# Severn Estuary Shoreline Management Plan Review

## Appendix I: Part A - Strategic Environmental Assessment Report

ATKINS

## Notice

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## Annexes

This Appendix is divided into **two parts** which can be considered as separate reports:

**Part A – Strategic Environmental Assessment (SEA)**

Strategic Environmental Assessment (SEA) is the systematic appraisal of the possible effects of decisions taken at a high level (such as those in strategies, policies and plans) on the built, natural and historic environments.

The EU SEA Directive1 sets out the legal requirements for this appraisal in EU countries. The SEA Directive is transposed into law in England and Wales by the Environmental Assessment of Plans and Programmes Regulations 2004 (SI 1633) and the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004 (SI 1656).

Although the SMP2 is not a statutory plan, it forms an integral part of decision making in relation to coastal areas. Defra and WAG, therefore, recommend that an SEA is carried out.

Whilst the SMP2 is being developed, the Environment Agency is also developing a ***Severn Estuary Flood Risk Management Strategy (SEFRMS)***. This takes a more detailed look at the future management of flood defence structures and how some of the flood risk policies proposed in the SMP2 will be implemented. The areas and issues being considered for both the SMP2 and the SEFRMS are very similar and an SEA is required for both projects. To reduce confusion between the two projects, aid communication and information sharing, and reduce costs to both processes, some elements of the SEA process have been combined. More information on the SEFRMS can be found in ***SMP2 Main Report Part A Section 1.5***

**Part B – Habitats Regulations Assessment (HRA)**

The EU Habitats (92/43/EEC) and Birds (79/409/EEC) Directives aim to protect European birds, other plant and animal species and the habitats that support them. In the UK, the Directives are implemented through the Conservation of Habitats and Species Regulations 2010 as amended. These are known as the Habitats Regulations.

The legislation requires 'competent authorities' to undertake an 'appropriate assessment' of plans, projects and strategies that may have a significant effect on the site, if those plans, projects or strategies are not directly concerned with the management of the protected sites themselves. The process that includes the 'appropriate assessment' is known as a Habitats Regulations Assessment (HRA).

In the UK, it is also policy to carry out a similar assessment for sites designated under the Ramsar Convention (known as Ramsar sites).

The majority of the SMP2 area covers the Severn Estuary SAC, SPA and Ramsar site. Other European protected sites are also wholly or partly within the area of the SMP2 or located nearby and could be affected by the SMP2. The 'competent authorities' therefore need to carry out an HRA to ensure that damage to the sites does not take place when the policies in the SMP2 are followed. If the plan or project cannot be shown to have no adverse effect on the integrity of the site(s), the competent authority is required to demonstrate that there are no alternative solutions , and then seek a decision from the Secretary of State and/or WAG, that the plan should be approved on the grounds of overriding public interest, subject to the provision of an appropriate level compensation to offset the adverse impacts on the site(s).

For this SMP2, the competent authorities are WAG and Defra. In England, Defra has delegated this role to the Environment Agency (EA).

[1] Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment.

# Non-Technical Summary

## The Need for Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) is the systematic appraisal of the potential environmental consequences of high level decision-making, such as policies, plans, strategies and programmes, before they are approved. It ensures that the implications of plans and programmes are fully and transparently considered before final decisions are taken.

The requirement to undertake SEA in the European Union (EU) came about when the EC Directive (2001/42/EC) *'on the assessment of the effects of certain plans and programmes on the environment'*, known as the 'SEA Directive', came into force in 2004. The Directive is implemented in England and Wales through the *Environmental Assessment of Plans and Programmes Regulations* (SI 1633 2004) and the *Environmental Assessment of Plans and Programmes (Wales) Regulations* (SI 1656 2004). The Directive and associated regulations make SEA a mandatory requirement for certain plans and programmes which are likely to have significant effects on the environment.

Defra guidance states that documented plans for medium to long-term river or coastal management, such as Shoreline Management Plans (SMPs) and Flood Risk Management Strategies (FRMSs), are not required by administrative provisions, as defined by ODPM (Office for the Deputy Prime Minister). There is, therefore, no legal requirement to apply the Directive to these plans. However, SMPs, Catchment Flood Management Plans (CFMPs) and Strategies clearly help to set the framework for future planning, have significant environmental implications, and require extensive consultation. Defra recommend therefore, that adopting an SEA approach is appropriate and they strongly encourage the operating authorities to undertake SEA for these plans. For these reasons and in accordance with good practice, an SEA of the SMP2 is being undertaken.

## The Severn Estuary Shoreline Management Plan Review (SMP2)

Shoreline Management Plans (SMPs) are non-statutory plans produced by Coastal Groups (in this case the Severn Estuary Coastal Group) which are made up of maritime Local Authorities and other bodies with coastal defence responsibilities or interests. Shoreline Management Plans set high level policy approaches for the future management of flood and erosion risk along coastline. SMPs allow the development of strategy plans to be prioritised.

SMPs typically cover large areas such as several counties or catchments and define the broad policy for management of the plan area. They typically look at the predicted evolution of the coast under three timeframes or epochs: 0-20 years, 20-50 years and 50-100 years. The SMP2 has divided the Severn Estuary study area into policy units (see Annex C), with one of the four **policy options** being applied to each unit:

- Hold the existing defence line;
- Advance the existing defence line;
- Managed realignment - identifying a new shape for the shoreline and actively managing change;
- No active intervention - a decision not to invest in providing or maintaining defences.

The Severn Estuary (*Môr Hafren* in Welsh) is located on the west coast of Britain, bordering both England and Wales. It is renowned for having the second highest tidal range in the world. The Severn is typical of estuaries in England and Wales, in that it has provided a focus for human activity, a location for settlement, a source of food, water and raw materials and a gateway for trading and exploration. The Estuary and its coastal hinterland support the cities of Cardiff, Bristol, Newport and Gloucester. Major industries are located around the Estuary's shores, including modern port installations, chemical processing companies and power stations.

The Severn Estuary and its surrounding area are afforded a very high level of protection under European wildlife law. Large areas of it are designated as a Special Protection Area (SPA) under the Birds Directive and as a Special Conservation Area (SAC) under the Habitats Directive for their intertidal and sub tidal habitats and migratory fish species. The area surrounding the estuary is also designated as a wetland of international importance under the Ramsar convention and as a Site of Special Scientific Interest. In addition, several freshwater SSSIs (e.g. the Gwent Levels SSSI complex) lie behind the existing coastal defences.

The SMP2 study area stretches from Anchor Head (Birnbeck Island) on the English side of the Estuary (a move northeast from the first SMP) to Lavernock Point on the Welsh side. The upstream boundary is at Haw Bridge approximately 5km upstream of Gloucester.

## The SEA Process

The SEA provides a systematic appraisal of the potential environmental consequences of high-level decision-making; by addressing strategic level issues, the SEA process shapes the selection of the preferred option. The SEA is therefore intended to ensure that consideration of the socioeconomic and environmental issues relating to the coast have been central in the development and evaluation of policy. Within the SEA process, the term 'environment' has been used to cover the following receptors (as defined in Environmental Assessment of Plans and Programmes Regulations, SI 1633 2004):

- Population & communities (including human health, critical infrastructure etc);
- Cultural heritage, including architectural and archaeological heritage;
- Material assets;
- Biodiversity, fauna and flora;
- Soil;
- Water;
- Air;
- Climatic factors; and
- Landscape.

## The Assessment

An environmental assessment of the suite of four alternative SMP2 policies has been undertaken at the strategic level and integrated into the SMP2 policy option selection process.

The SEA process has developed two key outputs: a Scoping report and an Environmental report. The Scoping report established an environmental baseline for the Severn Estuary and through doing so developed a series of SEA objectives, by which the SMP policies could be assessed. The Scoping report underwent a four week consultation period in early 2009. Following the consultation period and the provision of feedback by the statutory consultees and others, the environmental assessment of preferred SMP2 policies was undertaken using the SEA objectives agreed through the consultation period; the assessment fed back into the option

selection process and a more detailed assessment of the preferred SMP2 polices was undertaken. This report is the summation of that process and constitutes the Environmental Report.

The methodology used to identify and predict the significant likely environmental effects related to implementing the Severn Estuary SMP2 involved the use of an evidence-based, expert judgement system based on the widely accepted Source-Pathway-Receptor model. The appraisal largely took the form of a qualitative assessment based on professional judgement and supported by peer reviewed literature, with the outcomes being scored in five categories between major positive and major negative.

## Key Features of the Estuary

### Population and Human Health

- The tidal floodplain throughout the estuary is under pressure from development.
- Key development proposals in or adjacent to the study area include:
  - the new M4: 24 miles of three lane motorway between Junction 23a (Magor)and Junction 29 (Castleton);
  - Severn Tidal Power Generation;
  - development of wind farms;
  - the regeneration of ports and waterfronts e.g. Portishead, Watchet and Weston;
  - Bristol Port;
  - development of a new gas fired power station at Uskmouth and construction of a 6km pipeline between Uskmouth and Marshfield;
  - increased access to the coast and development of coastal footpaths in England and Wales;
  - potential development of new nuclear power; potential sites for new nuclear power plants along the estuary include Oldbury and Hinkley.
- Significant conurbations within the SMP2 study area with populations of more than 10,000 include Penarth, Cardiff, St Mellons, Newport, Caldicot/PortSkewett, Lydney/Allaston/ Chepstow, Gloucester, Quedgely, Bristol, Portishead, Clevedon and Yatton/Congresbury.
- Areas within the study area with high levels of deprivation include Gloucester, Weston-Super-Mare, Burnham, Newport and Cardiff.
- Material assets including : M48, M4 and M5, two Severn road crossings, Severn rail tunnel, several strategic rail routes including South Wales to London main line and Chepstow to Gloucester, numerous sewage treatment works and pumping stations, several power stations (including Avonmouth, Berkely, Oldbury and Uskmouth).
- Numerous formal and informal tourism and recreation opportunities around the estuary.

**Biodiversity, Flora and Fauna**

- The study area supports a variety of habitats and a diverse flora and fauna, with protected species of national and international importance present. There are Seven Natura 2000 sites, over 50 SSSIs and 4 NNRs within the study area.
- Habitats around the estuary have been lost in the past due to increased urbanisation, draining of land and intensification of agriculture. Many of the Biodiversity Action Plans covering the study area highlight the importance of reversing decline in habitats, particularly for wetlands.

