agency has been working with the Water Companies to consider climate impacts. A joint initiative has been established to ensure that carbon is accounted for (financially or quantitatively) in decision making as part of a 'net environmental benefit' assessment in order to promote sustainable choices in protecting the water environment. In order to achieve this we will seek to develop a common approach to:<br>• principles of carbon accounting;<br>• risk and environmental benefit;<br>• ongoing policy work, for example;<br>– seasonal consents<br>– consenting by reference to in river quality standards<br>– carbon impact in setting new standards.<br>Also, as a result of this finding, SEPA and the Environment Agency have undertaken a 'climate resilience check' of all RBMP measures. This has evaluated the resilience of the measures to predicted climate change.<br><br>Appendix B of this SEA statement provides details of this work. |

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| **Deployable output**<br>A number of measures could have a negative effect on the deployable output from impoundments (such as for hydro electric power generation). | Mitigation of such effects is likely to be particular to individual measures and their implementation. As part of their regulatory duties SEPA and the Environment Agency will consider these issues. |
| **Increased waste**<br>Increases in waste production were identified as potential effects from a number of measures. The RBMP should ensure that consideration of waste generation and its disposal, is given due emphasis during planning. It should also ensure that best practice associated with measures includes the application of the waste hierarchy, whereby preferred options of re-use and recycling of materials are utilised over disposal to landfill. | The potential negative effects attributable to increased waste will be effectively managed through best practice and through existing legislative and regulatory regimes which comprehensively cover waste management. These include those on sludge disposal, incineration, waste management licensing, and landfill regulations |

## Alternatives

Alternatives to the Solway Tweed RBMP were considered as part of the Environmental Report. The SEA of the Solway Tweed RBMP has considered the effects of the following groups of measures:

**Reference/baseline measures**
Existing measures, planned changes (eg agreed investments programmes) and planned changes (where policy is in place for other drivers that should support implementation of the first RBMP);

**Draft RBMP measures**
Priority actions with a reasonable degree of certainty of being implemented in the first cycle of river management. It assumes there is no need for significant new powers, delivery or funding mechanisms outside those already in place or in the process of being introduced;

**Continued improvement measures**
All the measures in the draft RBMP, plus measures that the Scottish Government after consultation with stakeholders believe are worthwhile exploring. These additional measures have the potential to move the water environment towards the desired objectives even if there is some uncertainty about their effectiveness/implementation. These potential measures are outlined in the Scottish Government's consultation 'Continued improvement'.

## How have opinions expressed during the consultation period been taken into account?

A consultation on the Solway Tweed RBMP and the SEA environmental report commenced on 8 January 2009 and closed on 9 April 2009. This section only refers to the views expressed in relation to the report in order to meet the requirements of the Environmental Assessment of Plans and Programmes Regulations 2004.

A total of four opinions on the environmental report were received. Table 2 below sets out all of the views received and how they have been taken into account as the RBMP has been finalised:

**Table 2: Summary of views expressed and of how SEPA and the EA has taken them into account**

| Opinion expressed | How opinions have been taken into account |
|---|---|
| **Scottish Natural Heritage** | |
| **Q1:** Do you think SEPA and the Environment Agency – In Appendix C – have identified all the other relevant plans, programmes and strategies that the RBMP may influence or be influenced by?<br><br>**Response:** Yes, we note that our comments for the scoping for the environment report have been taken into account, and the additional plans/programmes we suggested have been included in Appendix C. | No action needed |
| **Q2:** Do you think SEPA and the Environment Agency have identified the key environmental issues in, and baseline characteristics of, the river basin district?<br><br>**Response:** The section in Annex B dealing with invasive, non-native species does not follow UKTAG policy. SNH considers that it is important that all species on the High Impact list be considered, as they are species that pose significant problems if present. Therefore, in this regard, we do not consider that the Environmental Report has identified the key environmental issues in, and baseline characteristics of, the river basin districts. | The finalised RBMP addresses this. In December 2007, the UK Technical Advisory Group provided an updated list of species[5] that should be taken into account when classifying water bodies in Scotland The following species from this list are present and considered a high priority in the Scotland river basin district:<br><br>• North American Signal crayfish (Pacifastacus leniusculus);<br>• Common cord grass (Spartina anglica);<br>• Wireweed (Sargassum muticum);<br>• Canadian and Nuttall's Pondweeds |

[5] Annex B of *Recommendations on Surface Water Classification Schemes for the purposes of the Water Framework Directive* (www.wfduk.org/UKCLASSPUB/LibraryPublicDocs/sw_status_classification)

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| We also note that reference has been made to alien species that compete with native, aquatic plants and animals. The UKTAG High Impact list applies not only to aquatic species, but also to species that may be found in riparian and wetland habitats. | (Elodea canadensis and E. nuttallii);<br>• Australian swamp stonecrop (Crassula helmsii).<br><br>The finalised RBMP also recognises that: "Invasive non native riparian plant species such as giant hogweed and Japanese knotweed have the potential to cause impacts on the bankside habitat of many rivers and lochs. The presence of these plants will be incorporated into the assessment of riparian vegetation on the physical habitats in future. Measures to remove these species and prevent spread are in Chapter 3. |
| Section 5 (Sub-section 5.2) of the Solway Tweed Environmental Report states that, 'Overall, water quality in the Solway Tweed area is generally good.' Given that the results of the classification showed that only 40% of all water bodies are at high or good status/potential, we are not sure that the statement that water quality is generally good can be justified. | This is noted. These statements were intended to show that the majority of water bodies fall into the good or high category. This was not meant to detract from the work required to address the 40% of water bodies below this status. |
| **Q3:** Do you think SEPA and the Environment Agency have identified the potential significant environmental effects likely to arise from water body measures already in place (the Reference/Baseline case)?<br><br>**Response:** Yes - so far as is realistically possible. | No action needed |
| **Q5:** Do you think SEPA and the Environment Agency have identified the potential significant environmental effects likely to arise from implementing the potential additional measures identified under the Scottish Government consultation 'Continued improvement'?<br><br>**Response:** Yes – so far as is realistically possible. | No action needed |
| **Q6:** Do you think SEPA and the Environment Agency have identified all the potential cumulative effects arising from implementing the draft RBMP and continued improvement measures?<br><br>**Response:** SNH is content that the Environmental Reports have identified the potential cumulative effects, as far as is possible. | No action needed |
| **Q7:** Do you think SEPA and the Environment Agency have identified appropriate mitigation and enhancement measures? | No action needed |

