



**Severn Estuary Tidal Power Feasibility Study
Phase One Consultation Response
The Royal Society for the Protection of Birds
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Contact: Mariam Ali, Planning Policy Officer
Organisation: The Royal Society for the Protection of Birds
Address: The Lodge, Sandy, Bedfordshire, SG19 2DL
E-mail address: mariam.ali@rspb.org.uk
Telephone number: 01767 693486

About the RSPB

The Royal Society for the Protection of Birds (the RSPB) is the charity that takes action for wild birds and the environment. We are the largest wildlife conservation organisation in Europe with over one million members. We own or manage 140,444 hectares of land for nature conservation on 203 reserves throughout the UK.

The RSPB's commitment to renewable energy

The RSPB believes that climate change is the greatest long-term threat faced by people and biodiversity. Without rapid action to reduce greenhouse gas emissions, one third of all land based species may be committed towards extinction by 2050. We have welcomed the UK Government's plans to cut emissions by 80% by 2050 and we support the Government's pledge to deliver the UK's share of the EU renewable energy target for 2020. The UK Government's Renewable Energy Strategy has proposed that, to contribute its fair share to the target, it will seek to generate 15% of its energy (and up to 40% of electricity) from renewable sources. This will require a revolution in the way that we generate and use energy. The RSPB advocates that this revolution should take place in a way that minimises damage to the natural environment.

Wave and tidal power are essential in moving to a zero carbon power sector in the 2030s - a point re-enforced by the advice provided by the Committee for Climate Change on 1 December 2008. The right way forward must be to actively pursue wave and tidal power solutions that deliver maximum energy at minimal environmental cost. In this context and timeframe, and given the huge long-term potential of wave and tidal energy, our focus should be on getting the right solutions in place to provide a significant percentage of our energy needs in the period 2020-2050, at an appropriate economic and environmental cost. The RSPB believes that this can be achieved by taking a strategic approach to investing in, designing and pilot testing wave and tidal energy projects that incorporate environmental concerns from the outset.

RSPB RECOMMENDATIONS FOR PHASE 2

1. **The Study should be redefined so that it focuses on a search for a tidal project (or projects) in the Severn that maximise clean energy generation, while minimising environmental damage, all at an affordable cost to consumers.** This should be achieved by:
 - a) **Amending the current assessment framework**, which is seriously flawed in a number of ways (Section 3 of the WS Atkins Engineering Review¹ proposes an alternative assessment framework)
 - b) **Using the SEA process effectively to identify a wide range of alternatives** and the elements necessary for a scheme to be as environmentally benign as possible, while still generating a significant amount of clean electricity (Section 1 of this response proposes an alternative approach to identifying alternatives)
 - c) **Taking a strategic approach to investing in, designing and pilot testing tidal energy projects** that incorporate environmental concerns from the outset (we believe there is a need to accelerate innovation).
2. **The UK Government should refrain from agreeing a short-list of options until after all schemes are optimised to increase energy, reduce cost and avoid environmental impacts.** The recent WS Atkins Engineering Review concludes that *"...the assessment's methodology and outcomes are insufficient at this stage to adequately identify a short-list of tidal power options for the Severn Estuary."* (see Annex 1, p.2)
3. **The UK Government should provide sustained and proportionate investment in those innovative tidal power technologies, which offer the potential to put the UK and UK Engineering at the forefront of tidal power.** We want the solution for the Severn to stimulate the roll out of environmentally sustainable technologies elsewhere. Adequate resources should be made available to support the development of environmentally sustainable marine technologies. The £500,000 Embryonic Technology Scheme (ETS) is welcome. However, we are concerned that is insufficient to give innovative schemes a fighting chance to compete with traditional, and more environmentally damaging, options. The Marine Renewables Deployment Fund should be used to support this ambition.
4. **If a short-list goes ahead, the tidal reef should be included for consideration in Phase 2 of the Study** and receive adequate financial support from the Embryonic Technology Scheme. If other promising technologies emerge, they should be similarly supported.

¹ See Annex 1

5. **Any renewable scheme considered for the Severn must form part of a radical plan to tackle climate change.** The SDC argued in *Turning the Tide*² that “*the willingness for government to put in place radical policies needed on energy demand, greater decentralised supply and technology innovation should be a prerequisite for any decision in favour of a Severn barrage*”. All the evidence suggests that it will be impossible to meet Government’s targets to reduce greenhouse gas emissions by 80% by 2050 without ruling out new unabated coal-fired power stations and without stabilising emissions from aviation. Government’s policy interventions on runways and coal are clear indications of its intent to tackle climate change

RESPONSE SUMMARY

1. *Treatment of alternatives under the SEA and Habitats Directive*

- **The proposed short-list of five is unacceptable due to the failure to use the SEA process to identify and evaluate 'reasonable alternatives'.** The Government is proposing that the SEA should only assess the provisional short-list, which excludes all schemes that were specifically designed with environmental considerations in mind, such as the tidal reef. This reflects a fundamental misunderstanding of the SEA Directive. Alternatives should not be artificially limited from the outset of an SEA and potential ‘reasonable alternatives’ should not be discounted prior to the completion of an SEA process.
- **We note that combinations of options are not identified in the scoping report as potentially ‘reasonable alternatives’.**
- **In our view, the Severn Tidal Power Feasibility Study SEA should consider at least two levels of alternatives:** (i) high level scenarios for delivering a strategically significant supply of renewable electricity; and (ii) alternative tidal power schemes/combinations of schemes and deployment options.
- **If a short-list goes ahead, it should include the tidal reef.** The tidal reef is one of the only options that is designed from the outset with environmental considerations in mind. While we acknowledge that the Study cannot reasonably be required to carry out detailed work on an option which has no realistic prospect of delivering the Study’s objectives, based on WS Atkins’ 2008³ and 2009⁴ reports we conclude that there is no show-stopper for a conventionally engineered low-head tidal reef scheme which incorporates fish-friendly turbines.
- **Alternatives will also have to be considered in an Appropriate Assessment.** It is crucial that tidal power options that are potentially less environmentally

²*Turning the Tide: Tidal Power in the UK*, Sustainable Development Commission, http://www.sd-commission.org.uk/publications/downloads/Tidal_Power_in_the_UK_Oct07.pdf

³ WS Atkins Tidal Reef Report, 2008, see http://www.rspb.org.uk/Images/atkins_tcm9-203975.pdf

⁴ WS Atkins Severn Tidal Power: Review of the Interim Options Analysis Report, 2009, see Annex 1

damaging be considered within the SEA of the Feasibility Study. This will ultimately be cost-effective as these options are likely to be re-visited if the 'alternatives stage' is reached in the Appropriate Assessment.

2. *The short-list of options and the Study's assessment framework*

- **The assessment framework is seriously flawed.** Application of the current assessment framework means that only options which meet specified economic and technical criteria have been short-listed, irrespective of their socio-environmental impacts. In contrast, those projects that take socio-environmental considerations into account in innovative designs appear to have been rejected on cost grounds. In our view, this approach is irrational and contrary to public interest in that it could lead to the rejection of a practicable alternative on cost grounds alone.

The WS Atkins Review of the Study's Phase 1 engineering reports concludes that "...the assessment's methodology and outcomes are insufficient at this stage to adequately identify a short-list of tidal power options for the Severn Estuary." (p.2, see Annex 1)

- **The Feasibility Study's flawed assessment framework should be revised** so that environmental constraints are given equal consideration alongside economic factors, energy generation and technological advancement. Given the objectives of the Feasibility Study, which are to produce a reasonably affordable and strategically significant supply of renewable energy with acceptable environmental impacts, short-listing should logically take place only after schemes are optimised to increase energy, reduce cost and avoid environmental impacts.
- **The application of a more consistent and inclusive assessment framework would have resulted in retention of the innovative technologies, such as the tidal reef,** on the shortlist. It makes little sense to leave these options off the shortlist. By excluding them, Government is excluding what could be some of the least environmentally damaging options from its assessment of environmental and socio-economic impacts.
- **The focus of the Severn Feasibility Study should shift to innovative technologies** which maximise clean energy generation, while minimising environmental damage at an affordable cost to consumers.

3. *The Phase 1 engineering studies*

- The WS Atkins review of Study's Phase 1 engineering report. i.e. the Interim Options Analysis Report (IOAR), concludes that:
 - **There are several serious shortcomings in the power calculations,** which bias the short-listing, process by underestimating the power generation potential of innovative and less environmentally damaging

schemes such as the tidal reef – this has the knock-on effect of also increasing the predicted price of energy for these options.

- **New low-head turbine developments should not be dismissed** by the Study. These are highly relevant to the Severn because they suit two-way generation schemes, which are much less environmentally damaging than ebb-only schemes. In particular, two-way generation may limit loss of inter-tidal habitat on which birds depend.
- **There are several significant weaknesses in the IOAR's costing work** that are likely to result in Phase 1 work underestimating the absolute cost of larger schemes.