**Fisheries**

- In addition to more common species the River Severn also supports: salmon, eel, allis and twaite shad, river, brook and sea lamprey.
- Commercial salmon fishing on the estuary has declined in productivity and importance; There is very little shell fishing on the Estuary, however commercial fishing for white, sea fish does take place.

**Soil Geology and Geomorphology**

- Soil type and geology vary across the estuary; the shape (cross-section and plan form) of the Severn Estuary is determined by the underlying geology.
- Studies undertaken for the Severn Coastal Habitat Management Plan (ABPmer, 2006) suggest that the main sediment source for the Severn Estuary is from the river systems including the Wye, Avon, Usk and Severn.
- Future short term predictions (i.e. up to 2028) for morphological evolution indicate some areas of the Estuary will experience marginal erosion (a loss of saltmarsh of 10-30%), although there is local evidence of intermittent accretion; however in other areas the short term trend is for both marginal erosion and accretion (±20% variation in saltmarsh coverage).
- Man has influenced the geomorphology of the rivers within the Severn Basin in a number of ways including:

  - construction of structures that alter flow and deposition of sediment e.g. Barrages;
  - change of land use along the edge of the estuary;
  - draining land that would otherwise have flooded e.g. the Gwent and Somerset Levels;
  - construction of flood defences or hard bank engineering which reduces natural interaction with the floodplain;
  - navigational or maintenance dredging is undertaken around ports e.g. Bristol, Cardiff, Newport and Sharpness;
  - dredging for mineral and aggregate in the wider estuary.

**Land Use and Land Management**

- Most of the study area is rural with agriculture being the major land use. Pasture still dominates, but its extent has reduced in recent years due to increasing conversion to arable farming.
- There are significant areas of residential, commercial and industrial development at Avonmouth, Weston-Super-Mare, Gloucester, Lydney, Clevedon, Cardiff, Newport and Chepstow.
- UK agriculture has been subject to some significant changes in the past five years.
    - Common Agricultural Policy (CAP) reform has resulted in some areas of land being removed from agricultural production and the reallocation of grazing land to arable use.
    - changes in wheat prices have influenced farmers cropping choice and amount of land in production (agricultural land prices have also increased);
    - cultivation of crops for biofuels;
    - future cultivation of genetically modified (GM) crops and
    - changes in set-aside legislation.

Water

- Inputs to the Estuary that affect water quality include sewage effluents, abandoned mines, diffuse runoff from agricultural and forestry activities, industrial effluents and marine vessel discharges.
- Current and emerging legislation and policy drivers (such as the water Framework Directive and Catchment Sensitive Farming (CSF) Initiatives are likely to result in further improvements in water quality over the next ten years and beyond
- Issues potentially affecting groundwater quality within the study area include:
    - Increased tidal influence within coastal areas could result in saline intrusion into freshwater bodies;
    - increased levels of nitrate and phosphates in agricultural areas;
    - contamination from industrial land use or landfill.
- In addition to the main rivers within the study area, there are numerous drainage ditches (also known as reens or rhynes) bisecting the low lying land adjacent to the estuary. The smaller reens and watercourses on the levels are maintained by the relevant Internal Drainage Board;

**Air and Climate**

- Climate change is likely to increase tidal flood risk in the Severn Estuary. Flood risk is exacerbated in low lying areas where increases sea levels can inhibit land drainage.

**The Historic Environment (Cultural Heritage)**

- The Severn Estuary is a phenomenally rich and varied archaeological landscape. People have been living in this area since before the Severn Estuary was formed in the Mesolithic, some 8,000 years ago.
- There are approximately 107 Scheduled Monuments within the Study Area. These include the most prominent, best conserved and significant monuments and features. However, they represent only a small proportion of the entire archaeological record of the Severn Estuary.
- The total number of Listed Buildings with the Study Area runs into the thousands. The greatest concentrations of Listed Buildings are those within the larger towns and villages found within the study area: Gloucester, Berkeley, Thornbury, Clevedon and Weston-super-Mare on the English side, and Newport, Cardiff Bay and Penarth on the Welsh. In addition, the historic centres of many of the older settlements within the study area are designated as Conservation Areas.
- There are 10 Registered Parks and Gardens within the Study Area and the Gwent Levels are designated as a Landscape of Outstanding Historic Interest.

**Landscape and Visual Amenity**

- The study area is predominantly a riverside landscape with associated low lying valleys; the lower sections for the study are have a distinctly estuarine landscape with open expanses of salt marsh and mudflats; the area as a whole is further characterised by expansive floodplains, open farmland and prominent views of surrounding hills at the edges of the study area.
- The Wye Valley AONB extends from Mordiford (approx 4km south east of Hereford) to Chepstow and the Gwent Levels are identified as a Landscape of Outstanding Historic Interest.

Contaminated Land

- Land that is contaminated includes any land where intense industrial activity such as chemical manufacturing, metal refining and finishing, steel production, old landfill sites, oil refining, oil storage and gas production has occurred. There are many of these sites around the Estuary.

## Environmental Effects of the Preferred Strategy

An environmental assessment of the suite of four alternative SMP2 policies has been undertaken at the strategic level (and detailed in Annex C). This assessment was then integrated into the SMP2 policy option selection process, alongside economic and technical issues. The preferred policy options identified for public consultation are shown in Table S1.
It should be noted that some policies have been amended as a result of the public consultation. The SEA has not been amended to reflect these changes. If the policy changes are considered to be significant, an addendum to the SEA will be produced and publicly advertised to ensure that stakeholders are aware of the changes. Any addendum produced will be made available on the SECG website, along with all the other SMP2 documents.

In addition, in accordance with Part 4 of the Environmental Assessment of Plans and Programmes Regulations 2004, a post Adoption Statement will be prepared to document the way in which the Severn Estuary Coastal Group have taken environmental considerations and the views of consultees into account in the adopted SMP2.

**Table S1 SMP2 Preferred Policy Options**

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| Policy Unit | 0 to 20 years | 20-50 years | 50-100 years |
|---|---|---|---|
| PEN 1 | NAI | NAI | NAI |
| PEN 2 | NAI | NAI | NAI |
| CAR 1 | HTL | HTL | HTL |
| CAR 2 | HTL | HTL | HTL |
| CAR 3 | HTL | HTL | HTL |
| WEN 1 | HTL | HTL | HTL |
| WEN 2 | HTL | HTL | HTL |
| NEW 1 | HTL | HTL | HTL |
| NEW 2 | HTL | HTL | HTL |
| NEW 3 | NAI | NAI | MR |
| NEW 4 | HTL | HTL | HTL |
| NEW 5 | HTL | HTL | HTL |
| CALD 1 | HTL | HTL | HTL |
| CALD 2 | NAI | NAI | NAI |
| CALD 3 | HTL | HTL | HTL |
| WYE 1 | NAI | NAI | NAI |
| WYE 2 | NAI | NAI | NAI |
| WYE 3 | NAI | NAI | NAI |
| WYE 4 | NAI | NAI | NAI |
| TID 1 | NAI | NAI | NAI |
| TID 2 | NAI | MR | MR |
| LYD 1 | HTL | HTL | HTL |
| GLO 1 | NAI | NAI | NAI |
| GLO 2 | NAI | MR | MR |
| GLO 3 | NAI | NAI | NAI |
| GLO 4 | HTL | HTL | HTL |
| GLO 5 | HTL | HTL | HTL |
| GLO 6 | NAI | NAI | NAI |
| GLO 7 | HTL | HTL | HTL |
| GLO 8 | HTL | HTL | HTL |
| MAI 1 | NAI | MR | MR |
| MAI 2 | HTL | HTL | HTL |
| MAI 3 | NAI | NAI | NAI |
| MAI 4 | HTL | HTL | HTL |
| MAI 5 | HTL | HTL | HTL |

| | | | |
|---|---|---|---|
| MAI 6 | HTL | HTL | HTL |
| SHA 1 | NAI | MR | MR |
| SHA 2 | NAI | MR | MR |
| SHA 3 | HTL | HTL | HTL |
| SHA 4 | NAI | MR | MR |
| SHA 5 | NAI | NAI | NAI |
| SHA 6 | HTL | HTL | HTL |
| SHA 7 | NAI | MR | MR |
| SHA 8 | NAI | NAI | NAI |
| SEV 1 | HTL | HTL | HTL |
| SEV 2 | HTL | HTL | HTL |
| SEV 3 | HTL | HTL | HTL |
| SEV 4 | HTL | HTL | HTL |
| SEV 5 | HTL | HTL | HTL |
| SEV 6 | NAI | NAI | NAI |
| BRIS 1 | HTL | HTL | HTL |
| BRIS 2 | HTL | HTL | HTL |
| BRIS 3 | HTL | HTL | HTL |
| BRIS 4 | HTL | HTL | HTL |
| BRIS 5 | HTL | HTL | HTL |
| BRIS 6 | HTL | HTL | HTL |
| PORT 1 | NAI | NAI | NAI |
| PORT 2 | NAI | NAI | NAI |
| PORT 3 | NAI | NAI | NAI |
| PORT 4 | NAI | NAI | NAI |
| KIN 1 | NAI | MR | MR |
| KIN 2 | NAI | NAI | NAI |
| KIN 3 | HTL | HTL | HTL |
| KIN 4 | NAI | NAI | NAI |
| HOL 1 | NAI | NAI | NAI |
| HOL 2 | NAI | NAI | NAI |

Key

| | | | | | |
|---|---|---|---|---|---|
| MR | Managed Realignment | HTL | Hold the Line | NAI | No Active Intervention |

An assessment of the environmental impacts of the preferred policies was undertaken. The significance of the individual effects for each objective was aggregated in order to give an overall assessment of how well each option performed against the objectives (see Table S2). The aggregated impacts are colour coded according to the significance scale shown in the key.