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| **Response:** Yes – so far as is realistically possible. | |
| **Q8:** Do you think SEPA and the Environment Agency have identified appropriate processes and indicators to monitor environmental effects?<br><br>**Response:** We note that the Environmental Reports set out SEPA/EA monitoring categories, ie surveillance, operational and investigative monitoring, and state that it is anticipated that the WFD monitoring programme will be sufficient to monitor the significant effects of the plan. We agree that the monitoring programme is the key method of monitoring environmental effects. There will need to be careful links between the implementation of WFD measures, and monitoring, in order to pick up environmental effects at both local and national scales. We also suggest that consideration is given to integration of monitoring carried out by other organisations, eg for Protected Areas on the WFD Protected Areas Register. | Noted. We have developed our monitoring schedule further from the environmental report, as set out in the 'Monitoring' section of this document. |
| Appropriate Assessment (AA)<br><br>On the whole the approach to AA that has been adopted seems to SNH to be sensible, and we consider that it will provide a good audit trail. Our detailed comments on the AA are set out in Appendix B.<br><br>**Appendix B:**<br><br>In para. 1.1, the reference to the 'European Habitats Directive and Habitats Regulations (England and Wales) and Habitats Regulations (Scotland)' should be deleted, and replaced with '…assist in meeting the requirements of the Conservation (Natural Habitats &c.) Regulations 1994 (as amended). This screening report addresses….'.<br><br>Para. 1.4 states that Habitats Regulations Assessment is also commonly referred to as Appropriate Assessment (AA). However, this isn't the case in SNH, although we appreciate that SEPA may use different phraseology.<br><br>In para 1.6, the bracketed reference to England and Wales should be deleted.<br><br>In para 1.6, the following text should be deleted: 'and Regulation 48 of the Conservation (Natural Habitats, &c.) (Scotland) Regulations 1994 (as amended)'. It should be replaced with, 'It should be noted that the amendments since 1994 have led to some differences in the legislation north and south of the border. However, these are not relevant here and will not be considered further'.<br><br>The beginning of para. 1.7 refers to Article 6 (3) of the directive. We suggest that by this stage of the report, it should be dealing with the regulations, rather than the directive. Para. 1.7 then goes on to state that the RBMPs must therefore be subject to a screening process in order to determine if the plans are likely to have a significant effect one or more European sites. However, this is not the case. The directive states that if not connected to the conservation management of the site and likely to have a significant effect, an appropriate assessment is needed. At that stage, it can only proceed (subject to reg. 49) if it has been ascertained that it will not adversely affect the integrity of the site. | The environmental report incorporated early work towards an appropriate assessment (AA) of the RBMP in terms of its potential to affect European protected sites and species. Further work on the AA has been undertaken in consultation with Scottish Natural Heritage and Natural England. The AA has been published as a separate document and is available on SEPA's website http://www.sepa.org.uk/water/river_basin_planning.aspx. This incorporates the comments made by SNH in their response to the environmental report consultation. |

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| In para 1.8, the following text should be inserted after the second sentence, 'It should be noted that consideration of alternatives at this stage is not the same as consideration of alternatives under regulation 49'.<br><br>We suggest that footnote 13 on page 2 is reworded to, 'In Scotland, the integrity is described thus "The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or levels of populations of the species for which it was classified, (Circular 6/1995 as revised June 2000)"'.<br><br>On page 20, the last two measures related to increasing downstream flows to enable fish migration and maintain/improve habitat. We note the inclusion of the words 'as appropriate' for both measures, and interpret this as indicating that there will be site-specific evaluation of the degree to which flows need to be adjusted, and the potential wider environmental effects of proposed adjustments. Is this correct? | |
| **Historic Scotland** | |
| **Q1:** Do you think SEPA and the Environment Agency – in Appendix C – have identified all the other relevant plans, programmes and strategies that the Scotland RBMP may influence or be influenced by?<br><br>**Response:** I welcome the inclusion of NPPG 5 & 18 in this section. Simply for information, these have been replaced by *Scottish Planning Policy 23: Planning and the Historic Environment (SPP 23)*: www.scotland.gov.uk/Publications/2008/10/28135841/0. This policy statement supersedes and consolidates national planning policy guidelines.<br><br>NPPG18: Planning and the Historic Environment and NPPG 5: Archaeology and Planning. It sets out the national planning policy for the historic environment and indicates how the planning system will contribute towards the delivery of Scottish Ministers' policies as set out in the current *Scottish Historic Environment Policy*: www.historic-scotland.gov.uk/shep.pdf<br><br>Also, policies 1 to 5 have now been consolidated into a single document. The policy was originally developed as a series of five free-standing publications, published between 2006 and 2008. Now that the series is nearing completion Ministers have decided to publish it as a single document, reducing the amount of detail and duplication between the original publications. There have been no substantive changes to previously published policy on Scheduling, Scheduled Monument Consent, Gardens & Designed Landscapes and Properties in the Care of Scottish Ministers. The consolidated policy document also sees the publication of the final Ministerial policy on Listing and Listed Building Consent.<br><br>Finally, to clarify section 3.3.8, listed building consent is the mechanism by which planning authorities ensure that any changes to listed buildings are appropriate and sympathetic to their character. This process is managed by local planning authorities although Historic Scotland may be involved in certain applications. Further information can be found at: www.historic-scotland.gov.uk/index/heritage/historicandlistedbuildings/listing-guidance-for-owners/listed-building-consent.htm | Noted – These changes occurred immediately before or during the consultation period. These will be taken into consideration in future SEA work. |