4. The Cardiff-Weston barrage

- **We are sceptical that the Cardiff-Weston barrage is a viable option.** The level of environmental destruction that would result from the Cardiff-Weston proposal, which would be extremely difficult to adequately compensate for, coupled with the huge financial cost means that it is difficult to see how this could be a viable option for harnessing the Severn Estuary's potential for renewable power generation.
- **Including the Cardiff-Weston barrage on the shortlist risks it sucking resources away from investment in technology that could be both sustainable and transferable to other estuaries.**

5. Innovative technology funding

- **We are sceptical that £500,000 funding is sufficient:** While we welcome the availability of new funds, we question whether £500,000 funding is sufficient to enable multiple innovative proposals to be adequately investigated and inform the final decision on the Feasibility Study. In its critique of the tidal reef concept, WS Atkins concluded that the tidal reef alone could be developed to a project design with £500,000 within the two-year timescales of the Government Feasibility Study (WS Atkins Tidal Reef Report, 2008).
- **We urge Government to lever funds from the Marine Renewables Deployment Fund.** For any of these technologies to be seriously considered at the end of the two year Feasibility Study, alongside the barrage and lagoon proposals, which are considered to be more developed, we recommend that Government either invests in one option, or lever more funds from its £50m Marine Renewables Deployment Fund. Spreading the funding too thinly is unlikely to result in a project able to compete with more traditional options on the shortlist.
- **We are concerned by the lack of a level playing field between the short listed options and the 'innovative technologies'** The Embryonic Technology Scheme's unfair requirement for commercial match funding is likely to prove an insurmountable barrier for some schemes; the fund should be fully publicly sourced and significantly increased.

6. Preliminary Review of Possible Mitigation and Compensation Requirements under the Habitats Directive

- **The RSPB agrees with the report's conclusions that the tidal power options considered are likely to have significant impacts on Severn Estuary's designated sites as well as adjacent riverine SACs.**
- **In general, these impacts will require substantial compensatory measures, although the scale is likely to vary considerably dependent on the option chosen.**
- **We broadly agree with two of the three potential approaches to compensatory measures identified:** managed realignment to create new intertidal habitats (including for feeding and roosting waterbirds) and designation of new SACs for intertidal and subtidal habitats and migratory fish. The former, in particular, still poses significant operational difficulties in achieving the predicted scale of compensation required.
- **The third approach, enhancement measures for migratory fish stocks, causes us major concerns in the absence of improved scientific knowledge demonstrating its effectiveness.**
- Given these concerns, while we welcome high-level consideration of potential mitigation and compensation requirements as part of the process of considering a range of options, **we recommend that the Severn Tidal Power Unit should not do too much detailed work on compensatory measures until the nature of the option selected is confirmed and it has been demonstrated that there are no less damaging alternative solutions to that option.** Any final option selection should be based on a thorough exploration of the role of tidal and wave energy in helping to achieve a low-carbon economy in the medium-long term.

7. Ornithology SEA scoping topic paper

- **Our concerns with the Ornithology Topic Paper relate primarily to its treatment of the Severn SPA designation, the proposed assessment approach (particularly the process for evaluating the sensitivity of receptors), and consideration of climate change and sea level rise effects.**
- **We are broadly in agreement with the further survey work recommended for Phase 2 of the SEA,** but are concerned with the suggestion that this work may terminate in June 2009 rather than winter 2009.

8. Geomorphology SEA scoping topic paper

- **The hydraulics and geomorphology topic paper underpins the assessment in several other topic areas and is crucial to understanding the potential environmental effects of various tidal power options.** The RSPB has serious concerns in relation to the lack of recent and comprehensive data upon which to base the hydraulic and geomorphological assessments and modelling.

- **We are also particularly concerned at the use of the La Rance case**, not only because of the fundamentally different geomorphology of this steep-sided sandy coastal ria with low suspended sediments to that of the sediment-rich Severn estuary with its extensive intertidal flats and marshes, but also because of the lack of baseline data to allow effective assessment of the impacts of that scheme. **The Oosterschelde barrage, in Holland, provides a much better comparator**, both because the impacts are better understood and the nature of the site affected has more in common with the Severn.
- **We note that the geomorphological impacts of smaller barrage schemes could potentially have disproportionately greater effects** by truncating the upstream part of the high sediment load system.

9. *Migratory and Estuarine Fish scoping topic paper*

- **There is a lack of basic information about key aspects of the ecology and behaviour of diadromous fish species** (including routes and depth of passage, tidal transport, swim speed, transit time, residence time, diurnal timing, seasonality, migratory cue, homing behaviour and stock status) found in the Severn Estuary.
- **It is clear that the further work recommended for Phase 2 of the SEA will do little to fill these gaps**, since in the time available it will not be possible to undertake field work.
- **Equally, it is not possible in the current state of knowledge to judge the effectiveness of any of the possible mitigation measures** suggested in the topic paper (leaving aside the point that we cannot at present know the scale of mitigation that might be required.)
- **In our view, substantial additional work, including field work, needs to be undertaken before decisions on any tidal power options are taken.**

INTRODUCTION

The threat of climate change demands nothing short of a revolution in the way we generate our energy. Harnessing the enormous tidal power of the Severn has to be the right thing to do, but this must be done while respecting the international importance of the estuary's wildlife. The Severn Feasibility Study is a golden opportunity to crack the problem of how to harness the Severn's tides without destroying its wildlife.

The Study's relationship with government plans to tackle climate change

Any tidal power solution in the Severn Estuary must form part of a coherent and radical plan to tackle climate change.

The Sustainable Development Commission argued in *Turning the Tide* that "*the willingness for government to put in place radical policies needed on energy demand, greater decentralised supply and technology innovation should be a prerequisite for any decision in favour of a Severn barrage*". All the evidence suggests that it will be impossible to meet government's targets to reduce greenhouse gas emissions by 80% by 2050 without ruling out new unabated coal-fired power stations and without stabilising emissions from aviation. The UK Government's support for the third runway at Heathrow and its delay in rejecting a planning proposal for an unabated coal-fired power station at Kingsnorth casts serious doubt on whether government's climate change plan is coherent, let alone radical. This further undermines the justification for pursuing the environmentally destructive Cardiff-Weston barrage.

The UK Government should provide sustained and proportionate investment in innovative tidal power technologies, which offer the potential to put the UK and UK Engineering at the forefront of tidal power. We want the solution for the Severn to stimulate the roll out of environmentally sustainable technologies elsewhere. It would be a missed opportunity if development in the Severn failed to form part of a coherent plan to develop sustainable tidal power in the UK.

The Ecology of the Severn Estuary

While there are good reasons to harness the tidal range of the Severn Estuary, it remains exceptional for its ecological value. We agree with the Sustainable Development Commission that large tidal range projects, in particular a large barrage or series of lagoons, would fundamentally change the nature of the Severn Estuary⁵. The RSPB remains deeply concerned about the likely environmental impacts of some of the options submitted, particularly the Cardiff-Weston barrage.

The Severn estuary is recognised as an internationally important estuary for its waterbirds and has international as well as national designations. It is a Special Protection Area (SPA), a Ramsar site, a possible Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI); many areas behind the seawall are also SSSIs and SPAs, including Slimbridge and the Somerset Levels (the Government intends that the Newport Wetlands Reserve will also be an SPA 'alongside the Severn'). Seven species of birds are currently of international importance (including Bewick's swan,

⁵ *Turning the Tide: Tidal Power in the UK*, Sustainable Development Commission
[http://www.sdcommission.org.uk/publications/downloads/Tidal Power in the UK Oct07.pdf](http://www.sdcommission.org.uk/publications/downloads/Tidal_Power_in_the_UK_Oct07.pdf)

Shelduck, Pintail, Shoveler, Ringed Plover and Dunlin) and eight are of national importance on the site. A total of nearly 69,000 waterbirds form the Assemblage on the site⁶. The Severn is not just important for its bird populations but also for its SAC habitats, including saltmarsh and inter-tidal mudflats, and other species, notably six species of fish and a reef-building worm, *Sabellaria*.

There are a number of vocal critics of the ecological importance and future of the Severn and they have made many statements about the barren and deteriorating nature of the wildlife of the Severn estuary. The changes in bird numbers do not support their claims, especially when the acknowledged reduction in count coverage of recent years is taken into account (N. Burton pers. comm.). There are comments that the Severn is an atypical high-energy estuary; it is a high-energy system but because it has the highest tidal range of any estuary in Europe and is one of the highest in the world, it would be expected to differ in some ways from other estuaries. A barrage, if it is considered, would reduce the energy in the system and move the faunal communities towards those more typical of other GB estuaries and result in a greater diversity of life in the Severn. It is undoubtedly true that this would be the direction of change but this is not the purpose of conservation designations; they are to conserve the special, not make the special ordinary.

La Rance is claimed to provide an excellent template for what would happen post-barrage; no quantitative before studies were undertaken and it provides very limited comparison with the Severn proposal. In contrast the Oosterschelde barrage, in Holland, which suffers serious siltation problems, provides a much better comparator. We should be alert to the ecological harm that such a structure could cause to the Severn's ecology.