## Table S2 - Aggregated Impact Significance for the Preferred SMP2 Policies

| Policy Unit & Preferred Strategy Option | Population and Human Health | Material Assets | Biodiversity Flora and Fauna | Historic Environment | Water Envir't | Air and Climate | L'scape | Sus Dev't |
|---|---|---|---|---|---|---|---|---|
| PEN-1NAI | - | - | | - | - | - | - | |
| PEN 2-NAI | | | | | - | - | - | |
| CAR 1-HTL | - | | | - | - | - | - | |
| CAR 2-HTL | | | | | - | | - | |
| CAR 3-HTL | | | | - | - | | - | |
| WEN 1-HTL | | | | | - | | | |
| WEN 2-HTL | | | | | | | | |
| NEW 1-HTL | | | - | | | | - | |
| NEW 2-HTL | | | - | | | | | |
| NEW 3-NAI | - | | - | - | - | - | - | |
| NEW 4-HTL | | | - | | | | | |
| NEW 5-HTL | | | | | | | | |
| CALD 1-HTL | | | | | | | | |
| CALD 2-NAI | - | - | | - | - | | | |
| CALD 3- HTL | | | | | - | | | |
| WYE 1- NAI | - | - | - | - | - | - | - | |
| WYE 2 -NAI | - | - | - | - | - | - | - | |
| WYE 3 - NAI | - | - | - | - | - | - | - | |
| WYE 4 -NAI | - | - | - | - | - | - | - | |
| TID 1 -NAI | | | | - | | - | - | |
| TID 2 - NAI/MR | | | | - | - | - | - | |
| LYD 1 -HTL | - | - | - | | - | | | |
| GLO 1 -NAI | - | - | | - | - | - | - | |
| GLO 2 - NAI/MR | | | | - | - | - | - | |
| GLO 3 -NAI | | - | - | - | - | - | - | |
| GLO 4 -HTL | | | - | | - | | | |
| GLO 5 -HTL | | | | | - | | | |
| GLO 6 -NAI | | | | - | - | - | - | |
| GLO 7 HTL | | | | | - | | | |
| GLO 8 -HTL | | | | | - | | | |
| MAI 1 - NAI/MR | | | - | - | - | - | - | |
| MAI 2 -HTL | | | | | - | | | |
| MAI 3 -NAI | | | | - | - | - | - | |
| MAI 4 - HTL | | | - | | - | | | |
| MAI 5 -HTL | | | - | | - | | | |
| MAI 6 -HTL | | | | - | | | | |
| SHA 1 - NAI/MR | | | | | - | - | - | |
| SHA 2 - NAI/MR | | | | | - | - | - | |
| SHA 3 - HTL | | | | | - | | | |
| SHA 4 - NAI/MR | | | - | | - | | | |
| SHA 5 -NAI | - | - | | - | - | - | - | |
| SHA 6 -HTL | | | | | | | | |
| SHA 7 - NAI/MR | | | | - | | - | - | |
| SHA 8 - NAI | - | - | | - | - | - | - | |
| SEV 1 - HTL | | | | | - | | | |

| Policy Unit & Preferred Strategy Option | Population and Human Health | Material Assets | Biodiversity Flora and Fauna | Historic Environment | Water Envir't | Air and Climate | L'scape | Sus Dev't |
|---|---|---|---|---|---|---|---|---|
| SEV 2 - HTL | | | | | - | | | |
| SEV 3 - HTL | | | | | - | | | |
| SEV 4 - HTL | | | | | | | | |
| SEV 5 - HTL | | | | | - | | | |
| SEV 6 - NAI | - | - | | - | - | - | - | |
| BRIS 1 -HTL | | | | | | | | |
| BRIS 2 -HTL | | | | | | | | |
| BRIS 3 -HTL | | | | | | | | |
| BRIS 4 -HTL | | | | - | - | | | |
| BRIS 5 - HTL | - | - | | - | - | | | |
| BRIS 6 - HTL | | | | | - | | | |
| PORT 1 - NAI | | - | | - | - | - | - | |
| PORT 2 - NAI | - | - | | - | - | - | - | |
| PORT 3 - NAI | - | - | | - | - | - | - | |
| PORT 4 - NAI | | | | - | - | - | - | |
| KIN 1 - NAI/MR | | | | | | - | - | |
| KIN 2 - NAI | - | - | | - | - | - | - | |
| KIN 3 - HTL | | | | | - | | | |
| KIN 4 - NAI | - | | | - | - | - | - | |
| HOL 1 - NAI | - | - | - | - | - | - | - | |
| HOL 2 - NAI | - | - | - | - | - | - | - | |

Key

| | | | |
|---|---|---|---|
| | Major positive contribution to objective | | Minor positive contribution to objective |
| | Major negative contribution to objective | | Minor negative contribution to objective |
| - | No impact, or change to existing situation | | |

A summary of the key impacts resulting from the adoption of the proposed SMP2 policy options and measures identified to manage or mitigate impacts is provided below:

**Population and Human Health**

The SMP2 will result in significant benefit to populations, human health, material assets and critical infrastructure by ensuring a strategic approach is taken to protect centres of population, businesses and critical infrastructure form increased flood and erosion risk, in the face of a changing climate. In some less densely populated policy units a Managed Realignment or No Active Intervention policy may result in the increased frequency of flooding to agricultural land which could affect nature and productivity of agricultural activities. As part of the delivery of the Action Plan discussions with IDBs and NFU/FUW are proposed to identify measures to avoid, offset or mitigate impacts.

Overall the SMP2 is considered to have a minor positive contribution to protecting recreational resources. The key strategic effect would be the protection of the existing footpath networks, public open space, cycle routes and other leisure amenities from increased flood and erosion risk.

**Biodiversity Flora and Fauna**

The assessment of likely significant effect undertaken for the SMP2 (see Appendix I, Part B) concluded that the only European sites potentially affected by the implementation of the SMP2 are the Severn SPA, SAC and Ramsar sites and the Somerset Levels and Moors SPA/Ramsar. This has been assessed as a major adverse impact. A calculation of the predicted habitat loss is being undertaken as an integral part of the Habitat Regulations Assessment. The Environment Agency is developing a Habitat Delivery Plan which will identify sites across the estuary which can be secured to provide compensation for habitat loss. It is not possible to state with certainty that a sufficient quantity of compensatory habitat or the required type / types will be provided within the estuary. This uncertainty is due to the need to secure the agreement of land owners and funding to implement projects as well as general uncertainty around how well the sites will perform in developing the necessary replacement habitat. Further investigation and assessment will be undertaken for the IROPI Statement of Case, prepared for the FRMS and as part of the development of individual projects.

All of the SSSIs that comprise the Gwent Levels will be protected by a Hold the Line policy in this location. No adverse impacts on any other non-geological SSSI are predicted and in many cases a Hold the Line policy will ensure sites continue to be protected from adverse effects of flooding and/or erosion. Overall the impact of the SMP2 on sites of national nature conservation importance has been assessed as a major beneficial impact.

There are eleven coastal SSSIs designated for geological features and one RIGS within the study area. Of these, nine of the SSSIs and the RIGS are located within policy units where No Active Intervention is the preferred policy. This policy will ensure that the cliff faces continue to be exposed to natural coastal processes, which will help to maintain the features for which these SSSIs and the RIGS have been designated. Rhymney River Section SSSI is located within policy unit CAR3 where a Hold the Line Policy is proposed. Further consideration of how the policy will be delivered will be undertaken at the FRMS and project level to ensure adverse impacts on the site are avoided or minimised. Overall the SMP2 will have a major positive impact on geological SSSIs, although this conclusion should be treated with caution, as uncertainty about how policy options will be implemented remain at the SMP2 level. The FRMS will help to clarify some of these issues; others will need to be addressed at project level.

**Historic Environment (Cultural Heritage)**

Overall all the SMP2 will have a major beneficial impact on the historic environment, largely protecting features and historic landscapes behind existing defences where a Hold the Line policy is being proposed.

There is the potential for adverse effects on individual features within some policy units either where structures are on the existing defence line (e.g. a SM within policy unit WEN 1) are in front of the defence line (e.g. the pier and esplanade in PEN2) or are potentially affected by increased flooding as a result of a No Active Intervention or Managed Realignment policy option. In addition, where defence works are required to Hold the Line these could affect the setting of designated historic environment assets. Further discussions with relevant heritage organisations including County Archaeologists (in England), Cadw, English Heritage and the Gwent and Glamorgan Archaeological Trust will be undertaken as part of the development of the SMP2 Action Plan to determine priorities for measures to avoid or mitigate potential impacts on the heritage environment. Further assessment of impacts,as well as identification of avoidance and mitigation measures will be undertaken at the FRMS and project level, when further details of proposals are available.

**Water Environment**

The SMP2 will have a major positive effect on water resources and water quality, protecting key features such as sewage treatment works, existing abstractions and source protection zones from future flood and erosion risk.

### Air and Climate

Where a no active intervention policy or managed realignment is to be applied, the natural evolution of the coast will adapt to accommodate the impacts of climate change, delivering a minor beneficial impact. A Hold the Line policy is likely to require ongoing maintenance or increasing height of defences to take the effects of climate change into account so has been assessed as having minor adverse impact in that the approach will not provide sustainable ongoing adaptation to climate change

### Landscape

Overall the SMP2 has been considered to have a neutral impact on the landscape of the Severn estuary. Uncertainty remains over specific impacts and mitigation measures that will need to be addressed either by the FRMS or at project level. The SMP2 Action Plan identifies the need to undertaken EIAs for all maintenance or construction works undertaken in order to implement policies.

Implementation of a Hold the Line policy may result in the need for new defences or the height of existing defences to be increased. Although these will result in local adverse effects, measures to ensure the structures are visually integrated into the local landscape will ensure this is only a local minor adverse impact. The adoption of this policy option will however ensure that the landscape behind the defence line is protected from change (major positive impact).

Where an option will result in a significant increase in the frequency of flooding of an area, a change in vegetation structure is likely to occur and this has been assessed as potentially resulting in a major adverse change to the landscape.

### Sustainable Development

Overall the SM2 will have a neutral impact when considered in the light of the sustainability objectives identified. No Active Intervention and Managed Realignment policies are suggested for approximately half the policy units and will allow natural processes to continue to operate, a minor beneficial impact. However a Hold the Line policy will constrain natural process, resulting in a minor adverse impact.

Hold the line and managed realignment policies will require ongoing input of resources (minor adverse effect), whereas the implementation of a Non Active Intervention policy will have minimal resource requirement (minor beneficial effect).

Uncertainty remains over specific impacts and mitigation measures needed; this will be considered further either by the FRMS or at project level. The SMP2 Action Plan identifies the need to undertaken EIAs for all maintenance or construction works to implement policies.