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| **Q2:** Do you think SEPA and the Environment Agency have identified the key environmental issues in, and baseline characteristics of, the Scotland river basin district?<br><br>**Answer:** Appendix B provides a clear overview of historic environment features in Scotland and the potential environmental effects arising from the management plans at a strategic level. For information, there are now five world heritage sites in Scotland; the Frontiers of the Roman Empire World Heritage Site was inscribed by UNESCO in July 2008. Further information can be found at: www.historic-scotland.gov.uk/index/heritage/worldheritage/world-heritage-sites-in-scotland/antoninewall.htm<br><br>I note that it was initially intended to gather baseline data for historic environment features within 10 metres of water bodies and that this was subsequently reviewed because this would not be proportionate with the high level nature of the assessment. I am content with this revision and welcome the commitment to consider effects on the historic environment arising from water management activities, associated infrastructure and the potential removal of historic engineering features. | The UNESCO listing is noted. We welcome acknowledgement that our approach to the proposed 10m assessment is acceptable. |
| **Q3:** Do you think SEPA and the Environment Agency have identified the potential significant environmental effects likely to arise from water body measures already in place (the reference case)?<br><br>**Answer:** Yes, I agree with the findings of the reference case for effects on the historic environment; that significant effects are unlikely. However, as noted above, careful consideration should be given to the removal of historic elements of water engineering where they are not scheduled or listed, balancing the preservation of the historic environment and the benefits to be gained by removal or alteration. Where historic elements of water engineering are scheduled or listed then consent process would be required, depending upon the nature of the works involved. | Noted. Impacts on the historic environment will be picked up through licencing or through planning consents. |
| **Q4:** Do you think SEPA and the Environment Agency have identified the potential significant environmental effects likely to arise from implementing the draft river basin management plan?<br><br>**Answer:** Yes, as above. | No action needed |
| **Q5:** Do you think SEPA and the Environment Agency have identified the potential significant environmental effects likely to arise from implementing continued improvement measures?<br><br>**Answer:** Yes, I agree with the assessment findings outlined in section 5.3.2 for the historic environment. | No action needed |
| **Q6:** Do you think that SEPA and the Environment Agency have identified all the potential cumulative effects arising from implementing the draft RBMP and continued improvement measures ?<br><br>**Answer:** Yes, as above. | No action needed |
| **Q7:** Do you think that SEPA and the Environment Agency have identified appropriate mitigation and | Noted. Impacts on the historic environment will be picked up through licencing or through |

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| enhancement measures?<br><br>**Answer:** Given that there are no significant effects predicted for the historic environment, I am content with this section. As noted above, effects on the historic environment should be considered where activities to remove engineering structures may lead to indirect effects (such as flooding) and it would be useful if the Post Adoption statement could demonstrate how such unforeseen effects will be picked up by lower level plans/projects. | planning consents. Also see section 7 on monitoring. |
| **Q8:** Do you think that SEPA and the Environment Agency have identified appropriate processes and indicators to monitor environmental effects?<br><br>**Answer:** As above. | No action needed |
| **Scottish Water** | |
| Scottish Water welcomes the opportunity to comment on the two aforementioned strategic Environmental Reports. Our comments on these documents are set out below:<br><br>1. We welcome the balanced approach presented in the Environmental Reports and their clarity and brevity, given the large amount of information and data captured within the draft river basin management plans. | No action needed |
| 2. We are pleased that the Environmental Reports acknowledge that control at source for phosphorus in detergents may help to reduce cumulative impacts on climate factors. | No action needed |
| 3. Although it has not been possible to estimate or quantify the additional carbon emissions that may result from the measures within the river basin management plans in this first cycle, we look forward to working with SEPA on developing tools and capability to improve estimates of emissions in future cycles. This would support the strategic environmental assessment process in future. | Welcome this comment. As noted in table 1, SEPA is currently working with Scottish Water to consider carbon impacts. |
| 4. It is understandable that the method for these Environmental Reports excluded assessment of local measures, as their inclusion would have made the process unwieldy. However, Scottish Water would welcome consideration of their inclusion in future cycles and development of techniques and methods to do so. We make this suggestion as we wish to see greater emphasis on source control for all pollutants (please see our recent submission to Scottish Government on 'Scotland's Water: Future Directions'). Control at source for all pollutants, involving action across multiple sectors, is required in order to mainstream mitigation actions on climate change. Source control measures are likely to result in fewer greenhouse gas emissions, compared to end-of-pipe treatment. Source control needs to be viewed as a key measure to achieve water quality objectives in a sustainable manner – ie preventing the pollutant entering the watercourse and hence the need to invest money, energy and hence carbon into building and then operating assets to remove pollutants. Therefore, the strategic environmental assessment process needs to be able to capture numerous small-scale and local source control activities and the benefits this may bring in terms of climate change mitigation. | SEPA will consider this for future RBMP cycles and will discuss with Scottish Water. |
| 5. Under the Potential Adverse Effects section the following significant adverse impact is noted:<br>Second bullet point – "Population and human health – through possible changes in water supply output" – | This is noted and SEPA agrees with the points raised. |