The RSPB's involvement in the Severn Tidal Power Feasibility Study SEA

We welcome the Severn Tidal Power Feasibility Study (the 'Feasibility Study') and its Strategic Environmental Assessment (SEA) as processes that have the potential to identify and evaluate less environmentally damaging tidal power schemes. DECC and the consortium of Feasibility Study consultants have carried out an enormous amount of work during Phase 1 and covered a wide variety of relevant issues.

Over the last year, the RSPB has supported the Feasibility Study's ambitions to explore how to harness the considerable tidal power potential of the estuary. In particular, we contributed our ornithological and SEA knowledge through our membership of the Severn Tidal Power Feasibility SEA Steering Group. Over the course of 2008, we advised DECC and the Feasibility Study consultants on many of the points contained in this Phase 1 consultation response. In particular, we highlighted to DECC that the short-listing process gave insufficient weight to environmental issues, was biased towards cost and other 'quantitative' criteria and would fail to meet the Study's stated objectives to produce an affordable and significant amount of renewable energy with acceptable environmental impacts (listed in Box 1 below).

This first phase is critical to ensuring the Feasibility Study and its SEA realise their potential to identify and evaluate potentially less environmentally damaging tidal

⁶ Most recently available 5 year average for 2002/03 to 2006/07 from the WeBS 0607 report (Austin et al. 2008).

power schemes. However, we are seriously concerned that the short-listing process and assessment framework adopted by the Study are flawed and incapable of achieving its objectives.

The RSPB continues to challenge the UK Government to find a tidal power solution for the Severn Estuary which maximises clean energy generation, while minimising environmental damage and at an affordable cost to consumers.

Structure of this response

Given the large number of consultation documents, we have made detailed comments on a relevant selection of these (listed below). We would be happy to discuss our comments further.

Below we respond to the following consultation reports:

1. Severn Tidal Power Feasibility Study SEA scoping report (*our comments answer part or all of consultation questions 19-27*)
2. The Engineering Studies in the Interim Options Analysis Report (*our comments answer part or all of consultation questions 12-18*)
3. Preliminary Review of Possible Mitigation and Compensation Requirements under the Habitats Directive (*our comments answer part or all of consultation questions 1,2 & 28*)
4. Ornithology SEA scoping topic paper (*our comments answer part or all of consultation questions 1, 2 & 28*)
5. Geomorphology SEA scoping topic paper (*our comments answer part or all of consultation questions 1, 2 & 28*)
6. Migratory and Estuarine Fish SEA scoping topic paper (*our comments answer part or all of consultation questions 1, 2 & 28*)

Annexes

Annex 1a: WS Atkins Review of the Interim Options Analysis Report

Annex 1b: WS Atkins Technical Note

Annex 2: Detailed comments on the Preliminary Review of Possible Mitigation and Compensation Requirements under the Habitats Directive

Annex 3: Detailed comments on the Ornithology SEA scoping topic paper

Annex 4: Detailed comments on the Geomorphology SEA scoping topic paper

1. STRATEGIC ENVIRONMENTAL ASSESSMENT SCOPING REPORT

This section answers part or all of consultation questions 19-27.

The Role of the Severn Tidal Power SEA

The role of SEA is to integrate environmental considerations into decision-making with the aim of promoting sustainable development. The Severn Feasibility Study SEA should aim to ensure that environmental constraints are given equal consideration alongside cost and energy generation criteria in the design of any tidal power scheme for the Severn Estuary.

The legal requirement to consider 'reasonable alternatives' as defined by the SEA Directive

The SEA Directive requires consideration of 'reasonable alternatives'⁷, taking into account the plan's objectives and geographical scope (Article 5(1) of the SEA Directive).

The SEA process clearly entails an iterative approach to selecting major project options. This process supposes that one does not start with a particular option and try to justify it, but one starts with plan objectives and then through an iterative process assesses how best to deliver those objectives in light of environmental considerations.

The proposed short-list of five is unacceptable due to the failure from the outset to use the SEA process to consider 'reasonable alternatives'

If the above basic premise is accepted, then rejecting options that are potentially less environmentally damaging prior to the SEA seems unjustifiable, particularly when one considers that the objectives of the Feasibility Study are to produce an affordable and significant supply of renewable energy at an acceptable environmental cost (see Box 1 below).

Nevertheless, Government is proposing that the SEA should only assess the provisional short-list, which excludes all the options that were specifically designed with environmental considerations in mind, such as the tidal reef. The scoping report states that following consultation, the short-listed proposals will have defined the "...reasonable alternatives' that the SEA will assess..." and that these will be compared against a 'do nothing' option (Section 4.1, p.119). This reflects a fundamental misunderstanding of the SEA Directive. Alternatives should not be artificially limited from the outset of an SEA and potential 'reasonable alternatives' should not be discounted prior to the completion of an SEA process.

The RSPB is seriously concerned about the SEA's approach to identifying 'reasonable alternatives': it is the wrong approach, both methodologically and with respect to the legal requirements of the SEA Directive. The SEA Directive requires that the SEA process itself should inform the development of the Study and the identification, description and evaluation of 'reasonable alternatives' (see Article 5(1) and Annex 1(h) of the SEA Directive and the relevant sections of EU and UK SEA guidance in Table 1 below).

⁷ Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment ("SEA Directive")

Box 1: Objectives of the Severn Tidal Power Feasibility Study

- i) to generate electricity from the renewable tidal range resource of the Severn Estuary with acceptable impact on the environment and economy both locally and nationally
- ii) to deliver a strategically significant supply of renewable electricity, which is reasonably affordable compared to other sources of supply and represents value for money, in the context of the UK's statutory obligations under the forthcoming Renewable Energy Directive and Climate Change Act and our goal to deliver a secure supply of low-carbon electricity [Source: Initial Options Appraisal Report, Executive Summary, page v]

Table 1: 'Reasonable alternatives' - Relevant SEA Directive requirements and EU⁸ and UK⁹ guidance

SEA Guidance	Relevant EU and UK guidance on 'reasonable alternatives'
SEA Directive Article 1	<i>"The objective of this Directive is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment."</i>
SEA Directive (Article 5 (1))	Requires preparation of an Environmental Report <i>"...in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and geographical scope of the plan or programme, are identified, described and evaluated."</i>
SEA Directive Annex 1(h)	Requires the Environmental Report to contain <i>"an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;"</i>
EUSEA Guidance, Para 5.11	<i>"The obligation to identify, describe and evaluate reasonable alternatives must be read in the context of the objective of the Directive which is to ensure that the effects of implementing plans and programmes are taken into account during their preparation and before their adoption."</i>
EU SEA Guidance, Para 5.12	<i>"...The essential thing is that the likely significant effects of the plan or programme and the alternatives are identified, described and evaluated in a comparable way. The requirements in Article 5(2) concerning the scope and level of detail for the information in the report apply to the assessment of alternatives as well. It is essential that the authority or Parliament responsible for the adoption of the plan or programme as well as the authorities and the public</i>

⁸ http://ec.europa.eu/environment/eia/pdf/030923_sea_guidance.pdf

⁹ <http://www.communities.gov.uk/publications/planningandbuilding/practicalguidesea>

	<i>consulted, are presented with an accurate picture of what reasonable alternatives there are and why they are not considered to be the best option."</i>
EU SEA Guidance, Para 5.13	<i>"...The first consideration in deciding on possible reasonable alternatives should be to take into account the objectives and the geographical scope of the plan or programme.... An alternative can thus be a different way of fulfilling the objectives of the plan or programme..."</i>
UK SEA Guidance, appendix 6 ¹⁰	UK Guidance indicates that the guiding principle is that the assessment of alternatives should be proportionate (see appendix 6). What is proportionate is dependent on context. With respect to the Severn Estuary, the nature and impacts of the project dictate a wide approach to consideration of alternatives.

In our view, the current provisional short-list does not constitute 'reasonable alternatives'. Less environmentally damaging options that may require pilot testing, such as the tidal reef and tidal fence, are also 'reasonable' given that:

- a. **The objective of the Study is to produce a significant supply of renewable energy with acceptable environmental impact;** and
- b. **The geographic scope of the Study includes internationally important wildlife sites** that are designated at International, European and National levels.

Furthermore, we note that combinations of options are not identified in the scoping report as potentially 'reasonable alternatives'.

How the SEA should identify 'reasonable alternatives' in Phase 2

Tidal power in the Severn is part of a total package for delivering renewable energy targets. The starting point for the selection of options for the Severn is that there is a national need to exploit its tidal range resource. The assumptions are that:

- 1) there is a need for renewable energy even if there are alternatives such as demand management;
- 2) small scale, local renewable projects will not be sufficient to meet targets;
- 3) a range of renewable resources will need to be part of the new energy mix, including tidal range projects; and
- 4) the Severn is an appropriate location to exploit tidal energy.