### Conclusions

Overall, implementation of the SMP2 will result in several major beneficial impacts including:

- long term protection of major centres of population, critical infrastructure and material assets from flood and erosion risk;
- long term protection of the historic environment, water environment and landscape of the Severn estuary from flood and erosion risk;
- long term protection of nationally designated nature conservation sites from flood and erosion risk.

The SEA process has concluded that at the estuary wide scale the only major adverse impact likely to result from the implementation of the preferred SMP2 policy options is the loss of intertidal habitats from within the Severn Estuary European sites. A separate study (as part of the FRMS) is being undertaken by the Environment Agency to identify sites around the estuary

that could be used to compensate for habitat loss and mitigate this impact, although uncertainty remains due to the need to secure the agreement of land owners and funding to implement projects. There is also more general uncertainty regarding how well the sites will perform in developing the necessary replacement habitat. It is, therefore, not possible to state that all impacts of the SMP2 will be mitigated and further assessment of impacts and development of mitigation will be undertaken at the FRMS and project level.

**Implementation and Monitoring**

Monitoring proposals for the SMP2 have been derived, partly from the environmental objectives, indictors and targets identified during the Scoping stage of the SEA. An Action Plan is being developed as an integral part of the SMP2. The lead Local Authority for co-ordinating the Action Plan is Monmouthshire County Council (MCC) as Chair of the SECG. The SECG intend to monitor the delivery of the action plan through meetings held with Local Authorities (consisting of elected member of the PMG, strategic planner and flood defence engineer) bordering the Severn Estuary SMP2 shoreline, plus representatives from the EA, to discuss the approach to implementation of the Severn Estuary SMP2.

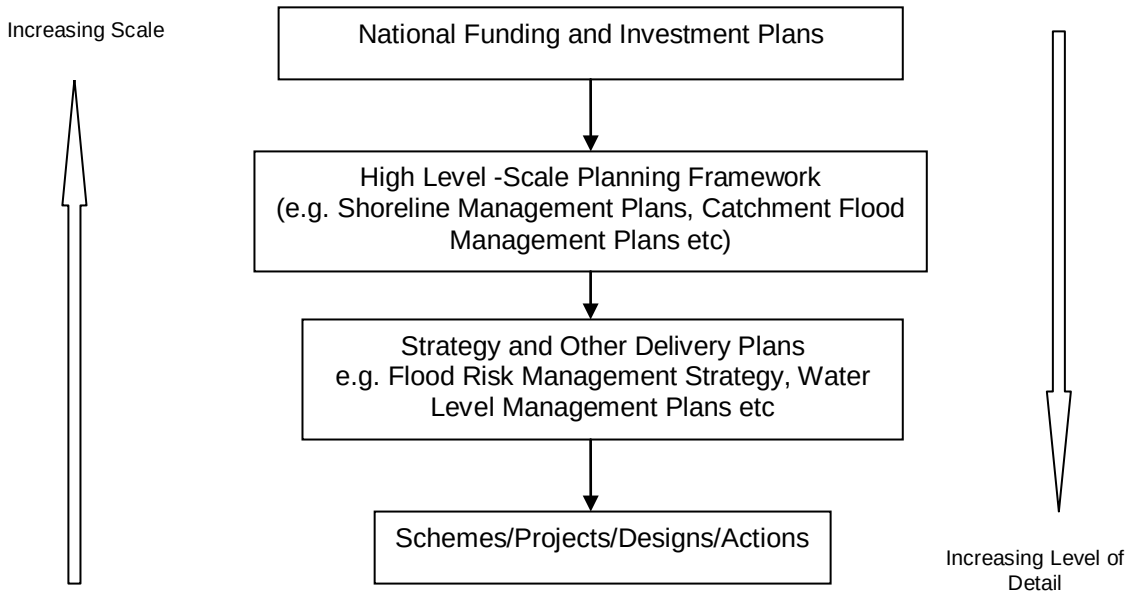
# 1. Introduction and Background

## 1.1 Overview

This document presents the findings of the Strategic Environmental Assessment (SEA) undertaken for the Severn Estuary Shoreline Management Plan 2 (SMP2).

Flood risk and erosion management planning is undertaken at several different levels of detail, as shown in Figure 1.1 below. At the highest level 'large-scale plans', such as Shoreline Management Plans (SMPs) and Catchment Flood Management Plans (CFMPs) set the policy context for flood risk and erosion planning over the next 50-100 years. They promote a sustainable approach which helps ensure work in one place does not cause problems in another and they help ensure the best ways of managing risk are identified. They provide large-scale assessments of the risks associated with coastal and fluvial processes and identify long term policy frameworks to reduce risk in a sustainable manner.

**Figure 1-1: Flood Risk and Erosion Management Strategic Planning Hierarchy**




## 1.2 Defining and Managing Flood and Erosion Risk

In 2004 UK Government produced a report called Future Flooding (the Foresight Report). This warns that the risk from flooding will increase between 2 and 20 fold over the next 75 years. The Chief Scientific Advisor to the Government concluded:

*"continuing with existing policies is not an option – in virtually every scenario considered (for climate change), the risks grow to unacceptable levels. Secondly, the risk needs to be tackled across a broad front. However, this is unlikely to be sufficient in itself. Hard choices need to be taken – we must either invest in more sustainable approaches to flood and coastal management or learn to live with increasing flooding".*

Flooding and coastal erosion happen naturally and cannot always be prevented or predicted in advance. They can have a major impact on lives, communities, the economy and the environment. The judgement as to what is an acceptable and affordable level of flood and/or erosion risk is a societal decision and is expressed and enacted through political process and Government policy. Risk is a combination of two components, the likelihood (or probability) of a particular flood event occurring and the consequence (or impact) that the event would have, if it did occur. Flood and erosion risk management is about taking action to manage both the likelihood and consequences of flood events and/or erosion.

Flood risk management can reduce the likelihood of flooding by managing the land, river and drainage systems and by building and maintaining defences. Avoiding introducing additional development into flood risk areas and relocating existing 'at risk' properties and community facilities to lower risk areas can reduce the consequences of flooding. In addition, the consequences of flooding can be managed by raising the level of flood awareness, increasing the resilience of development in flood risk areas, by warning people when floods might occur so that they can take actions to help themselves and by responding rapidly and effectively to emergencies when they happen.

The Environment Agency is the principal flood defence operating authority in England and Wales and is responsible under the Water Resources Act (1991) for managing flood risk from "main rivers" and the sea. The EA is empowered (but does not have a legal obligation) to manage flood risk from designated 'main rivers' and to provide coastal flood defence. Although the Environment Agency is an England and Wales body, it has slightly different roles in England and Wales. In England the EA provides a strategic overview role for coastal erosion and flooding. It does not have this role in Wales.

Internal Drainage Boards (IDBs) have powers regarding drainage matters relating to significant areas of land along the estuary. These areas are totally dependent on complex systems of flood defences and land drainage to enable land to be used for agricultural production.

Local authorities also have a central responsibility for coordinating and delivering significant changes to local flood risk management. Responsibilities include:

- collating and mapping flood risk management and drainage areas;
- coordinating surface water management plans;
- adopting and maintaining Sustainable Urban Drainage Schemes (SUDs);
- assessing and where necessary enhancing technical capabilities in flood risk management;
- working with all relevant parties to tackle local problems of flooding.

## 1.3 Predicted Climate Change and Impacts

Our climate is changing, both in Britain and round the world. Climate change has consequences for many aspects of our lives, including: water supply, the natural environment, health, business and industry, agriculture, tourism and transport. Some of the most significant impacts of climate change include:

- increased strain on water availability for people and ecosystems brought by longer, hotter, drier summers and development in areas where water resources are scarce;
- an increase in flood risk and coastal erosion caused by wetter winters, greater storminess and sea level rise. In England and Wales, 5 million people already live in flood risk areas and about 12 per cent of farmland and a quarter of

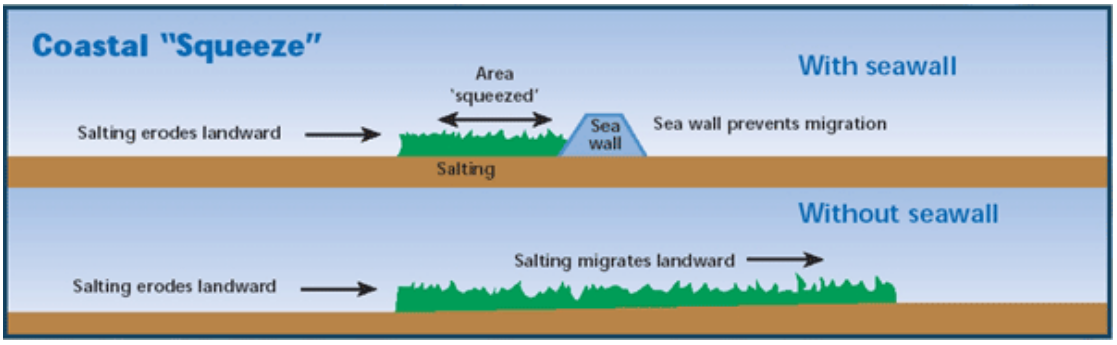
industrial sites are at risk. Some 11 per cent of new homes are built in flood risk areas in England;

- potential to harness energy from increased water volumes or tidal surges.

As much as 65 per cent of all flood risk is from coastal and tidal flooding. As storms and sea levels increase, more properties, businesses and people will be affected. Sea levels around the UK are now about 10 cm higher than they were in 1900. Coastal flooding will become increasingly common, damaging property and threatening lives.

When the sea level rises marginal coastal habitat such as saltmarsh and shingle beaches are inundated or eroded at the seaward edge; these habitats and the plants they support cannot survive under deep sea water and are therefore lost. On a natural coastline new habitats are formed on slightly higher land as the conditions become suitable. However coastal defences such as sea walls prevent this landward migration of habitat and the reduced extent or loss of these marginal habitats is called coastal squeeze (as shown in Figure 1-2).