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| Scottish Water would like to take this opportunity to note that we have a 25 year Water Resources Plan for public water supplies and duties to maintain the wholesomeness of public water supplies. If the river basin planning process requires Scottish Water to change operational practices or sources of water supplies in order to protect the environment, then we would be funded to provide alternative supplies. Scottish Water and SEPA work closely together to deliver cost effective and practical solutions to meeting the requirements of river basin planning and the Water Framework Directive. Consequently, there is no residual adverse effect on human health or the availability of public water supplies as a result of river basin planning. We suggest that this adverse effect should be modified to reflect the mitigation efforts that both SEPA and Scottish Water have taken and will continue to take through river basin planning. | |
| 6. We welcome the recognition within the Environmental Reports that increased waste production is a side-effect of increased treatment. Again we would encourage the use of source control to reduce the requirement for end-of-pipe treatment and the associated carbon emissions. | Noted. |
| **Scottish Waterways** | |
| The majority of the draft RBMP measures are expected to have no significant effect on the cultural heritage SEA topic. There are, however, two exceptions. The measures to remove barriers/engineering structures to enable fish migration may result in the loss of historic water-related features such as weirs, mills, fish traps, artificial ponds, dams and canals, or even potential wetland archaeological sites. The loss of engineering structures may also negatively impact existing water supply infrastructure, and in some cases increase flood risk. Where the structures provide amenity benefits through creating recreational opportunities for boating or angling, the effects of removing these barriers may be negative for some sectors of the local economy. This could apply to a number of British Waterway structures. We agree and need to be involved when assessing measures for these. | Noted. This will be considered in more detail as part of specific proposals. |
| Recreational use of canals, and their need for water supply, should be included, as should the policy document for canals *SCOTLAND'S CANALS: an asset for the future*: www.scotland.gov.uk/Publications/2002/10/15571/11777 | Noted for future work. |

## Transboundary consultation

There were no transboundary consultations as there are no effects on other EU Member States

## Reasons for adopting the Solway Tweed RBMP in its final form

Overall, there was a great deal of support for the Solway Tweed RBMP. The SEA environmental report found that the RBMP was likely to have significant positive effects on the environment, particularly in respect of water, population and human health, biodiversity, air and soil. Accordingly, SEPA has adopted the Solway Tweed RBMP. In the adopted plan, a number of changes have been made. The changes range from minor text alterations to additions of actions and a change in structure. The general content and vision of the plan, however, remains the same. There are no significant environmental effects arising from these changes that require further assessment. The key changes are summarised below:

# Summary of key changes made to the RBMP

## Delivering improvements

The most significant change between the draft and first plan is the greater ambition. The first plan sets out our target of achieving good status in the vast majority of water bodies by 2027. Where good status is not possible by 2015 (and in a small number of cases by 2027), we have included the reasons why we have extended deadlines or set less stringent objectives.

Stakeholders highlighted the importance of continuing to work together to meet these targets. We will continue to work with area advisory groups and at a catchment scale. Stakeholders also commented on incorporating considerations about climate change into the river basin management planning process and we have done this more effectively.
There were no changes made to the range of types of physical measures (ie how improvements will be made on the ground) that will be used to deliver the improvements between the draft and final plan

## Information on the assessment of pressures and impacts

We have been working to incorporate new monitoring data and assessment tools (eg for acidification and an interim fish tool) into the classification system for the first plan. We have worked with stakeholders to review and set new assessments for ecological potential for heavily modified and artificial water bodies. Stakeholders were particularly interested in how we assess pressures and impacts of diffuse pollution, invasive non-native species and climate change and how we target improvements.

Where possible we have taken consultation responses on individual water bodies into account, but there are some comments on specific water bodies that we have not been able to review in time for the publication of the first plan. These will be taken into account as we plan our monitoring and undertake classification assessments through 2010. Classification assessments will be updated annually.

## Changes to the layout and presentation of information in the plan

We received comments about the style, shape and overall content of the plans, the information provided throughout the documents and about the interactive map. We have worked to develop a first plan that is simpler and more accessible.

Several notes of clarification are included in this document and are working to ensure these messages are clearer in the first plan.

We also recognise that other formats of information will be required for specific or more general audiences.

We are also working to update and upgrade the map facilities offered online.

## Monitoring

SEA requires that the environmental effects of the Solway Tweed RBMP are monitored. The RBMP itself is objective based and will be monitored throughout its life in order to assess whether water quality objectives have been met. At the heart of this will be annual reporting on water body classification and publication of monitoring data. Given the focus of the RBMP on protection and enhancement of the ecological quality of waterbodies, this annual reporting of water body status will be the key monitoring regime. Current water body classification is reported in Annex 2 of the RBMP and is available at www.sepa.org.uk/water/river_basin_planning.aspx. Further, regulation of activities

affecting the water environment is considered under the Controlled Activities Regulations (CAR) on a case by case basis.

In addition to this reporting, SEPA has also identified monitoring indicators to cover wider effects:

- Scottish river level data: www.sepa.org.uk/water/river_levels/river_level_data.aspx;
- Scottish waste data: www.sepa.org.uk/waste/waste_data_menu/waste_data_digest.aspx;
- the joint SEPA/Scottish Water carbon accounting work may also be able to contribute to monitoring, although it is too early to identify indicators which may be able to be used;
- climate change adaptation – the climate check in Appendix 2 has assessed the resilience of the measures. The outcome of this assessment has been taken into account to ensure that as the RBMP is implemented the measures continue to be resilient to climate change impacts.

## Appendix A – list of documents associated with this strategic environmental assessment

The Strategic Environmental Assessment has been undertaken alongside the preparation of the Solway Tweed RBMP. Throughout this time, a number of key documents have been prepared. These are set out below, along with key dates when these were published.

| SEA stage | Document(s) published | Timescale |
|---|---|---|
| **Screening** | As an automatically qualifying plan or programme under the Environmental Assessment of Plans and Programmes Regulations 2004, no screening report was necessary. | |
| **Scoping** | A scoping report was sent to Scottish SEA consultation authorities and English consultation bodies. It was also made available for comments from the Solway and Tweed RBMP area advisory groups. | Published in October 2007 and was subject to consultation for a five week period. It was also made available for comment to area advisory group members on request. |
| **Environmental report** | The Environmental Report and draft Solway Tweed RBMP were published on the SEPA and EA websites for full public consultation. These are available at: www.sepa.org.uk/water/river_basin_planning.aspx | Draft RBMP published 22 December 2008.<br>Environmental report published 8 January 2009. |
| **Post adoption** | The SEA statement was sent to Scottish SEA consultation authorities and English SEA consultation bodies and published on SEPA and EA websites. This is available at: | Published 22 December 2009 |
| **Post adoption advertisement** | Advertisement advertising adoption of plan [as required under Regulation 16(1)]. | To be published in Edinburgh Gazette in January 2009 |

## Appendix B – climate check Of RBMP measures

This appendix summarises how SEPA and the Environment Agency has climate checked the measures in the Solway Tweed RBMP in order to check how resilient they are to anticipated climate change.