This is an important step in the hierarchy of options (illustrated in Figure 1 below) and is not adequately addressed by the Feasibility Study SEA scoping report, either through cross-referencing to the Renewable Energy Strategy or by reference to the forthcoming Renewable Energy NPS and UK-wide Wave and Tidal SEA.

¹⁰ 'A Practical Guide to the SEA Directive'¹⁰, p.23, section 5.3

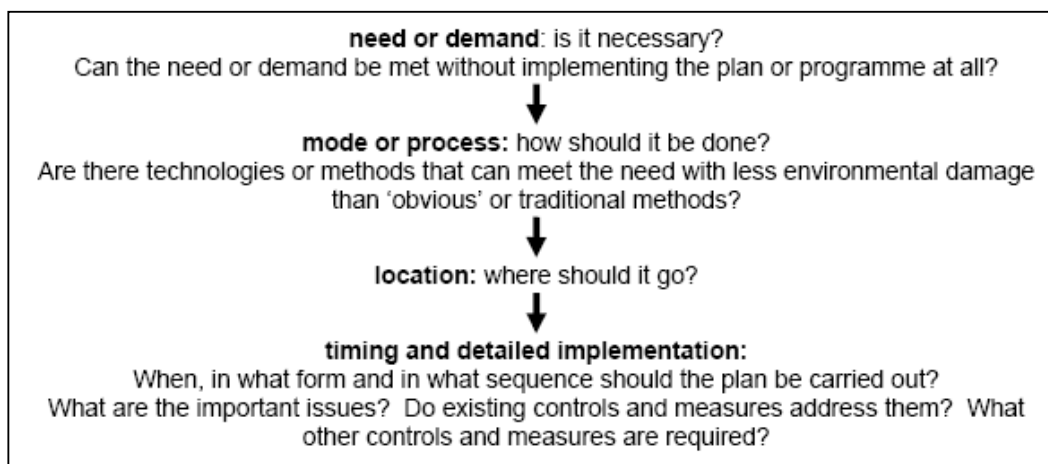


Figure 1: Hierarchy of options (Source: 'A practical guide to the SEA Directive')

In our view, the Severn Tidal Power Feasibility Study SEA should consider at least two tiers of alternatives:

- i) High-level scenarios for delivering a strategically significant supply of renewable electricity, are reasonably affordable compared to other sources of supply, and represents value for money in the context of the UK's commitments. These scenarios should also consider carbon abatement measures.

The process of identifying and evaluating high-level scenarios should clarify national-level options for delivering a significant supply of renewable electricity, and highlight the least environmentally damaging ways of achieving this. For example, scenarios could include delivering targets through a combination of offshore wind and wave power.

High-level scenarios ought to address the need for a plan/proposal. The need for a clean electricity supply from the Severn Estuary may be addressed in the forthcoming Renewable Energy National Policy Statement (NPS). At the very least, the Study and its SEA should refer to this forthcoming NPS.

- ii) Alternative tidal power schemes/combinations of schemes and deployment options, including potentially less environmentally damaging concepts that may require development to outline design stage/pilot testing.

The identification and evaluation of alternative tidal power schemes and deployment options should clarify the ways in which the Severn Estuary could be exploited with acceptable impacts on the environment. Alternative tidal power schemes include the long-list of options published by the Feasibility Study in Spring 2008, as well as tidal stream options, which were prematurely excluded from the Study's remit. Deployment options that could be assessed include (this list is indicative):

- a) Progressing immediately to commercial phase as opposed to pilot testing a selection of potentially less environmentally damaging options¹¹ (relates to timing of implementation, e.g. the implications of the 2020 renewable energy target)
- b) Building permanent structures as opposed to modular/removable ones
- c) The post-SEA addition of transport infrastructure to schemes, resulting in ancillary development and cumulative effects on the Severn's environment
- d) Different possibilities for sourcing construction materials.

The tidal reef scheme is a 'reasonable alternative' in our view

The basic engineering requirements for the WS Atkins version of the tidal reef, i.e. creating a concrete engineering structure in deep water, is the same as for other options on the provisional short-list (see the WS Atkins Tidal Reef Report, 2008)¹². Moreover, the recent WS Atkins Engineering Review concludes that the basic technology for low-head turbines is available and could be scaled up and fit to a tidal reef scheme (see Annex 1).

While we acknowledge that the Study cannot reasonably be required to carry out detailed work on an option which has no realistic prospect of delivering the Study's objectives, based on WS Atkins reports we conclude that there is no show-stopper for a conventionally engineered low-head tidal reef scheme which retains fish-friendly turbines.

We must remember that this is, after all, a Feasibility Study. For a Feasibility Study not to be prepared to look at the tidal reef simply because it is not yet fully developed seems a deliberate misunderstanding of the purpose of a Feasibility Study and contrary to the purposes of the SEA Directive. While we welcome the establishment of the Embryonic Technology Scheme and the commitment to consider these proposals alongside the traditional schemes at the end of the process, it is still clear that these schemes are being treated differently. This does nothing to give confidence in the objectivity of the process.

Moreover, it is worth noting here that, historically, less environmentally damaging options which were originally dismissed as unworkable have, once investigated, been accepted. For example, end-to-end tunnelling for Crossrail was accepted rather than the much more environmentally disruptive tunnelling from various entry points. Another example is the dismissal of options for compensation at Dibden Bay at too early a stage, which meant that the proposers ended up promoting a scheme that was fundamentally and fatally flawed. Ensuring that options are not artificially limited at the outset is clearly fundamental to good decision making.

¹² http://www.rspb.org.uk/Images/atkins_tcm9-203975.pdf

Treatment of significant effects in the SEA scoping report

We welcome the adoption of the precautionary approach in identifying potential significant issues to be considered by the SEA. However, section 7.2.1 states that:

“If a risk has been identified that tidal power options may cause severe or irreversible to society or to the environment, and in the absence of a scientific consent that harm would not ensue, the assumptions has been made that such a risk exists.”

The SEA Directive requires identification of ‘significant effects’, which clearly implies a lesser impact than ‘severe or irreversible harm’ (Article 5(1) of the SEA Directive). In Phase 2, the SEA should clearly define how it determines significance of effects and set a lower risk threshold.

‘Optimising’ tidal power schemes through the SEA

Section 8.6 of the scoping report states that ‘scenarios’ will be developed for each short-listed scheme and will consider how schemes can be ‘optimised’ to minimise environmental impacts: e.g. considering ebb-flow generation (instead of ebb-only), different turbine designs, sluice gate placement, ship lock types/placement, use of recycled aggregates etc.

The Phase 2 engineering studies will also be ‘optimising’ options through a different set of criteria and priorities, and a different assessment framework. In Phase 2, it will be critical to ensure environmental criteria are given equal consideration to cost minimisation and other criteria in optimising the different schemes.

Less environmentally damaging options will need to be revisited within an appropriate assessment

The legal tests of the Habitats Directive¹³ require that if a less damaging alternative exists, it must be used¹⁴. If there are no less damaging alternatives, a preferred option cannot go forward unless it meets strict checks to determine if damage to the site can be justified on the basis of imperative reasons of overriding public interest (IROPI). However, IROPI arguments can only be considered in the absence of alternative solutions: it will be essential to demonstrate that a particular option must go ahead at that particular location and no other location and/or solution, either locally or nationally, would be appropriate to address the public need that the plan seeks to meet. It should be noted that because of the iterative nature of the development of any plan, the search for alternatives is likely to be an ongoing process.

Therefore, it is crucial that potentially feasible options which are likely to be less damaging to European sites are short-listed and go on to be evaluated within Phase 2 of the Study and the SEA. This will ultimately be cost-effective as it is more than likely that less environmental damaging options would need to be re-visited if the ‘alternatives stage’ is reached.

Good practice lessons – The Bay of Fundy SEA’s precautionary approach

¹³ Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora

During Phase 1, the main difficulty has been the level of unknowns associated with many of the options, not just in terms of possible impacts on habitats, birds, fish etc., but also in terms of aspects of the technology and energy generation and the likely design and location. Based on the level of unknowns in Phase 1, the inevitable concern is that the basis for short-listing alternatives at this stage is based on 'best guesses'.

We note that the Bay of Fundy SEA dealt with similar levels of unknowns and took a precautionary approach, recommending that various tidal power options should be pilot tested in the estuary (see Box 2 for an overview of the Bay of Fundy SEA and its conclusions).

Box 2: A precautionary approach - The Bay of Fundy Marine Renewables SEA¹⁵

The Bay of Fundy SEA was commissioned by the Nova Scotia Department of Energy and undertaken by the Offshore Energy Environmental Research Associations (OEER). It focused on tidal in-stream energy conversion devices suitable for the Bay's deep waters. The Bay of Fundy SEA's remit was similar to the Severn Tidal Power Feasibility Study's SEA: "...to provide advice on whether, when and under what conditions tidal energy demonstration and commercial projects should be allowed in the Bay of Fundy." (p.1, Bay of Fundy SEA Final Report).