Figure 1-2 Coastal Squeeze resulting from Sea Level Rise

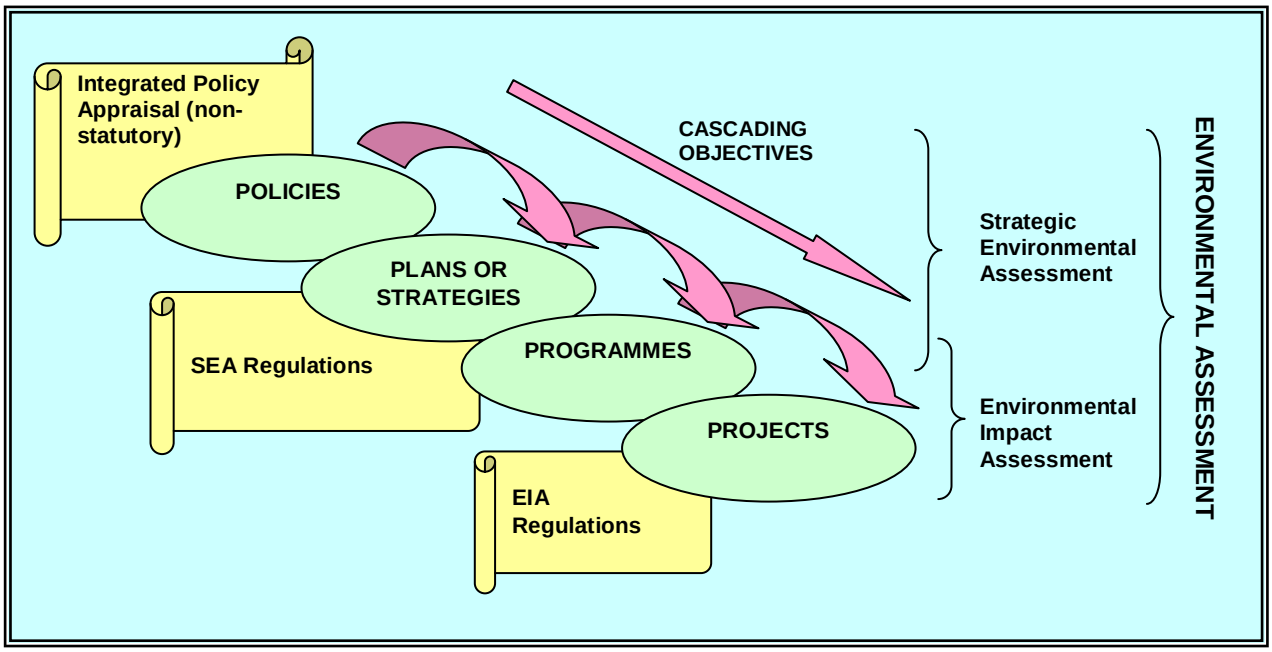


# 2. Scope of Study and SEA Process

## 2.1 The Need for Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) is the systematic appraisal of the potential environmental consequences of high level decision-making, such as policies, plans, strategies and programmes, before they are approved (Figure 2-1). It ensures that the implications of plans and programmes are fully and transparently considered before final decisions are taken.

**Figure 2-1: Application of Strategic Environmental Assessment (Environment Agency Guidance Document, 2004)**




The requirement to undertake SEA in the European Union (EU) came about when the EC Directive (2001/42/EC) *'on the assessment of the effects of certain plans and programmes on the environment'*, known as the 'SEA Directive', came into force in 2004. The Directive is implemented in England and Wales through the *Environmental Assessment of Plans and Programmes Regulations* (SI 1633 2004) and the *Environmental Assessment of Plans and Programmes (Wales) Regulations* (SI 1656 2004). The Directive and associated regulations make SEA a mandatory requirement for certain plans and programmes which are likely to have significant effects on the environment.

The Directive's overall objective 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*."

Defra guidance states that documented plans for medium to long-term river or coastal management, such as SMPs and Flood Risk Management Strategies (FRMSs), are not required by administrative provisions, as defined by Office of the Deputy Prime Minister (ODPM) . There is, therefore, no legal requirement to apply the Directive to these plans. However, SMPs, CFMPs and Strategies clearly help to set the framework for future planning, have significant

environmental implications, and require extensive consultation. Defra recommend therefore, that adopting an SEA approach is appropriate and they strongly encourage the operating authorities to undertake SEA for these plans. For these reasons and in accordance with good practice, an SEA of the SMP2 is being undertaken.

## 2.2 The Severn Estuary Shoreline Management Plan Review (SMP2)

### 2.2.1 Context

Shoreline Management Plans (SMPs) are non-statutory plans produced by Coastal Groups (in this case the Severn Estuary Coastal Group) which are made up of maritime Local Authorities and other bodies with coastal defence responsibilities or interests. Shoreline Management Plans set high level policy approaches for the future management of flood and erosion risk along coastline. They involve undertaking a large scale assessment of the risks associated with coastal processes and present a long term policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. SMPs allow the development of strategy plans to be prioritised.

SMPs typically cover large areas such as several counties or catchments and define the broad policy for management of the plan area. They typically look at the predicted evolution of the coast under three timeframes or epochs: 0-20 years, 20-50 years and 50-100 years. The SMP2 has divided the Severn Estuary study area into policy units (see Annex C), with one of the four **policy options** (see Section 9 for more detail ) being applied to each unit:

- Hold the existing defence line;
- Advance the existing defence line;
- Managed realignment - identifying a new shape for the shoreline and actively managing change;
- No active intervention - a decision not to invest in providing or maintaining defences.

Following approval of the SMP2 the policies will be developed into implementation plans within the Severn Estuary Flood Risk Management Strategy (FRMS). FRMSs are long-term plans for sustainable flood risk management of an area taking full account of the requirements set out in relevant overarching plans such as the CFMP and SMP; they are typically undertaken by the Environment Agency and identify appropriate levels of protection for all flood risk areas, taking onto consideration economic and environmental costs and benefits. They also address how flood risk management will be implemented on the ground e.g. detailing alignment and type of defences. Strategy plans will normally be consistent with the recommendations of relevant overarching plans (including SMPs), unless subsequent detailed investigations suggest that these should be revised.

### 2.2.2 Definition of the SMP2 Study Area

The Severn Estuary (*Môr Hafren* in Welsh) is located on the west coast of Britain, bordering both England and Wales. It is renowned for having the second highest tidal range in the world. The Severn is typical of estuaries in England and Wales, in that it has provided a focus for human activity, a location for settlement, a source of food, water and raw materials and a gateway for trading and exploration. The Estuary and its coastal hinterland support the cities of Cardiff, Bristol, Newport and Gloucester. Major industries are located around the Estuary's shores, including modern port installations, chemical processing companies and power stations.

The Severn Estuary and its surrounding area are afforded a very high level of protection under European wildlife law. Large areas are designated as a Special Protection Area (SPA) under the

Birds Directive and as a Special Conservation Area (SAC) under the Habitats Directive for their intertidal and sub tidal habitats and migratory fish species. The area surrounding the estuary is also designated as a wetland of international importance under the Ramsar convention and as a Site of Special Scientific Interest. In addition, several freshwater SSSIs (e.g. the Gwent Levels SSSI complex) lie behind the existing coastal defences.

The SMP2 study area stretches from Anchor Head (Birnbeck Island) on the English side of the Estuary (a move northeast from the first SMP) to Lavernock Point on the Welsh side. The upstream boundary is at Haw Bridge approximately 5km upstream of Gloucester (Figure 2-2 shows the SMP2 study area, alongside that of the FRMS, with key locations referred to within this report shown in Figure 2-3). The extent of coastline selected for inclusion within the study area has been influenced by our current knowledge of the coastal process in operation within the estuary. For the purposes of data gathering and obtaining an indication of key issues we have used the current 1 in 1000 year extreme event floodplain to create a buffer zone around the coastline and rivers that form the SMP2 boundary. This corresponds to the extreme flood event outline identified in PPS 25 Development and Flood Risk and TAN 15 Development and Flood Risk. Using this buffer zone will ensure that all areas likely to be affected by changes to the shoreline or flooding from the sea are included within the SMP2.

### 2.2.3 Current Flood and Erosion Risk

**Estuary Processes**

Within the Severn Estuary the physical environment is varied. The whole area is dominated by tidal processes, although fluvial influence becomes more appreciable north of the Noose. There is a significant wave climate downstream of the Second Severn Crossing, diminishing upstream due to reduced fetch and shelter from swell waves. The geomorphology of the Severn Estuary is dominated by tidal processes, consisting of areas of offshore sand banks and bed rock (generally downstream of the Severn Crossings), with the shoreline fringed by mudflats and saltmarsh, and intermittent sand beaches downstream of Clevedon. The floodplain itself is predominantly historically reclaimed land adjacent to the Gwent Levels and the Avon and Somerset Levels, noted to have low land levels relative to the Severn Estuary tidal range.

**Risk of Flooding and Erosion**

A high level consideration of flood risk under current conditions has identified that the Standard of Protection (SoP) for flood defences around the Severn Estuary varies significantly between 100% Annual Event Probability (AEP) (i.e. the magnitude of event statistically predicted to occur once every year) and 0.1% AEP (i.e. the magnitude of event statistically predicted to occur once every 100 years). Particularly weak sections of defence exist along the River Usk (policy units NEW 1-5), Awre/Arlingham peninsulas and intermittent lengths near Gloucester (policy units GLO 1-8, SHAR 1-7, MAI 1-5), near the River Avon (policy units BRIS 1-3 and PORT 1-4) and along Congresbury Yeo (policy unit KIN 1).

Current understanding indicates that in the short term (up to year 2028) the predicted geomorphological evolution along the estuary fringes for policy units PEN 1-2, CAR 1-2, WEN 1-2, CALD 1, BRIS 1-3, PORT 1-4 and KIN 1-4 is marginal erosion (a loss of saltmarsh of 10-30%), although there is local evidence of intermittent accretion. For policy units TID1-2, GLOU 1-8, MAI 1-5, SHAR 1-8 and SEV 1-6 the short term trend is for both marginal erosion and accretion (±20% variation in saltmarsh coverage). In the medium to long term (2058 and 2108) uncertainties significantly increase. In relation to flood risk, virtually all flood defences are predicted to have structurally failed due to degradation under the No Active Intervention scenario after the year 2058.