**The RBMP measures have been checked for their resilience and flexibility in the context of predicted climate change**

| Key |
| --- |
| Good resilience and flexibility to predicted climate change |
| May require modification in order to remain resilient to climate change |
| Effectiveness may be compromised due to predicted climate change |

Climate change has a wide variety of implications for the environment. Rising water temperatures and changes in precipitation patterns are of particular importance to surface water ecosystems. Such changes are likely to affect how ecosystems function, especially in combination with changes in water chemistry. For example, warmer standing waters receiving greater nutrient run-off as a result of higher intensity rainfall events could exacerbate algal blooms and eutrophication. Significant changes in average temperature, precipitation and soil moisture are likely to affect water demand in most sectors – especially agriculture, forestry and public supply. Irrigation water needs are likely to increase across the east coast.

Groundwater supplies are less susceptible than surface water to short-term climate variability; they are influenced more by long-term trends. However, groundwater levels may fall along the east coast during the summer, with knock-on consequences for river flows and the possibility of saline intrusion to aquifers. The surface water temperature will fluctuate more rapidly with reduced volumes of water causing direct impacts on fish populations and indirect consequences by exacerbating the effects of pollution.

**Water quality**

Lower minimum flows will lead to less volume for dilution and therefore higher pollutant concentrations downstream of point source discharges, eg water treatment works.

**Changes to morphology**

More frequent and severe river flooding will increase requirements for flood defence schemes and sustainable flood management.

Higher temperatures and increased concentrations of nitrates and phosphorous due to lower flows may lead to increased Biological Oxygen Demand (BOD) and reduced dissolved oxygen (particularly at night when there is no photosynthesis) and more frequent and more widespread algal blooms.

Increased storm events may lead to more combined sewer overflows discharging pollutants and run-off of diffuse pollutants from both agricultural and urban sources.

Rises in sea level may lead to salt water intrusion to groundwater in coastal areas. This is likely to affect the viability of existing groundwater sources of irrigation and drinking water supply.

River and lake/loch water temperatures are closely correlated with air temperature. Higher water temperatures impact many aquatic organisms, including fish spawning survival and migration patterns.

Lower summer flows may lead to a build-up of fine sediment which could then be flushed out in higher autumn/winter flows.

Warmer drier summers followed by wetter autumns and winters are likely to lead to higher dissolved organic carbon (DOC) loadings in rivers. A doubling of concentration over 20 years has been seen at nearly 39 out of 58 sites in Scotland. This has consequences for water treatment costs and is a loss from the soil carbon store. Increased DOC may also alter the bioavailability of metals.

More intense rainfall may increase soil erosion and sediment loadings.

There will be higher rates of river erosion due to more intense rainfall and higher flows. In addition degradation of the river habitat may reduce bank protection.

Increased erosion from land will lead to siltation of fish spawning gravels. This increased transport of suspended solids may also have implications for downstream infrastructure such as dams and hydro schemes. It may also lead to growth of estuarine mudflats.

Loss of soil carbon may reduce soil water holding capacity and increase run-off.

Increased installation of hydro-schemes will impact on morphology.

There may be a need for more water impoundment in parts of eastern Scotland to ensure that supplies are maintained in summer.

Rising sea levels will impact on low-lying coast and transitional waters, and may be exacerbated by larger and more frequent storm surges. This will cause increased coastal flooding in vulnerable areas and more coastal erosion.

**Water resources**

**Biodiversity and Invasive non native species**

| | |
|---|---|
| Higher winter flows may increase water resource for supply and power generation but may also lead to more dam spills.<br><br>Lower summer flows will reduce resource for power supply, drinking water and irrigation.<br><br>Higher summer temperatures will lead to greater demand for irrigation water.<br><br>More frequent and/or increased intensity of storm events may lead to more flooding, land slides and sediment mobilisation. These may cause damage to water resource infrastructure.<br><br>Sea level rise may lead to flooding of water supply assets near the coast.<br><br>Reductions in snow accumulation and melt may reduce the water resource for power generation and public water supply in spring and summer in upland catchments. | Higher temperatures, changing hydrological conditions and water quality may provide more favourable conditions for invasive non-native species.<br><br>Changing conditions may allow the spread of rare or non-native diseases, including waterborne diseases, and diseases of aquatic species.<br>There will be changes in the abundance and distribution of native species and the length of growing season.<br>Higher temperatures, changing hydrological conditions and water quality will be less favourable for some native species, but more favourable for others. Predators may be affected by changes in the distribution of prey. Habitats may be affected by changes in land use, eg the introduction of new crops to suit new climates, or increased production of biofuels.<br><br>More wetlands may be created as flood management measures.<br>Increased riparian and coastal erosion may adversely affect these habitats. |