The SEA's output included 29 recommendations to guide a strategic approach to the development of marine renewables, and 10 recommended Sustainability Principles intended to ensure that marine renewable energy developments respect ecological integrity. The intention is to incorporate these principles into new legislation that would provide a framework for testing and developing marine renewable energy technology.

The Fundy SEA recommended that: "...Nova Scotia proceed in a cautious and incremental manner, beginning with a Demonstration Program..." including a range of technologies at different scales and locations (p.1, Bay of Fundy SEA Final Report). The SEA identified three scales of projects:

1. Short-term pilot projects to carry out initial testing;
2. Demonstration projects that could generate 5MW in total, designed to provide information about technical performance; and
3. Commercial development.

Finally, the SEA recommended development of "...one or more carefully designed, located and managed demonstration projects..." (p.27), and that the purpose of these should to determine:

- a) operational feasibility;
- b) the extent of environmental impacts; and
- c) the effectiveness of mitigation approaches.

¹⁵ see <http://www.offshoreenergyresearch.ca/OEER/SEAHome/tabid/117/Default.aspx>

WS ATKINS REVIEW OF THE ENGINEERING STUDIES

A coalition of NGOs, including the WWF, WWT, National Trust, RSPB and the Wye and Usk Foundation, commissioned a critical review of the Technical Options Appraisal Report (Vols 1 & 2), henceforth referred to as the IOAR. This review was commissioned to inform our respective responses to the Phase 1 consultation process, as well as propose recommendations for Phase 2.

Below, we reproduce the Review's conclusions and recommendations, which in our view answer all or part of consultation questions 12-18. The NGOs who supported this Review, the RSPB and WS Atkins would be happy to discuss these recommendations in more details.

Conclusions on Phase 1

Equal consideration has not been given to the study aims of acceptable environmental impact and providing a significant amount of renewable energy at an affordable price. There has been no attempt to modify the long listed options to reduce environmental impacts.

The Phase 1 IOAR assessment framework was based on quantitative measures, largely: power output, construction cost, and cost and amount of energy. The qualitative measures included: impact on energy markets, environmental impact, technical risk, affordability, and economic and social impacts. A fair basis methodology was used to apply a consistent set of cost rates and assumptions across all options. A number of options including the tidal reef, tidal fence and some lagoons were then dismissed based on cost of energy. No options were dismissed based on environmental impact.

The quantitative measures assessed are in our opinion open to more potential bias than the IOAR team acknowledges. We have significant questions over both the energy estimates for some of the newer schemes and over the cost estimates and construction risk, where the same basis has been used for both small and large schemes. The difference in risk and environmental impact between small and large projects means that these "quantitative measures" are not truly and directly comparable and, in our view, risks discarding some schemes which might in reality be viable when environmental aspects are weighed appropriately in the balance.

There is no explanation of what constitutes a "significant" quantity of energy and the omission of any discussion of this parameter means that there has been less focus than is merited, in our view, on the potential of "in-combination" schemes (eg a group of tidal lagoons or lagoons with an inner barrage for example). The IOAR proposes to review the in-combination schemes only in subsequent phases with reference to options which have made it to the short-list. This presents the risk that some discarded options might be significant and suitable in combination whereas they have been assessed as unsuitable as stand-alone schemes.

The assessment approach seems, in our view, to eliminate options before sufficient work has been done on optimising arrangements for generation and management of

environmental impacts. Our view is that the level of detail given in the IOAR is only sufficient to dismiss options that are clearly unreasonable.

Power calculations

There are several serious shortcomings in the IOAR' power calculations which bias the short-listing process. The IOAR does not discriminate between ebb-only generation schemes and two-way generation schemes, which are potentially less environmentally damaging, and gives the false impression that two-way generation schemes produce much less power. The calculations in our Review demonstrate that:

- Two-way generation, which is potentially less environmentally damaging, produces more power than ebb-only generation, provided suitable turbines are available. The maximum power available increases steadily as tidal power schemes are moved downstream in the Estuary. This negates the findings of the Bondi committee, which were that the power does not increase with reservoir area, but peaks at Minehead-Aberthaw, and then begins to fall if the barrage is moved further downstream (see the calculations in the Appendix).
- Because the IOAR bases its conclusions on the 30-year-old findings of the Bondi committee and fails to undertake new power calculations, it seriously underestimates the potential of sites downstream from Cardiff-Weston. While the IOAR concludes that the power is only 25 TWh/yr for the Minehead-Aberthaw route, the calculations in this Review show clearly that that this route could produce up to 31 TWh/yr (see section 4.4).
- It is not satisfactory to rely on other sources, i.e. the Bondi Committee's conclusions, in this way, given the importance of the short listing process. The IOAR should have investigated these matters more thoroughly, and carried out its own independent calculations, e.g. with computer models. This would have been perfectly feasible given the resources available, which we understand were 10 man-years of engineering time, or £1 million, for the production of the IOAR. The IOAR is in error in abandoning its empirical relationship between power and reservoir area, in favour of the findings of the Bondi committee.
- The Tidal Reef was found to produce only half the power of a barrage with ebb-only generation at the same site (13 TWh/yr rather than 25 TWh/yr). This appears to be the result of some very sub-optimal assumptions about the operation of the Tidal Reef, and gives the false impression that two-way generation gives less power than ebb-only generation.

Recent developments in turbine technology

In recent years the hydro-electric turbine industry has begun building very-low-head (VLH) turbines, albeit only on a small scale. Our Review concludes that:

- These new developments are highly relevant to the Severn because they suit two-way generation schemes, which can be much less environmentally damaging than ebb-only schemes. In particular, two-way generation may limit loss of intertidal habitat by allowing the pre-barrage tidal regime to be more closely matched

during generation. In addition the small scale VLH turbines used to date have low blade speeds (which would remain the case even when scaled up) which ought to have benefits of reduced migratory fish mortality. The IOAR dismisses such turbines as irrelevant, because the turbines built to date would have to be scaled up. We disagree in principle – it appears feasible to scale them up in the timescale of a major generation project in the Severn, although undoubtedly there would need to be some incentive for the turbine manufacturers to tread this path.

- Atkins have had conversations with senior representatives of a major technology manufacturer in this field, and they have expressed their strong interest in developing a scaled up prototype over the next 2 years for these operating conditions.

Cost estimation

Our Review identifies several significant weaknesses in the IOAR's costing work:

- The IOAR's cost estimates take no account of the scale of the project, because they are all based on per-unit costs (cost per tonne of concrete, cost per MW of generating capacity, etc.). Since large projects tend to distort markets and inflate costs, this means that the cost estimates in the IOAR can only be considered as giving correct relative costs (which was the aim of the IOAR), if the overall project size is similar (i.e. several of the smaller schemes are built simultaneously, to give a project of similar size to one of the larger schemes). The absolute costs could be significantly under-estimated, taking other large projects as a guide.
- The larger schemes also appear to be significantly riskier than the smaller ones, because the caissons are bigger and more exposed, and thus more difficult to install. We estimate that this risk factor could double the caisson installation costs given in the IOAR, for the larger schemes.
- The construction programme for Cardiff-Weston has not identified a location for the caisson construction facility. We suspect that a new deep water port facility may be required on the Severn, which could have a significant impact on cost.
- The construction programme for Cardiff-Weston is inadequately described. If required, the planning and construction of new port facilities on the Severn would significantly extend the proposed construction and implementation programme.
- The caissons for the "outer barrage" between Minehead and Aberthaw (about a third of its total cost) are assumed in the IOAR to require 65% more concrete than those for the Cardiff-Weston barrage. This is only an educated guess.
- The turbines for the Tidal Reef between Minehead and Aberthaw (about two thirds of its total cost) are assumed in the IOAR to cost four times as much per MW as conventional turbines. This again is only an educated guess, as is the caisson cost (assumed to be 45% of the cost of the "outer barrage", which is again only an educated guess). It is discussed in Section 4.

Economic analysis

The IOAR only seeks to provide guidance on the relative economics of the various tidal power options on the Severn. The assessment methodology comprised the calculation of an average annual energy cost derived from discounting capital and annual costs at a variety of discount rates and then calculating a cost of energy. This is standard practice for assessing and comparing energy generation projects. Various discount rates were used to reflect either public or private ownership. A second phase of work will now follow, in which it is clearly essential that:

- Some absolute cost figures be produced (addressing the points above, especially those in 1.6) – otherwise a misleading impression may be given of the cost of Severn tidal power compared with other renewable energy options, such as wind.
- The analysis in Phase II also include the cost of other environmental mitigation measures (aside from compensatory habitat). In particular, the impact on fisheries and the cost of mitigation or reduced turbine performance is not priced.

Assessment framework adopted in IOAR

The IOAR's short-listing assessment framework does not achieve a fair basis in its evaluation of energy, cost and environmental impact criteria and therefore gives some schemes unfair advantages over others. This is because the different schemes have different risks and environmental impacts.