**Figure 2-2 – Area covered by the Shoreline Management Plan Review**

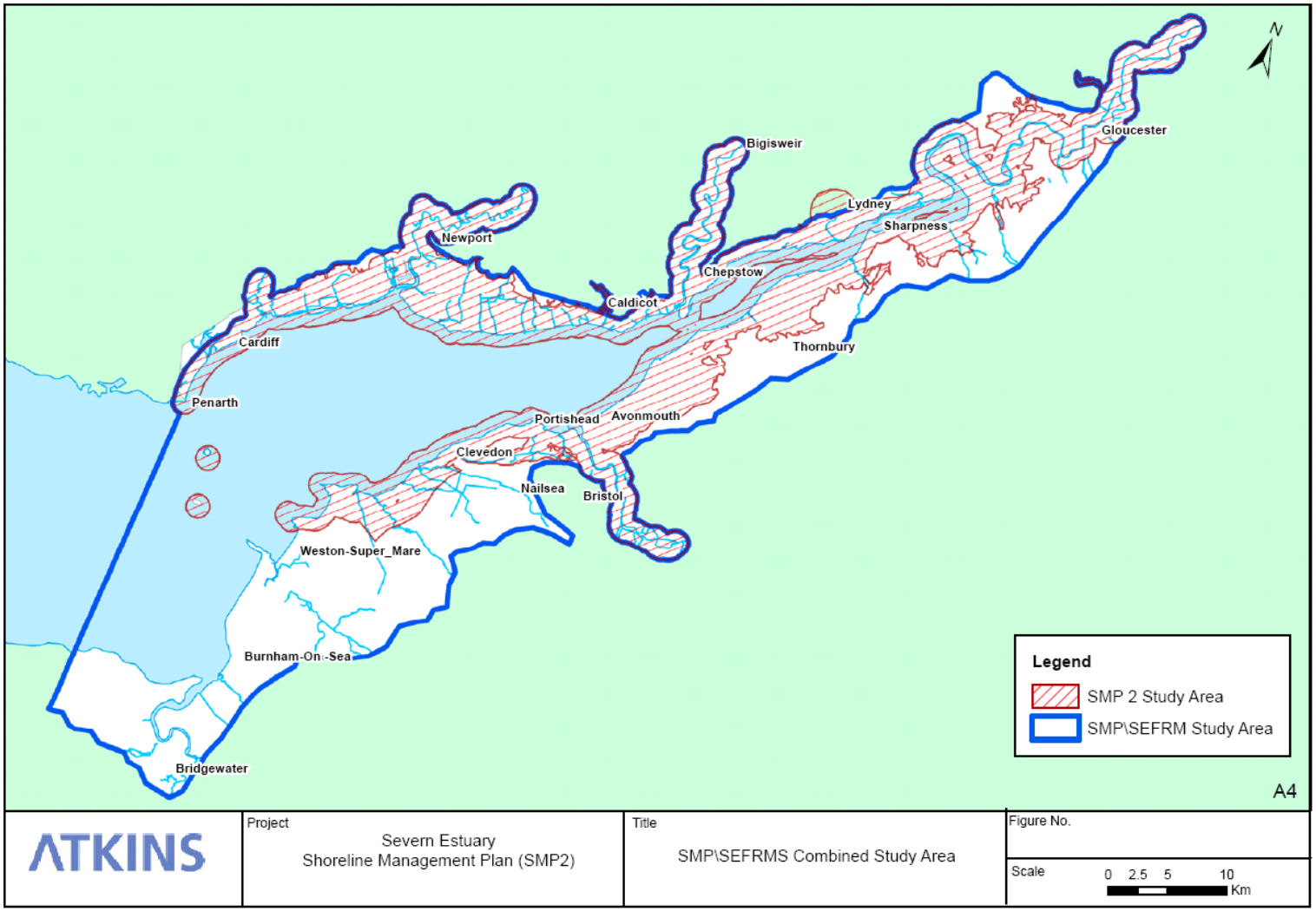
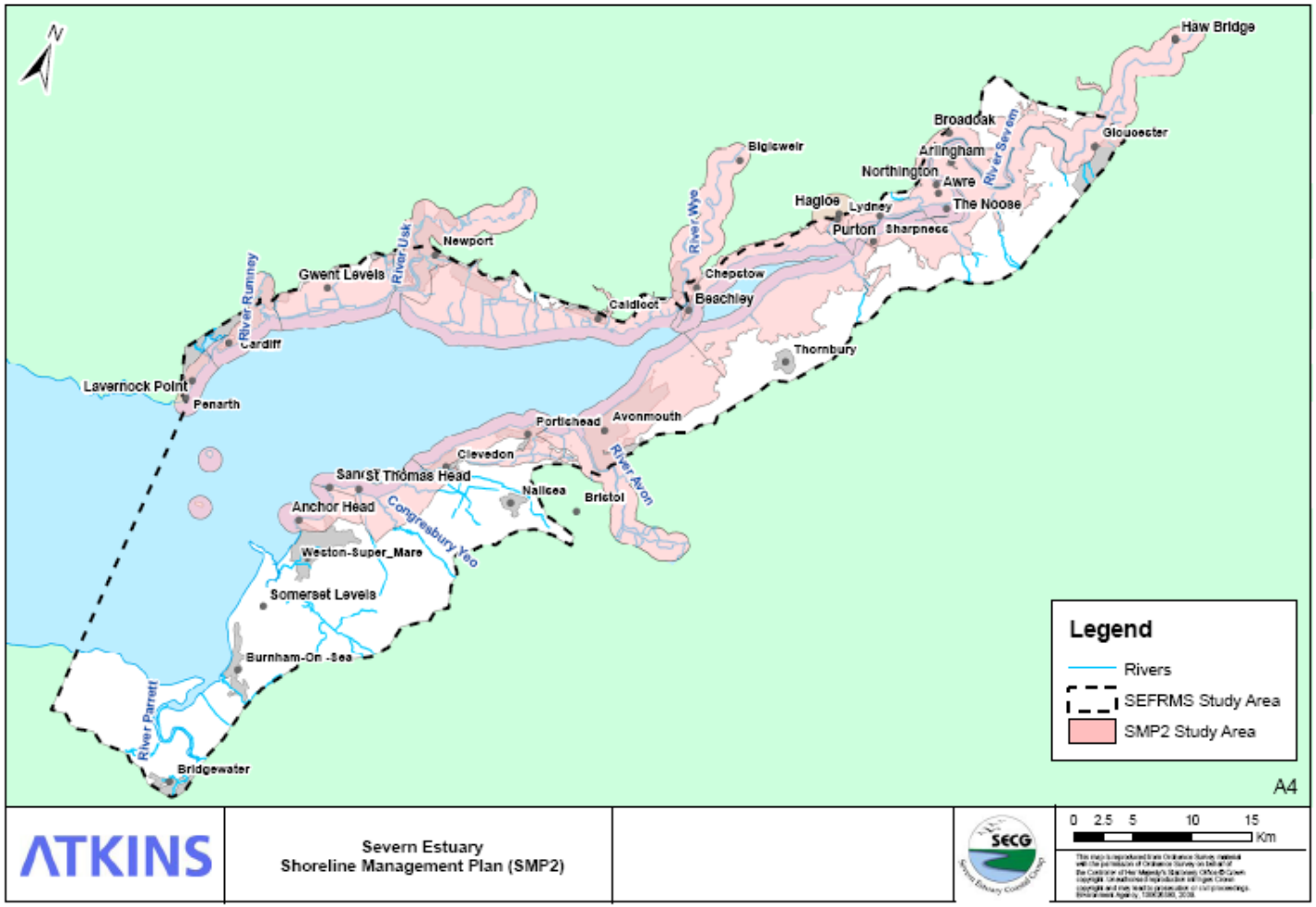



**Figure 2-3 – Key Locations Around the Study Area**


Haw Bridge
Broadoak
Gloucester
Arlingham
Northington
Awre
River Severn
Bigsweir
Hagloe
Lydney
The Noose
Purton
Sharpness
River Wye
Newport
River Usk
Gwent Levels
River Rumney
Chepstow
Caldicot
Beachley
Cardiff
Thornbury
Lavernock Point
Penarth
Portishead
Avonmouth
Clevedon
River Avon
Sand St Thomas Head
Nailsea
Bristol
Anchor Head
Congresbury Yeo
Weston-Super_Mare
Somerset Levels
Burnham-On -Sea
River Parrett
Bridgewater
Legend
Rivers
SEFRMS Study Area
SMP2 Study Area
A4
ATKINS
Severn Estuary
Shoreline Management Plan (SMP2)
SECG
0 2.5 5 10 15
Km

The English Heritage Severn Estuary Rapid Coastal Zone Assessment (Gloucestershire County Council 2008) identified (for England only) areas where high degrees of change were likely to be expected over the next 100 years; areas of high parietal change identified included Sand Bay (north of Weston-super-Mare). Areas identified as being unlikely to be affected by change include:

- Sand Point to St Thomas Head;
- Clevedon to Portishead;
- Sharpness to Purton;
- Broadoak to Northington;
- Hagloe to Beachley.

Future predictions of climate change within the Severn Estuary include a rise in sea level of approximately 1m and up to 20% increase in river flows. These are indicative values and the actual impact of climate change could vary significantly. A high level assessment of the flood defences indicates that within the 100 year timeframe of the SMP2, if the flood defences were not maintained the general Severn Estuary floodplain would be completely inundated on an annual basis (100% AEP).

**Consequences of Flooding and Coastal Erosion**

Within the Severn Estuary flood processes and risks dominate over the erosion processes and risks. This is due to a) predicted climate change impacts (specifically sea level rise and increased storminess) reducing Standard of Protection significantly in the medium and long term epochs, whilst historical and predicted future erosion has less direct impact, and b) the extent of flooding propagating up to 10km inland in comparison to erosion up to the 10m order of magnitude.

There are a wide range of consequences to flooding and coastal erosion. The built environment consists of large conurbations (including Cardiff, Newport, Gloucester, Avonmouth/Bristol, Portishead, Clevedon and Weston-Super-Mare) and smaller, scattered residential areas, with large areas of agricultural usage. The physical, natural and built environment supports tourism throughout the Severn Estuary.

Strategic infrastructure potentially at risk from flooding includes transport routes (motorways and railways), industry (a number of ports, power stations and chemical processing plants), and power and fuel transmission lines.

The Severn Estuary and its floodplain benefit from various environmental designations (both national and international) related to habitats, wildlife and archaeology. It has a distinct landscape consisting of a diverse range of flat, open and gently undulating plains, interrupted by hilly areas.