## Table 1 Water quantity: abstraction and flow regulation measures

| Adaptation – building resilience to the impacts of climate change | | | | | |
|---|---|---|---|---|---|
| **Will the measure be resilient to increase precipitation and increase in heavy rainfall events?** | **Will the measure be resilient to less precipitation and droughts (eg drier summers, low flows, less snow melt)?** | **Will the measure be resilient to increased temperatures?** | **Will the measure be resilient to the effects of climate change on biodiversity?** | **Will the measure be resilient to future sea level rise?** | **Recommendations** **How can the measures be modified in the future to take account of climate changes?** |
| E.g. Wetter winters and increased heavy rainfall events leading to flood risk, higher river flows, soil erosion, increased run-off. | E.g. Drier summers leading to lower river flows, less snow cover leading to less melt to rivers, saline intrusion. | E.g. Increased temperatures leading to impacts on oxygen availability, increased human water use, irrigation. | E.g. Increase in invasive non native species; natural changes to species range and potential losses in biodiversity. | E.g. Storm surges, coastal erosion. | |
| **Control abstraction: use alternative source/relocate abstraction** | | | | | |
| Good resilience and flexibility to predicted climate change. | Measure is likely to be resilient to less precipitation and droughts. However, the alternative source/relocation of abstraction may need to take into account potential reduction in resources due to periods of drought. Saline intrusion may be a factor to consider for abstractions of groundwater near the coast. Alternative source check may increase resilience if this is taken into account. | Measure is likely to be resilient to increased temperatures. However, the alternative source/relocation of abstraction may need to take into account increased demand during periods of increased temperature and reduction in water resource. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Alternative source/relocation of abstraction may need to take into account increased demand during periods of increased temperature and reduction in water resource during periods of drought. Saline intrusion may be an issue for abstraction near the coast. |
| **Control abstraction: improve water efficiency (e.g. abstraction matches need) or reduce need** | | | | | |
| Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Measure is likely to be resilient to increased temperatures. However, efforts to improve water efficiency and reduce need may be partly countered due to effect of increasing temperatures on water demand for irrigation, drinking and cooling. | Measure is likely to be resilient to effects of climate change on biodiversity. However, introduction of new crops either as biofuels or food crops, change of range for arable production may result in increasing water demands. | Good resilience and flexibility to predicted climate change. | Measures to reduce need and improve water efficiency will improve resilience to climate change but will be partly countered by climate pressures resulting in increasing demand and may require periodic review. |
| **Control abstraction: reduce leakage** | | | | | |
| Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | |
| **Levels of abstraction, management of dams and efficient use of water** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Measure is likely to be resilient to increased precipitation and heavy rainfall events. However, management of dams will need to consider increased likelihood of spills under future climate. | Measure is likely to be resilient to less precipitation and droughts. However, design and management of dams will need to consider drawdown under future climate and possible need for more freshets in warmer dryer summers. | Measure is likely to be resilient to less precipitation and droughts. However, need to consider possible need for more freshets in warmer dryer summers. Increased temperatures may also result in increased demand. | Measure is likely to be resilient to effects of climate change on biodiversity. However, introduction of new crops either as biofuels or food crops, change of range for arable production may result in increasing water demands. | Good resilience and flexibility to predicted climate change | Design and management of dams will need to take into account likelihood of increased precipitation, periods of drought and increase in water demand due to climate change. |
| **Control abstraction: control pattern/timing of abstraction (hands off flow/utilisation of storage (new/existing))** | | | | | |
| **Control abstraction: provide appropriate baseline flow regime downstream of impoundment** | | | | | |
| **Control abstraction: provide higher flows as appropriate to enable fish migration downstream of impoundment** | | | | | |
| **Control abstraction: provide higher flows as appropriate to maintain/improve habitat downstream of impoundment** | | | | | |
| Measures are likely to be resilient to increased precipitation and heavy rainfall events. However, baseline flow conditions against which the flow regimes are set will need to be updated periodically to reflect climate change. | Measures are likely to be resilient to less precipitation and droughts. However, baseline flow conditions against which the flow regimes are set will need to be updated periodically to reflect potential reduction in river flows due to periods of drought and reduction in available water resource. | Measures are likely to be resilient to increased temperatures. However, higher compensation flows may be required to prevent water temperatures exceeding habitable conditions and to take into account increased demand and reduction in available water resource during periods of increased temperature. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Abstraction controls may need to be adjusted to take into account potential changes in river flows due to climate change. Regulatory guidance/procedures will need to take account of these climate change impacts. |
| **Control abstraction: appropriate management of rate and range of artificial drawdown** | | | | | |
| **Control abstraction: appropriate management of seasonal variation of water level changes behind the impoundment** | | | | | |
| Measures are likely to be resilient to increased precipitation and heavy rainfall events. However, levels may be maintained at spill level for longer during heavy rainfall events. This may increase the severity of drawdown when combined with lower summer flows. It is important that regulations consider the range and rate of drawdown and control the appropriate level directly rather than indirectly through abstraction rates. These controls may require periodic review to take account of climate change. | Measures are likely to be resilient to less precipitation and droughts. However, drawdown is likely to be exacerbated during drought periods and when summer flows are low. It is important that regulations consider the range and rate of drawdown and control the appropriate level directly rather than indirectly through abstraction rates. There may be a conflict between reducing drawdown and ensuring flow levels downstream. These controls may require periodic review to take account of climate change. | Measures are likely to be resilient to increased temperatures. However, increased temperatures are likely to lead to higher evaporative losses. It is important that regulations consider the range and rate of drawdown and control the appropriate level directly rather than indirectly through abstraction rates. These controls may require periodic review to take account of climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Management measures will need to take account of climate change and may require periodic review. Regulations may need to consider that the rate and range of artificial drawdown is measured/monitored directly rather than indirectly through abstraction rates. |
| **Controls on volume of water that can be abstracted and the time over which it can be abstracted** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Good resilience and flexibility to predicted climate change. | Measures are likely to be resilient to less precipitation and droughts. However, baseline flow conditions against which the flow regimes are set will need to be updated periodically to reflect potential reduction in river flows due to periods of drought and reduction in available water resource. | Measures are likely to be resilient to increased temperatures. However, higher compensation flows may be required to prevent water temperatures exceeding habitable conditions and to take into account increased demand and reduction in available water resource during periods of increased temperature. | Good resilience and flexibility to predicted climate change | Good resilience and flexibility to predicted climate change | Abstraction controls may need to be adjusted to take into account potential reduction in river flows due to periods of drought. Measures are based upon classification which in turn is based upon an assessment of natural flows. As flows change, ecological status of rivers may change, and more measures may be required. Need to ensure that all classification tools are sensitive to long term changes in flows. |
| **Control abstraction: reduce risk of fish mortality in intakes or screens** | | | | | |
| **Control abstraction: provide for fish access between reservoir and tributaries** | | | | | |
| Good resilience and flexibility to predicted climate change. | Measures are likely to be resilient to less precipitation and droughts but may need to be adapted to enable any mechanisms to remain functional during more extreme droughts and low flow conditions caused by climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Any mechanism that facilitates fish access between reservoir and tributaries may need to be adapted in order to remain functional during more extreme droughts and low flow conditions caused by climate change. |
| **Control abstraction: reduce impact on DO levels downstream of impoundment** | | | | | |
| **Control abstraction: reduce impact on temperature conditions downstream of impoundment** | | | | | |
| Good resilience and flexibility to predicted climate change. | Measures are likely to be resilient to less precipitation and droughts. However, the controls may need to be adjusted to take into account potential reduction in river flows due to periods of drought and reduction in available water resource. | Measures are likely to be resilient to increased temperatures. However, controls may need to be changed to take into account increased demand and reduction in available water resource during periods of increased temperature. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Controls may need to be adjusted to take into account potential reduction in river flows due to periods of drought, increased demand and reduction in available water resource. |
| **Controls on licensed hydropower schemes** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Good resilience and flexibility to predicted climate change. | Measure is likely to be resilient to less precipitation and droughts but may need to be adapted to ensure flows are maintained during more extreme droughts and low flow conditions caused by climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | May need to be adapted to ensure flows are maintained during more extreme droughts and low flow conditions caused by climate change. |