Our review of the IOAR demonstrates that the assessment's methodology and outcomes are insufficient at this stage to adequately identify a short-list of tidal power options for the Severn Estuary. Moreover, given the objectives of the Feasibility Study, which are to produce a reasonably affordable and strategically significant supply of renewable energy with acceptable environmental impacts, short-listing should logically take place only after schemes are optimised to increase energy, reduce cost and avoid environmental impacts.

Section 3 of this report proposes an alternative assessment framework where only unreasonable options would be discarded at this stage.

Recommendations for subsequent Phases.

Assessment framework & short-listing

1. Equal consideration should be given to the study aims of acceptable environmental impact and providing a significant amount of renewable energy at an affordable price. The assessment framework should be amended to reflect this in Phase 2 and include a detailed assessment of the available technology that can be used to reduce environmental impact.
2. Short-listing schemes at this stage of the Feasibility Study is premature. The overarching objective of the Feasibility Study, which is to produce a reasonably affordable and strategically significant supply of renewable energy with acceptable environmental impacts, may not be met by adopting an assessment

framework that short-list schemes at too early a stage. Moreover, premature short-listing has the potential to introduce bias in the cost and energy production estimates. The next phase of work will 'optimise' schemes to increase energy, reduce cost and avoid environmental impacts – it seems more rational to short-list options only after the completion of this step.

3. We remain unclear as to the role assumed for the SEA. The attempt to short-list options prior to an SEA seems illogical and may fail a legal test. We recommend that tidal power options should be short-listed within the SEA process.
4. The £0.5 Embryonic Technology Fund provides limited funding for potentially less environmentally damaging schemes such as the tidal reef and tidal fence. We recommend that investment in potentially less environmentally damaging schemes must be proportional to the scale of the challenge and that these schemes should be evaluated within the Feasibility Study.
5. Combined schemes should be considered in the next phase including multiple lagoons and barrages.
6. Phase 2 studies should clearly define what constitutes a “significant” quantity of energy.

Power calculations

7. The power calculations are seriously flawed. We recommend that Phase 2 should re-investigate the power generation potential downstream of the Cardiff-Weston alignment, e.g. at Minehead-Aberthaw, and carry out its own independent calculations prior to short-listing options. The power estimates for some schemes, in particular the tidal reef, seem to be significantly underestimated.

Turbine technology

8. The Study should not dismiss existing low-head turbines and the potential to scale these up and fit them to two-way generation schemes. A major tidal power scheme would seriously incentivise manufacturers to research new turbine options.

Cost estimation

9. More precise costing of schemes is necessary. It is clearly essential that some absolute cost figures be produced; otherwise a misleading impression may be given of the cost of Severn tidal power compared with other renewable energy options, such as wind. A consistent approach to assessing risk and pricing would help to make evaluation more objective.
10. The next phase of the work should quantify unit costs taking account of the risks associated with the scale of the project otherwise the cost of larger projects, such as the Cardiff-Weston barrage, may be seriously underestimated.

COMMENTS ON OTHER REPORTS

Below, we summarise our comments on four other key reports. These comments answer all or part of consultation questions 1, 2 and 28:

- Preliminary Review of Possible Mitigation and Compensation Requirements under the Habitats Directive (detailed comments in Annex 2)
- Ornithology SEA scoping topic paper (detailed comments in Annex 3)
- Geomorphology SEA scoping topic paper (detailed comments in Annex 4)
- Migratory and Estuarine Fish scoping topic paper (comments courtesy of the Atlantic Salmon Trust)

3. PRELIMINARY REVIEW OF POSSIBLE MITIGATION AND COMPENSATION REQUIREMENTS

The SDC report on tidal power options in the Severn gives strong support to the value of the EU Birds and Habitats Directives (**the Nature Directives**), both in their own right and in the practical delivery of sustainable development. In particular, the SDC acknowledged how:

“...the Directives are guided by sound science, and establish a clear decision making process that is intended to facilitate ‘good governance’, whilst recognising the importance of economic and social goals in development decisions”

The SDC rightly recognised that the decision-making tests of the Habitats Directive enable society to make sound decisions for the future of our planet, and are not an outmoded legislative inconvenience. Through positive application of the Directives, it is possible to help deliver the Government’s objectives on climate change and biodiversity conservation and avoid consenting inappropriate and highly damaging schemes through poor planning. This approach is consistent with the Government’s twin goals for sustainable development: living within environmental limits and providing a just society.

RSPB agrees with the terms of reference of the Severn Tidal Power Unit in seeking to integrate climate change and biodiversity objectives. However, as noted earlier in our response, we have concerns that the assessment framework is biased in favour of technological and economic considerations. The draft report on the Preliminary review of possible mitigation and compensation requirements under the Habitats Directive (**the report**) is a constructive contribution to that work.

We welcome the report’s recognition of the international nature conservation importance of the Severn estuary, including its legal designation as a Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) (now approved by Europe as a Site of Community Importance) and Ramsar site: however it should be updated to reflect the fact that it is now accepted by the European Commission as a Site of

Community Interest. In this context, the Severn's Natura 2000 and Ramsar sites should be seen not only as important in their own right, but as an integral part of a European and global network of protected areas, whose value goes far beyond the Severn, south-west England or even the UK.

The RSPB agrees with the report's conclusions that the tidal power options considered are likely to have significant impacts on those designated sites as well as adjacent riverine SACs. In general, these will require substantial compensatory measures, although the scale is likely to vary considerably dependent on the option chosen. We broadly agree with two of the three potential approaches to compensatory measures identified: managed realignment to create new intertidal habitats (including for feeding and roosting waterbirds) and designation of new SACs for intertidal and subtidal habitats and migratory fish. The former, in particular, still poses significant operational difficulties in achieving the predicted scale of compensation required. The third approach, enhancement measures for migratory fish stocks, causes us major concerns in the absence of improved scientific knowledge demonstrating its effectiveness.

Our main comments are summarised below:

- **Effectiveness of mitigation measures:** we agree in general that the confidence in possible mitigation measures is low given the uncertainties over the nature and scale of predicted impacts at this stage and the degree to which some proposed measures could be relied upon;
- **Impact prediction and compensation requirements (birds):** we have commented separately that the Ornithology report concentrates on the long-term impacts only and does not specifically address the important component of a medium term significant impact. Phase 2 should consider both the construction and operational impacts in more detail, in particular the short/medium term post-construction impacts as the system moves towards a new equilibrium. This will help determine whether additional compensation is likely to be required to that identified for the long term impacts;
- **Like for like replacement:** the critical issue is, as far as possible, to compensate for the ecological functions that will be lost and upon which the affected species and habitats rely. This will require a careful analysis of each of the ecological functions lost or damaged, and the species and habitats affected, in order to identify measures needed to restore them to a favourable status. Some will be dependent on a high energy system, like the Severn estuary, while others will not: the latter are likely to exhibit greater flexibility in the type of compensatory measures available e.g. wintering and passage waterbirds;
- **Effectiveness of compensation - birds:** in principle we consider it is possible to create compensation for the effects on birds and their habitats, although this will be challenging given the potential scale of the job. The most likely locations to provide compensation on the scale required will be in north-west England and the east coast of England (see **Location of compensation** below);

- **Location of compensation:** Phase 2 should consider in more detail the degree to which each of the main areas of search for intertidal compensation (north-west England and the east coast) would provide the best functional match for the species and habitats likely to be affected. The better the functional match, the lower the ecological risk and the lower the compensation ratios required;
- **Effectiveness of compensation - fish:** more detailed research is required to understand the ecological requirements of the different species and what, if any, measures may be feasible to compensate for the likely impacts. This will need to be afforded a high priority in Phase 2, given the lead-in times of such research;
- **Effectiveness of compensation - SAC designation as compensation:** this should be a lower priority in the compensation hierarchy than habitat creation as it will not fundamentally benefit the UK's ability to secure favourable conservation status of the affected species or habitats, given that there will have been a net loss overall. However, the report is legally flawed in ruling out sites that are currently SPA-only – therefore there is greater potential in this area than the report suggests.
- **Interaction with other compensation requirements:** The implications of the scale of compensation required are that there is a strong risk that intertidal compensation for a tidal power option will compete with emerging plans to provide compensation for the predicted effects of sea level rise and coastal squeeze identified through Shoreline Management Plans and Flood Risk Management Strategies. Further studies will need to consider the implications of this “competition” and how it could be managed.
- **Timing of compensation:** The degree to which this issue can be addressed will dictate the confidence in the ability to secure fully functional habitat before any damage occurs, and impacts on the compensation ratios required. This could have significant implications for the confidence in protecting the coherence of relevant aspects of the Natura 2000 network and for related costs;
- **Habitat creation costs:** we consider the report significantly over-estimates the cost of habitat compensation due to use of an inflated figure for the unit cost of creating intertidal mudflats: based on the RSPB's considerable experience of this form of habitat creation, we estimate the overall cost of providing 20,000ha compensation for a middle barrage could be reduced from £1.3-3.9bn to £0.6-1.8bn, a saving of between £0.7-2.1bn. While this cost remains significant, we do not consider it disproportionate to the potential overall costs. Use of compulsory purchase may help avoid speculative land prices and enable ecologically-functional blocks of land to be assembled efficiently and effectively.