As an example, a worst case scenario of complete inundation in the present day would result in a flooded area of approximately 1000km$^2$. This would have serious implications for all receptors identified in Section 5, rendering large parts of the human, natural and built environment unsustainable. It would result in approximately 198,000 properties (both residential and commercial) directly affected by flooding, over £5 Billion worth of property damage, serious interruption and/or damage to strategic infrastructure and agricultural land, livestock and crops, and widespread degradation of ecology (both flora and fauna) and landscape character.

## 2.3 The SEA Process

Taking account of the possible impacts of decisions on the environment through SEA is a step by step process that is integral to the whole SMP2 development process. The SEA legislation requires that certain actions are taken (e.g. early and on-going stakeholder engagement) and that certain outputs are produced (e.g. an Environmental Report). The SEA has followed a number of key stages and has met the requirements of the SEA Directive in the following ways:

- **SEA Scoping Report –** this was produced in January 2009. It was circulated to the SECG and was brought to the attention of other stakeholders as part of the Key Stakeholder Group (KSG) events held in January 2009, through Severn Estuary Partnership (SEP) E-news and was published on the SECG website. The report covers the SMP2 and the SEFRMS;
- **Identification of Key Environmental Information –** the SEA Scoping Report, describes the environment in terms of 'receptors' (Population & human health; Biodiversity; Land use; Geology & soils; Water; Air; Material assets; Historic environment; Landscape; and the interrelationship between them); this information also informed the SMP2 Theme Review (see Appendix D of main SMP2 report), SEA Scoping Report and Section 7 of this document;
- **Identification of Objectives** – the SMP2 identifies features and objectives around the shoreline of the Severn Estuary. The objectives take account of the risks to that feature from coastal erosion and flooding and the benefits people get from the features. Issues and objectives are set out clearly in Appendix E of the main SMP2 report, the SEA Scoping Report and Sections 6 and 7 of this document;
- **Assessment of four alternative Policy Options, including their potential impacts on the environment –** The environmental effects of implementing the alternative policy options within each policy unit have been assessed. The source of impacts was determined by reviewing the policy options and was informed by our knowledge of the existing environment and predicted environmental trends. The pathways of impacts in the environment can be direct, for example habitat loss through land take or indirect through a number of links; for example, increased flooding over time affecting habitats or other features of interest. The pathways were again identified by expert judgement and consultation. The results of this assessment were then taken into consideration as part of the overall SMP2 policy selection process which also took economic factors into account. The assessment is detailed in Appendix F of the main SMP2 report and Sections 8 and 9 and Annex B of this report
- **Effects of the SMP2 –** preferred SMP2 options were selected and the effect of that policy on each stretch of shoreline (Policy Unit) was then undertaken and is presented in Appendix G of the main SMP2 report and Sections 8 and 9 of this report.
- **Environmental Report**– this environmental report summarises the findings of the SEA process to date; this report will be subject to public consultation along with other deliverables from the project.
- **Monitoring** – the SMP2 Action Plan and Section 10 of this report set out the monitoring requirements within the SMP2 area; this will be further developed following the public consultation.
- **Post Adoption Statement –** this document is part of the SEA process. It will summarise how environmental issues were integrated into the SMP process; the reasons for choosing the preferred options; the consultation results and the monitoring that is proposed. This will be developed and finalised following completion of the final SMP2 in 2010.

Following the SMP2 development process, the public consultation and revision, the SMP2 should be adopted/approved by Local Authorities and the Environment Agency (via Regional Flood Defence Committees or their equivalent) and WAG. Natural England (NE) and the Countryside Council for Wales (CCW) are advisors to the Severn Estuary Coastal Group (SECG), individual partners on the group and national government. Their input to the development of the SMP2 ensures it is compliant with relevant national and EU nature conservation legislation.

Should any major changes in the SEA be required, for example resulting from policy changes that arise as a result of the consultation process, an addendum to the SEA will be published. In addition, in accordance with Part 4 of the Environmental Assessment of Plans and Programmes Regulations 2004, a post Adoption Statement will be prepared to document the way in which the Severn Estuary Coastal Group have taken environmental considerations and the views of consultees into account in the adopted SMP2.

## 2.4 Synergies with Other Processes

The SEA will form a component of the wider assessment mechanisms for the SMP which also includes:

- An Appropriate Assessment under the Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora); and
- Consideration of the requirements of the Water Framework Directive (Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy).

### 2.4.1 Habitat Regulations Assessment

The Habitats Directive is implemented in the UK through the Conservation (Natural Habitats &c.) Regulations 1994 (the Habitats Regulations), as amended. If the SMP2 is considered likely to have a significant effect on a European site, it must be subject to assessment under the Habitats Regulations. This approach applies to all European sites in England and Wales and includes all Special Areas of Conservation and Special Protection Areas. As a matter of policy, we are also applying this to Ramsar sites.

There are numerous European sites located within and adjacent to the SMP2 study area. In order to assess the impacts of the preferred policy options of the SMP2, a test of likely significant effect and an Appropriate Assessment have been undertaken and are detailed in Appendix I Part B. As part of this HRA, the competent authorities will have regard to the manner in which the plan would be carried out, and to any conditions or restrictions which could avoid adverse impacts on the European site(s) (Conservation of Habitats and Species Regulations 2010). Where appropriate, specific actions to avoid adverse impacts have been included in the SMP2 Action Plan (see Main Report - Part C).

Where the Appropriate Assessment has been unable to conclude that the SMP2 does not adversely affect the integrity of the European sites, the SMP2 may only be adopted if the requirements of Regulations 103 and 105 of the Habitats Regulations are met:

- firstly, there must be no alternative solutions to the SMP2 that would have a lesser effect on the European site; and, if there are no alternative solutions
- secondly, there must be imperative reasons of over-riding public interest for adopting the SMP2.

Furthermore, the SMP2 may only be adopted in these circumstances if it can be demonstrated that, the Secretary of State can be satisfied that the competent authority will be able to secure

any necessary compensatory measures to ensure that the overall coherence of Natura 2000 is protected.

The HRA for the Severn SMP2 was unable to demonstrate no adverse effects on two European sites within and adjacent to the study area and a Statement of Case is being prepared for Defra/WAG approval to demonstrate that there are no acceptable alternative policy options and the SMP2 is required for Imperative Reasons of Overriding Public Interest (IROPI).

A Habitat Delivery Plan is currently being prepared by the Environment Agency to identify potential areas of habitat compensation around the estuary; this study, once complete, will support the SEA and HRA. Initial findings suggest that enough areas for compensation can be identified within the SMP2 study area, however some degree of uncertainty remains particlalry surrounding issues such as securing land owner agreement and funding to implement projects. There is also uncertainty regarding how well the sites will perform in developing the necessary replacement habitat. More work is required to identify the most appropriate areas to create replacement habitat and to ensure that actions are undertaken to create such replacement habitat. The FRMS project will continue after the SMP2 has been completed.

The HRA and SEA have been undertaken in parallel to ensure that the plan does not set the framework for coastline management which is subsequently compromised by the necessity to meet the requirements of the Habitats Regulations.

The procedures for agreeing and signing off the HRA are different in England and Wales. The Countryside Council for Wales (CCW) advises Welsh management authorities on nature conservation matters, including the Welsh Assembly Government (WAG) Local Authorities and the Environment Agency Wales (EAW). Natural England (NE) advises English management authorities on nature conservation matters, including Defra, Local Authorities and the Environment Agency (EA).

The cross border nature of this SMP2 makes the legal requirements of these pieces of legislation complicated because there is no one ‘competent authority’ that can act for and sign off all the assessments. This means that ensuring all the authorities are satisfied that the HRA has been completed in accordance with the legislation is a complex process.

### 2.4.2 Water Framework Directive

A separate assessment of the compliance of the SMP2 policies with the Water Framework Directive (WFD) environmental objectives has been undertaken by the Environment Agency and the results of this assessment can be found in Appendix J to the main SMP2 report.

# 3. Scope of the SEA

A scoping exercise was undertaken in late 2008 to identify the key environmental issues within the study area and define the scope of this SEA. Under the SEA Directive, *The Assessment of Plans and Programmes Regulations (2001/42EC)* identifies environmental factors that must be initially considered for all SEAs. These include:

- Human Beings including population and human health;
- Biodiversity, Flora and Fauna;
- Soil;
- Water;
- Air;
- Climatic factors;
- Material assets;
- Cultural, architectural and archaeological heritage;
- Landscape; and the
- Inter-relationship between the above factors

Table 3-1 summarises issues scoped into and out of the SEA. The SEA addresses, at the strategic level, the implications of implementing the SMP2 policies. Impacts at the site or project level will be addressed through the Environmental Impact Assessment (EIA) process as part of the appraisal undertaken for specific schemes.

The scoping process allows issues that are not considered to be significant for the purposes of the SMP2 to be 'scoped out' of the SEA. Similarly, other issues of particular relevance or significance to the catchment and not included within the SEA Directive may be 'scoped in' to the SEA. These impacts may be positive or negative, direct or indirect, temporary or permanent and of varying severity. The SEA process will identify likely impacts, evaluate their relative significance and identify the potential for mitigation where possible.