**Summary**

Generally all the water quantity measures will be able to perform under the predicted effects of climate change. Measures will need to take into account increased water demand and reduction in water resource and will need to be adapted to long-term changes in natural flow conditions. Also need to ensure that classification tools are sensitive to long-term changes. Water efficiency measures and reducing leakage improve our ability to manage water resources now and in the future but may be partly countered by climate pressures resulting in increasing demand.

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| **Key** |
|---|
| Good resilience and flexibility to predicted climate change. |
| May require modification in order to remain resilient to climate change. |
| Effectiveness may be compromised due to predicted climate change. |

## Table 2 Water quality: diffuse and point source pollution measures

| Adaptation – building resilience to the impacts of climate change | | | | | |
|---|---|---|---|---|---|
| **Will the measure be resilient to increase precipitation and increase in heavy rainfall events?** | **Will the measure be resilient to less precipitation and droughts (eg drier summers, low flows, less snow melt)?** | **Will the measure be resilient to increased temperatures?** | **Will the measure be resilient to the effects of climate change on biodiversity?** | **Will the measure be resilient to future sea level rise?** | **Recommendations** **How can the measures be modified in the future to take account of climate changes?** |
| Wetter winters and increased heavy rainfall events leading to flood risk, higher river flows, soil erosion, increased run-off. | Drier summers leading to lower river flows, less snow cover leading to less melt to rivers, saline intrusion. | Increased temperatures leading to impacts on oxygen availability, increased human water use, irrigation. | Increase in invasive non-native species; natural changes to species range and potential losses in biodiversity. | Storm surges, coastal erosion. | |
| **Reduce diffuse source inputs: non-urban land management issues** | | | | | |
| Measure is likely to be resilient to increased precipitation and heavy rainfall events. However, any management actions may need to be adapted to be able to address increased volumes, contamination and sediment loads likely to result from more extreme rainfall events. This is particularly likely for hydrophobic compounds which may adhere to soil/sediment. | Measure is likely to be resilient to less precipitation and droughts. However, during dry periods inputs of hydrophilic pollutants from rural diffuse sources may continue, but be less diluted in receiving water. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Management actions may need to be adapted to be able to address increased volumes, contamination and sediment loads likely to result from more extreme rainfall events. Actions will also need to take into account continued inputs from diffuse rural sources during periods of drought and decreased dilution of the receiving water. |
| **Reduce diffuse source inputs: reduce sources from built environment** | | | | | |
| **Reduce diffuse source inputs: retrofit/improve existing SUDs** | | | | | |
| **SEPA GBRs require SUDs for new surface water discharges - Q&S investment programme, Q&S retrofitting of SUDs to industrial areas** | | | | | |
| Measures are likely to be resilient to increased precipitation and heavy rainfall events. However, any management actions may need to be adapted to be able to address increased volumes, contamination and sediment loads likely to result from more extreme rainfall events. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Management actions may need to be adapted to be able to address increased volumes, contamination and sediment loads likely to result from more extreme rainfall events. |
| **Silage, Slurry and Fuel Oil (SSAFO) Regulation (SSAFO amendments)** | | | | | |
| **Low P detergents** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | |
| **Reduce diffuse source inputs: provide first time sewerage** | | | | | |
| Measure is likely to be resilient to increased precipitation and heavy rainfall events. However, new treatment works will need to be have enough capacity and be able to cope with more extreme weather events. It is essential that new infrastructure is 'climate proofed'. | Measure is likely to be resilient to less precipitation and droughts. However, new treatment works discharges will need to take into account low flows leading to reduced dilution of effluent and increasing concentration of pollutants. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | New treatment works will need to have enough capacity and be able to cope with more extreme weather events. It is essential that new infrastructure is 'climate proofed'. Discharges will need to take into account low flows and decreased dilution during periods of drought. |
| **Economic Incentive: Scottish / England Rural Development Programmes: 2008–2014 (covers agriculture, forestry, land management)** | | | | | |
| Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | |
| **Summary** | | | | | |
| Generally all the water quality measures will be able to perform under the predicted effects of climate change. Some of the measures may need to be adapted to ensure they have capacity to deal the increased frequency of heavy rainfall events to protect water quality. Some of the measures will also need to be adapted to less precipitation and droughts in order to manage reduced dilution of discharges that could result in increasing concentrations of pollutants. It is essential that new infrastructure is 'climate proofed'. | | | | | |

| **Key** |
|---|
| Good resilience and flexibility to predicted climate change. |
| May require modification in order to remain resilient to climate change. |
| Effectiveness may be compromised due to predicted climate change. |