Given these concerns, while we welcome high-level consideration of potential mitigation and compensation requirements as part of the process of considering a range of options, we recommend that the STPU should not do too much detailed work on compensatory measures until the nature of the option selected is confirmed and it has been demonstrated that there are no less damaging alternative solutions to that option. This

is especially important given that most analyses show that a Severn Barrage per se is not essential to meet existing medium-term emission reduction targets. Any final option selection should be based on a thorough exploration of the role of tidal and wave energy in helping to achieve a low-carbon economy in the medium-long term and the relative costs of a Severn Barrage compared to these.

4. ORNITHOLOGICAL SEA SCOPING TOPIC PAPER

Our concerns with the Ornithology Topic Paper relate primarily to its treatment of the Severn SPA designation, the proposed assessment approach (particularly the process for evaluating the sensitivity of receptors), and consideration of climate change and sea level rise effects. We are broadly in agreement with the further survey work recommended for Phase 2 of the SEA, but are concerned with the suggestion that this work may terminate in June 2009 rather than winter 2009, as was originally planned.

Below, we summarise our key comments on the Ornithology Topic Paper (see Annex 3 for more detail).

Severn Estuary SPA

- **Consideration of the SPA must include the long-standing proposed SPA/Ramsar extension:** This proposed extension has been with the Secretary of State for 15 years. We are extremely disappointed that the topic paper does not recognise this long-standing proposed extension, given that the pSPA is protected by Government policy.
- **Clarification is required over the qualifying interests of the Severn Estuary SPA,** given the apparent differences between the original citation, the Standard Data Form and the JNCC SPA Review site account. In addition, it will be important for the Secretary of State to clarify when Government will confirm the extension to the SPA that was submitted to him by English Nature in 1994.
- **Natural England should revise the site conservation objectives for the SPA and pSPA to reflect the requirements of common standards monitoring:** The RSPB welcomes the change to bullet points 1-3 in respect of the tests to be applied. It will be sensible to revisit the current site conservation objectives for the SPA given the subsequent adoption of Common Standards Monitoring requirement and the fact that the qualifying features of the SPA are not fully resolved. The RSPB would be happy to work with Natural England and other agencies on this.
- **Government's commitment to designate Newport Wetlands:** At the Public Inquiry too set up the Newport Wetland reserve the Welsh Assembly Government/UK Government gave the assurance that the reserve (whole reserve) was intended to be designated as an SPA alongside the Severn Estuary SPA. This commitment should be included within the scoping paper. The terrestrial component of the reserve is not yet included in the Severn SPA nor in the Severn Estuary SSSI (though the intertidal of the reserve is). Clarification on

when the terrestrial component will be designated should be identified. Note that this would be in addition to the SPA extension submitted to the Secretary of State in 1994 (see above).

Assessment approach and data

- **We are concerned about the process for evaluating the sensitivity of receptors:** We have some concerns about this process and the description of the definitions in Table 1, Annex 1. The fundamental concern is the description of vulnerability. The basis of this relates to the Alerts process, but then it is used to describe vulnerability and (in Table 1) is related to a non-reversible context. Clearly, there are changes that are related to global warming, but nowhere is there the slightest evidence that they are irreversible. So, in Table 2.5 the term vulnerability is not correct as most people would understand it – it relates to ‘observed changes in numbers’. Additionally, the method of defining vulnerability for each species, and for sensitivity in Table 2, Annex 1, needs to be described clearly, because this has not been done it casts serious doubt on many of the assessments made subsequently. Table 1 of the Annex is inadequate for this purpose.
- **The options assessed are not illustrative of the likely effects of potentially less damaging options/combinations of options:** This topic paper, and others, only consider three ‘generic’ options; 1) the Cardiff-Weston barrage, 2) a smaller barrage (like the Shoots or Beachley), and 3) land-connected lagoons. The options chosen are not illustrative of the likely effects of potentially less damaging options and potential combinations of options. This, and other topic papers, should have looked at a wider range of options including the potentially least damaging options (even though the ones chosen provide for the worst-case scenarios). We recommend that work in Phase 2 evaluates all relevant options and their optimised variants.
- **Medium term significant impacts are inadequately highlighted.** Section 3.1.2 describes the potential and probably likely significant negative impact on waterbirds of the construction and closure of a barrage, although with some reference to a possible partial improvement at a ‘later’ date. However, the important component of a medium term significant impact e.g. arising from the time taken for the estuary inter-tidal invertebrate populations to reach an equilibrium, is inadequately highlighted. We note that any additional residual adverse effects would require additional compensation to that identified for the medium term. This is in addition to any issues arising relating to the estuary reaching an equilibrium in the long term.
- **Given the importance of the Severn for passage populations as well as overwintering birds, the proposed studies should cover winter and passage periods (spring & autumn).** It is not clear in the paper whether this is the plan. We would appreciate clarification on this point.

- **We recommend using both types of IBM models:** It is ambiguous whether the suggestion is to use the CEH of habitat (ie BTO) models or if both CEH and WEBSTICS models should be run for the IBM side. From our perspective, we would recommend using both types of IBM. The two approaches are BTO habitat association models and CEH IBMs + Sovon WEBTICS which are subtly different forms of IBM. Application of both types of IBM might increase confidence in modelled outputs since these have not been fully tested in a 'before and after' application.
- **There remain significant uncertainties throughout the data set:** While we have substantial information on the Severn bird populations, the very fact that an enhanced WeBS survey has been authorised for this winter show that we do not have all relevant information yet. The fact that uncertainties exist throughout the data set means that a major caveat should be included early in the Baseline Information diction (p.16) and re-summarised at the end of section. Phase 2 should pull together new data and re-visit the current data sets.

Sea level rise and climate change

- **The Severn Estuary could be a future sea level rise (SLR) refuge:** Decreases in bird populations in southwest England are largely due to birds remaining further east in eastern England. However, SLR effects on east coast estuaries may lead to these declining in suitability. The Severn has been a cold weather refuge and similarly could be a future SLR refuge. It makes ecological sense for birds to winter close to their breeding grounds consistent with maximising their survival, hence moving further south and west when necessary, therefore the observed decline in the southwest may not continue.
- **The effects climate change:** The section on future trends (p.45) provides information on current warming trends due to climate change as and relates these to vulnerability. Technically, this is not vulnerability but a response to a specific set of conditions. This section does identify that there is uncertainty of the future scale, possibly even direction, of change. Further work in this area is urgently required. Climate change will increase the importance of protected areas for wildlife; criticism that protected areas are static anachronisms in a newly dynamic world are ill founded.

5. GEOMORPHOLOGY AND HYDRAULICS SEA SCOPING TOPIC PAPER

The hydraulics and geomorphology topic paper underpins the assessment in several other topic areas and is crucial to understanding the potential environmental effects of various tidal power options. Detailed comments on this topic paper are summarised in Annex 4. In summary, key issues with this paper are:

- **It is inappropriate to use the predicted impacts of climate change to discount the impacts of tidal power options:** While it will be important to understand the

estuary's response to climate change to inform assessment of the impacts of the various tidal power options, including habitat change in response to sea level rise and climate change, it would be inappropriate to use such predicted changes to discount the impacts of tidal power options. This is because the UK Government is under a separate responsibility to take appropriate steps to avoid the deterioration of Natura 2000 sites arising from man-made and natural changes and thereby maintain the Natura 2000 sites at a favourable status (see European Court of Justice. Case C-6/04 Commission versus United Kingdom).

- **Sediment budget:** It will be essential that more detailed analysis of the sediment budget not only informs an understanding of how a new equilibrium may develop, but also the timescales over which this might occur.
- **Implications of greater light penetration:** While reductions in suspended sediments may remove the high sediment concentrations associated with oxygen sags, depending on water quality, it may also result in increased photosynthesis with the potential risk of algal blooms and associated dissolved oxygen sags. Assessment of the implications of greater light penetration should therefore also address this issue.
- **Issues that must be addressed in detail:** Both the dissipation of detail throughout other topic papers and the high level nature of this paper (while understandable) makes it a little hard to clarify the detail of what will be covered. Here we therefore provide a list of some examples of the specific issues that must be addressed in detail (and which may or may not already be covered within the various related topic papers):
 - Changes in tidal range and tidal prism
 - Changes in sediment composition, sediment budgets, mobilisation, turbidity, erosion/accretion and long shore transport in the Bristol Channel and beyond
 - Changes in sediment budgets and mobilisation upstream of the barrage with particular regard to the effects of the change in tidal prism, the duration of anticipated sediment budget effects as the estuary attempts to move towards an equilibrium state and the effects of this in combination with anticipated rates of sea level rise and future sediment supply
 - Changes in intertidal profiles over time
 - Predicted loss of saltmarsh and upper foreshore due to reduction in tidal range
 - Quantification of the change in the positions of Mean High water Mean Low Water, and Lowest Astronomical Tide