## Table 3 Morphology measures

| Adaptation – building resilience to the impacts of climate change | | | | | Recommendations |
|---|---|---|---|---|---|
| **Will the measure be resilient to increase precipitation and increase in heavy rainfall events?** | **Will the measure be resilient to less precipitation and droughts (eg drier summers, low flows, less snow melt)?** | **Will the measure be resilient to increased temperatures?** | **Will the measure be resilient to the effects of climate change on biodiversity?** | **Will the measure be resilient to future sea level rise?** | **How can the measures be modified in the future to take account of climate changes?** |
| Wetter winters and increased heavy rainfall events leading to flood risk, higher river flows, soil erosion, increased run-off. | Drier summers leading to lower river flows, less snow cover leading to less melt to rivers, saline intrusion. | Increased temperatures leading to impacts on oxygen availability, increased human water use, irrigation. | Increase in invasive non-native species; natural changes to species range and potential losses in biodiversity. | Storm surges, coastal erosion. | |
| **Improve modified habitat: removal of barriers or provision of mechanisms to enable fish migration** | | | | | |
| Measure is likely to be resilient to increased precipitation and heavy rainfall events. However, need to consider the flood risk implications of removing barriers to fish migration. | Removal of barriers or provision of mechanisms to enable fish migration are likely to be resilient to less precipitation and droughts. However, they may need to be adapted to enable any mechanisms to remain functional during more extreme droughts and low flow conditions caused by climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. Removal of barriers may facilitate migration of non-native fish species. | Good resilience and flexibility to predicted climate change. | Climate change effects may have to be taken into account in the design and operation of any mechanisms to enable fish migration. |
| **Improve modified habitat: removal of engineering structures**<br>**Improve modified habitat: improvements to condition of channel/bed and/or banks/shoreline**<br>**Improve modified habitat: improvements to condition of riparian zone and/or wetland habitats** | | | | | |
| Measures are likely to be resilient to increased precipitation and heavy rainfall events. However, need to consider the flood risk implications of removing engineering structures. Banks and bed may be more prone to erosion in high flows. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. Removal of barriers may facilitate migration of non-native fish species. | Good resilience and flexibility to predicted climate change. | Measures that result in the removal of engineering structures will need to consider any potential impacts on flood risk. Actions to improve conditions of beds and banks need to take into account increased erosion in high flows and increased intense rainfall. |
| **Improve modified habitat: changes to sediment management maintenance regime** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Measure is likely to be resilient to increased precipitation and heavy rainfall events. However, any management actions may need to be adapted to be able to address changes in sediment loads and movement likely to result from more extreme rainfall events. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Management actions may need to be adapted to be able to address changes in sediment loads and movement likely to result from more extreme rainfall events. |
| **Prevent new damage to the water environment from engineering works on rivers (including maintenance regimes)**<br>**Historical engineering activities and urban development, agriculture and forestry (regulatory)**<br>**Restoration investment to remove abandoned structures such as old embankments (agriculture – regulatory)**<br>**Restoration policy for taking forward restoration work (Historical engineering activities and urban development – regulatory)** | | | | | |
| Measures are likely to be resilient to increased precipitation and heavy rainfall events. However, need to consider the flood risk implications of removing any historic engineering structures. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Good resilience and flexibility to predicted climate change. | Measures that result in the removal of engineering structures will need to consider any potential impacts on flood risk. |
| **Summary** | | | | | |
| Generally all the morphology measures will be able to perform under the predicted effects of climate change. Measures related to the removal of barriers or engineering structures will need to take into account the impact on flood risk. Measures related to sediment management may need to be adapted to increased sediment loads and movement. Provision of mechanisms to enable fish migration will also need to be adapted to less precipitation and droughts in order to remain functional during low flow conditions caused by climate change. Measures that improve or prevent new damage to the riparian zone/wetlands will be effective now and in the future but need to take into account increased erosion in high flows and increased intense rainfall. | | | | | |

| **Key** |
|---|
| Good resilience and flexibility to predicted climate change. |
| May require modification in order to remain resilient to climate change. |

## Table 4 Invasive non native species measures

| Adaptation – building resilience to the impacts of climate change | | | | | |
|---|---|---|---|---|---|
| **Will the measure be resilient to increase precipitation and increase in heavy rainfall events?** | **Will the measure be resilient to less precipitation and droughts (eg drier summers, low flows, less snow melt)?** | **Will the measure be resilient to increased temperatures?** | **Will the measure be resilient to the effects of climate change on biodiversity?** | **Will the measure be resilient to future sea level rise?** | **Recommendations** **How can the measures be modified in the future to take account of climate changes?** |
| Wetter winters and increased heavy rainfall events leading to flood risk, higher river flows, soil erosion, increased run-off. | Drier summers leading to lower river flows, less snow cover leading to less melt to rivers, saline intrusion. | Increased temperatures leading to impacts on oxygen availability, increased human water use, irrigation. | Increase in invasive non-native species; natural changes to species range and potential losses in biodiversity. | Storm surges, coastal erosion. | |
| **Possible policy mechanisms: additional programme of work (prevention, control, surveillance)** | | | | | |
| **Summary** | | | | | |
| There is no information on what mechanisms the policy will contain and it is therefore not possible to make a judgement on how effective and resilient the measure will be to the effects of climate change. Control of invasive non native species through mechanisms of prevention, control and surveillance may need to be updated and adapted to include possible new species as they are introduced and become invasive; as existing non-native species become invasive; or if naturally spreading species become invasive due to changing climate conditions. A risk assessment may need to be undertaken prior to intentional introductions of new species to ensure that they are not potentially invasive species, or there may need to be restrictions on planting/sale of already present non-native species assessed as becoming invasive. | | | | | |

| Key |
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| Good resilience and flexibility to predicted climate change. |
| May require modification in order to remain resilient to climate change. |
| Effectiveness may be compromised due to predicted climate change. |