- Quantification of the changes in extent and duration of intertidal exposure
 - Quantification of predicted rates of foreshore erosion and accretion during and after construction. This should include assessment of any predicted increases in wind-driven wave action associated with the increase in tidal duration
 - Quantification of the nature of erosion and accretion following barrage construction – which parts of the tidal prism and which geographic areas will be affected, how will sediment composition (both in intertidal and subtidal areas) be affected etc
 - Assessment of how changes to sediment composition, particularly in intertidal areas, will affect benthic invertebrate assemblages and biomass, and in turn fish and bird populations. This will need to be assessed in combination with any other predicted impacts on benthic invertebrates (e.g. through increased biomass associated with greater light penetration) to provide an overall assessment of the likely changes to benthic communities.
 - Predicted loss of saltmarsh/conversion of saltmarsh to reed etc due to any predicted shift of the fresh/saline interface downstream of its current position.
 - Impacts of reduced sediment concentrations, mobilisation and turbidity and associated increases in light penetration, photosynthesis, the potential for eutrophication including the risk of algal blooms and associated impacts on dissolved oxygen levels and fish
 - Quantification of the ‘life expectancy’ of the potential flood risk benefits of all tidal power options considered in the context of anticipated effects of climate change including sea level rise, and in combination with predicted changes in intertidal profiles and patterns of erosion and accretion, both up and down stream of the potential constructions.
- **Analogues:** As mentioned at 3.2.4 an important aspect of considering analogues will be recognition of the similarities and differences between the physical environments affected and those of the Severn Estuary. However, it is also essential that this includes an assessment of the quality of the information available for each potential analogue, and therefore the extent to which its use is appropriate. So, for example, the RSPB is particularly concerned at the use of the La Rance case, not only because of the fundamentally different geomorphology of this steep-sided sandy coastal ria with low suspended sediments to that of the sediment-rich Severn estuary with its extensive intertidal flats and marshes, but also because of the lack of baseline data to allow effective assessment of the impacts of that scheme. The Oosterschelde barrage in Holland, which has had

major problems with siltation, provides a much better comparator, both because the impacts are better understood and the nature of the site affected has more in common with the Severn.

- **Fundamental differences between La Rance and silty estuaries like the Severn:** The small-scale success of La Rance is potentially due to the fact that the coastal ria where it is located is not a silty estuary. The Bay of Fundy is a silty estuary, like the Severn, and there silt has cause massive problems. In the case of the Severn, silt impede the efficiency of a barrage and reduce its useful working life. Ultimately, large-scale barrages in silty estuaries is not a proven technology.
- **We question the stated intention to use a single model to inform the SEA studies,** given the massive uncertainty inherent in the use of models. For example, when modelling the Humber Estuary for the purposes of the Coastal Habitat Management Plan and Shoreline Management Plan, three separate models were used, and the (high) degree of variation between the outputs of these provided a valuable understanding of the degree of uncertainty that must be taken into account in the interpretation of their predictions. While it is understood that by varying parameters within the model, the range of predicted outcomes subject to certain variables may be understood, how will the accuracy of the model itself be assessed?
- **The RSPB has serious concerns in relation to the lack of recent and comprehensive data upon which to base the hydraulic and geomorphological assessments and modelling.** The topic paper is somewhat contradictory on this point highlighting the age of the last comprehensive data sets for the estuary, the extent to which methods and technology have moved on since this was collected, and the gaps in more recent data. It mentions that, for example 'there is no single dataset that provides a detailed and up-to-date description of the seabed bathymetry' (2.2.2, Pg 16), and yet states that 'given the availability of datathere is already a very strong starting position for Phase 2'. We disagree, and stress the need for a comprehensive and up-to-date data set as the basis for further assessment. The older, less comprehensive and less reliable the data used, the greater the levels of uncertainty inherent in any analysis, and the lower the levels of confidence that can be attached to predicted changes.
- **The estuary will not regain a new equilibrium for centuries:** Some of the proposed tidal power schemes, in particular Cardiff-Weston, would significantly inhibit the ability of a naturally dynamic system to recover some form of equilibrium following these alterations. It has been suggested that, whilst construction of a barrage will have significant effects on the geomorphology of the Severn Estuary, post-construction the estuary would settle to a new equilibrium, thereby mitigating some of the negative environmental impacts of the development. However, it is likely that it will take centuries for the channel to sort itself out through sedimentation in response to the new tidal prism.

- **Smaller barrage schemes could have a disproportionate effect:** The geomorphological effects of smaller barrage schemes could potentially having disproportionately greater effect by truncating the upstream part of the high sediment load system.
- **The need to assess the geomorphological effects of each 'optimised' variant:** Phase 2 work should focus on identifying and evaluating the differential geomorphological effects of all the short-listed options and their 'optimised' variants.

6. MIGRATORY AND ESTUARINE FISH SEA SCOPING TOPIC PAPER (comments courtesy of the Atlantic Salmon Trust)

As the Topic paper on Migratory and Estuarine Fish makes clear, there is a lack of basic information about key aspects of the ecology and behaviour of diadromous fish species (including routes and depth of passage, tidal transport, swim speed, transit time, residence time, diurnal timing, seasonality, migratory cue, homing behaviour and stock status) found in the Severn Estuary. It is clear that the further work recommended for phase 2 of the SEA will do little to fill these gaps, since in the time available it will not be possible to undertake field work. The Topic paper acknowledges that field studies 'will be essential before any STP option can be taken forward', yet the Government is proposing to take decisions on the short list and, at the end of phase 2, on its preferred option before this essential research is undertaken and without the necessary information on the impact of its decisions on a number of protected fish species.

In these circumstances, it is difficult to see how any of the options can be regarded as reasonable alternatives so far as diadromous fish are concerned. Equally, it is not possible in the current state of knowledge to judge the effectiveness of any of the possible mitigation measures suggested in the topic paper (leaving aside the point that we cannot at present know the scale of mitigation that might be required.)

In our view, the following work, including where necessary field work, needs to be undertaken **before** decisions on any STP options are taken:

1. **Studies of fish migration and movement within the estuary.** Migration routes and timing for the different diadromous species are not known. Once this information is available, it may be possible to reduce the adverse impact of some options by the careful siting of turbines and sluices and by modifying operational parameters to take account of migration patterns.

For salmon and shad the issue is complicated by the extent of movement within the estuary. Salmon, in particular, move extensively within the estuary before definitively returning to their natal rivers; salmon from the Wye and Usk are taken in the putcher ranks that operate upstream of all the possible barrages. Even if salmon passed unharmed through a barrage going upstream, there is a

considerable risk that they would be damaged by turbines as they dropped back downstream, and it is not known how often a salmon might attempt to pass a barrier.

The Centre for Environmental, Fisheries and Aquaculture Science (CEFAS) is a world leader in the use of acoustic tags to track salmon within estuaries, and is currently carrying out tracking studies in the estuaries of the Tyne and the Tees. The Canadian authorities also have extensive experience of a tracking salmon acoustically in the Bay of Fundy, and this technology has also been used for eels. The technology therefore exists to carry out the necessary tracking studies in the Severn, although employing them for all diadromous species concerned in such a large estuary would be challenging.

2. **Studies of the migration cues** for the different diadromous species and of the potential impact on them of the various options. This would need to take into account the possible hydromorphological effects of each of the options, since these would be likely to cause significant changes in flow patterns and temperature regimes and thus in migration cues.
3. **Studies of turbine design and locations to minimise their effect on fish** (the term 'fish-friendly' is a misnomer in relation to turbines, but it may be possible to make them less unfriendly). Such studies will need to encompass all relevant diadromous species at all relevant life-stages. Work in North America has shown that turbines are particularly damaging to emigrating silver eels. The topic paper summarises the impacts, both direct and indirect, that turbines can have on fish, including increased predation, and these all need to be covered by this work. The work also needs to examine the potential effects of sluices, which the Topic paper acknowledges could have adverse effects on fish passing through.

Although most of the designs envisage power generation on ebb tides only, the possibility of operating turbines on an incoming flood tide needs to be considered as a means of reducing impacts on fish moving downstream. This could significantly reduce losses of smolts, juvenile shad and silver eels at peak migration periods. However, where designs are intended to operate on both ebb and flood tides, such as a tidal reef, the effects on salmon, sea trout and shad moving up and down the estuary (see above) need to be considered.

The studies we suggest could help mitigate the effect of an STP scheme on diadromous fish. Some of the other studies proposed in the Topic paper, such as the development of life history models, would help inform an eventual decision. However, in our view many of the mitigation/compensation ideas suggested in the paper would not be effective. In particular, we do not consider that attempting to create new habitats outside the Severn estuary, translocate species or designate new SACs could compensate for the loss of a considerable number of genetically distinct salmon populations or work for most other species (although trapping and transport of elvers and adults might work for eels). For salmon the creation of new SACs would add very little to existing levels of

protection, since conservation limits, which the Environment Agency is working to achieve, have been set for all significant salmon rivers and these have been reinforced by the requirements of the Water Framework Directive.