**Table 3-1 Summary of Issues Scoped into and out of the Severn Estuary SMP2 Strategic Environmental Assessment**

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| **Population and Human Health** | Population, businesses and properties at risk from flooding | | SMP policy options will affect the population within flood risk areas, as well as business and property. | Reduce significance of adverse impact associated with flooding and erosion to people and property<br><br>Reduce significance of adverse impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism) |
| | Recreational and amenity resources of national and regional importance | | SMP policy options could affect important recreational and amenity resources and could also present opportunities to deliver recreational benefits | Reduce significance of adverse impact associated with flooding and erosion to key community, recreational and amenity facilities. |
| | Quality of life/Social deprivation | | Quality of life is affected by flooding and erosion; more socially deprived communities are likely to be more significantly affected | Avoid/minimise environmental impacts which may have long term health impacts (including stress and anxiety associated with flood and erosion risk)<br><br>Reduce significance of adverse impact associated with flooding and erosion to people and property |
| | Employment | The SMP2 will not have a significant direct effect on employment at the regional level, as it will not result in the creation or loss of jobs. The effects of any flood or erosion risk management policy on employment would be considered further at project EIA stage | The effects of flood risk on businesses as employers is captured under "*Population, businesses and properties at risk from flooding*" | Reduce significance of adverse impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism) |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| | Noise | The SMP2 will not have a significant effect on noise at a regional level. The effects of any flood or erosion flood risk management activities on noise would be considered further at project EIA stage | | |
| **Biodiversity** | International and European Sites of Conservation Importance (SAC, SPA, Ramsar site) and known supporting sites | | The SMP2 may have implications for both the integrity and features of European and international sites. The assessment will focus on those sites affected by current or future erosion or flooding and/or those that are dependent on the water environment to maintain their features of interest; the assessment will also give due consideration to impacts on designated sites beyond the study area and areas outside designated sites used by European site features/species, as appropriate. In addition, consideration will be given to cumulative and in combination effects. | Avoid significant adverse impact on the integrity of internationally designated sites and/or the favourable condition of their features. |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| | Sites of National Conservation Importance (NNRs, SSSIs) | | SMP policy options could have direct or indirect effects on the features of nationally designated sites. The SEA will focus on those sites potentially affected by changes in the current flooding regime and/or SMP2 policy options. | Reduce significance of adverse impact on nationally or locally designated conservation sites.<br><br>Allow natural processes and to maintain the visibility of geological exposures throughout the SSSI |
| | Nationally important Habitats and Species (UK BAP) | Potential impacts on species or habitats not classified within the UK BAP will not be addressed within the SEA but will be considered further at project EIA stage. We have not included all BAP species and habitats, but selected a list of those most likely to be found in or adjacent to the Estuary. Non priority BAP species/habitats have been excluded | The SMP2 could have direct or indirect effects on UK priority BAP species and habitats. The SEA will only consider those habitats and species known to be found within the study area. | Maintain and/or enhance Biodiversity Action Plan habitats and species in line with existing targets/plans |
| | Sites of Local Conservation Importance (e.g. CWS, LNRs) | | Locally designated sites of nature conservation importance may be affected by the SMP2. Where data is made available on these sites they will be included. | Reduce significance of adverse impact associated with managing adverse impacts on nationally or locally designated conservation sites. |
| | European Protected Species | Due to the scale of the study and availability of data it is not possible to assess impacts on European protected species at the policy unit level. Potential impacts will be addressed as an integral part of more local assessments/studies. | Impacts on European protected species have been incorporated where they form part of a national or international nature conservation designation | Avoid significant adverse impact on the integrity of internationally designated sites and/or the favourable condition of their features.<br>Reduce significance of adverse impact associated with managing adverse impacts on nationally or locally designated conservation sites. |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| **Land Use, Geology and Soils (inc Geomorphology and Contaminated Land)** | Land Use | | SMP2 strategic measures could have direct or indirect effects on land use, including agriculture. | Reduce significance of adverse impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism) (*captured within Population and Human Health suite of objectives)* |
| | Geology | The SMP2 will not have a significant effect on geology. More detailed interactions between flood risk and erosion management and geology would be considered further at project EIA stage. | A broad understanding of the local geology is required as it is a factor affecting both flood risk and erosion.<br>Water resource issues linked to geology will be considered as part of the Water receptor where relevant.<br>Policy options could affect geological SSSIs particularly those along the coast | Allow natural processes and to maintain the visibility of geological exposures throughout the SSSI (*captured within Biodiversity suite of objectives*)<br><br>Water resources are protected (*captured within Water objectives*) |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| | Soils | | SMP policy options strategic measures could alter the extent or duration of tidal flooding and therefore have implications for soil quality and therefore land use (including agriculture) and nature conservation | Reduce significance of adverse impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism) (*captured within Population and Human Health suite of objectives)*<br><br>Reduce significance of adverse impact associated with maintaining the integrity of internationally designated sites and the favourable condition of their features (*captured within Population and Human Health suite of objectives)*<br><br>Reduce significance of adverse impact on nationally or locally designated conservation sites. (*captured within Biodiversity suite of objectives*) |
| | Geomorphology | Terrestrial geomorphology will not be significantly affected by SMP policy options | Flood risk management policy could have direct and indirect effects on fluvial and estuarine geomorphology, and could offer opportunities to restore natural systems | Natural coastal process are promoted e.g. through managed retreat of defences. |
| | Contaminated Land | | Existing areas of contamination could have implications for future flood risk and erosion management along the estuary; the estuary has numerous existing or past industrial uses and active and closed landfill sites | No detriment to water quality |
| **Water** | Water Quality | | Flood risk management policy could have direct and indirect effects on water quality (surface and ground) | No detriment to water quality |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| | Water Resources | | Flood risk management policy could have direct and indirect effects on water resources (surface and ground) | Water resources are protected |
| **Air** | Air Quality | SMP policy options will not have a significant effect on air quality at a regional level. The effects of strategy policy on air quality would be considered further at project EIA stage | | |
| | Climate Change | | Climate change is a key driver of flood risk management, however SMP policy options will not significantly affect the impacts of climate change; they will only accommodate them. Options and measures should minimise contributions to future climate change | Policy is designed to adapt to or accommodate climate change trends. |
| **Material Assets** | Nationally and Regionally important community facilities (hospitals, educational facilities), emergency services, transport infrastructure, power & water supplies | | SMP policy options could have direct and indirect adverse/beneficial effects on national and regionally important material assets; navigation will be considered as appropriate. | Reduce significance of adverse impact associated with flooding and erosion to critical infrastructure<br><br>Reduce significance of adverse impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism) |
| **Historic Environment (Cultural Heritage)** | Landscapes of Historic Interest | | SMP policy options could potentially affect areas listed on the Register. | Reduce significance of adverse impact to scheduled and locally, regionally and nationally important cultural historic environment sites and their setting. |
| | World Heritage Sites | There are no World Heritage Sties within the study area | | |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| | Scheduled Monuments | | SMP policy options could potentially affect scheduled sites. In many cases it is difficult to predict what the impacts of an altered flooding regime might be, as the survival of some features e.g. protected wrecks is dependent on permanent water logging, whilst other features might be damaged by increased saturation. The SEA will consider those SMs within the defined study area, however, listed buildings have been used to characterise the impacts of flooding on the historic environment as they are typically adversely affected by any increase in inundation. | Reduce significance of adverse impact to scheduled and locally, regionally and nationally important cultural historic environment sites and their setting. |
| | Historic Parks and Gardens | | SMP policy options could potentially affect designated sites. The SEA will only consider those sites within the study area. | Reduce significance of adverse impact to scheduled and locally, regionally and nationally important cultural historic environment sites and their setting. |
| | Listed Buildings | The SMP2 could have a significant effect on individual listed buildings. However, due to the large number of listed buildings in the study area, it is not practicable to determine detailed impacts on individual structures. The effects of flood risk and erosion management activities policy on individual listed buildings would be considered further at project EIA stage. | To aid in the assessment of significance and future monitoring numbers of listed buildings will be used as an indicator at the appraisal stage to help quantify impacts of SMP policy options on the historic environment | Reduce significance of adverse impact to scheduled and locally, regionally and nationally important cultural historic environment sites and their setting. |
| | Conservation Areas | Conservation Areas will not be considered within the SEA however, listed buildings will be used at the appraisal stage and subsequent monitoring to help determine the significance of impacts of policy options on the historic environment | | |

| Receptor | | Scope and Justification | | How this issue will link to the SEA Objective Table 6.1 and Section 9 |
|---|---|---|---|---|
| | | Scoped out | Scoped In | |
| | Other known and unknown features of archaeological and/or heritage interest | It is not practicable to determine the effects of the SMP policy options on every known feature of archaeological interest. The SMP2 will therefore focus on sites of national importance. The way in which any negative effects on other heritage features can be minimised would be considered further at project EIA stage.<br>The effects of flood risk management on as yet unidentified heritage resources will also be considered at project level assessment. | | |
| | Historic Battlefields | There are no Historic Battlefields within the study area. | | |
| **Landscape** | National Park | There are no National Parks in the study area | | |
| | AONB | | The Mendip Hills AONB lies within the study area for the SMP2. The SEA will address impacts of the SMP2 strategic measures on the AONB | Avoid detrimental effects to landscape character. |
| | Local landscape designations e.g. SLA, AGLV etc | | The strategy could have implications for sites of regional and local landscape importance; these will be addressed where data is available | Avoid detrimental effects to landscape character. |
| | Heritage Coast | There are no lengths of Heritage Coast within the study area. | | Avoid detrimental effects to landscape character. |
| **Interrelationship between the above factors** | e.g. Water quality and biodiversity; Land Use change and landscape; Quality of life and recreation/biodiversity | Inter-relationships will be included where relevant i.e. where policy options give rise to the potential for secondary or cumulative impacts | | |

NB: for SPAs, SACs, SCIs and Ramsar sites where we cannot demonstrate that a significant detrimental effect is not likely to result from the SMP2 we will undertake a Habitats Regulations Assessment in accordance with the requirements of the Habitats Directive.

# 4. Consultation

## 4.1 Stakeholder Involvement

The opinions and views of stakeholders – those people that live, work and are interested in the area affected by the SMP2 – are important in producing an effective SMP2. Throughout the development of the SMP2, stakeholders have been asked to contribute information, local knowledge and their views (see Appendix B of the main SMP2 Report).

Four different groups of stakeholders have been involved in the development of the SMP2. No one group is more important than any other and views or comments raised by one group do not have more or less weight than views raised by another.

- **Severn Estuary Coastal Group (SECG) / Project Management Group (PMG) –** includes representatives from 10 Local Authorities, 3 Environment Agency (EA) Regions, 2 Internal Drainage Boards (IDBs) and the national statutory nature conservation bodies, as well as input from historic environment representatives from England and Wales;
- **Elected Members Forum (EMF) –** a forum for elected representatives from the Local Authorities within the SECG area to be involved in the SMP2 development process. Elected Members ultimately represent their constituents – the residents, businesses, etc. that will be affected by the SMP2 policies;
- **Key Stakeholders Group (KSG) –** a focal point for discussion and consultation – made up of people with primary interests in the Estuary (industry, conservation, user groups, etc.). Includes all town and parish councils; and
- **All other stakeholders –** this includes everyone that does not fall into one of the groups above, including members of the public. It is the largest and most diverse group. This group were and will continue to be contacted and made aware of progress on the development of the SMP2 through:
  - e-mail updates (using SEP monthly e-news, which reaches >1,000 contacts);
  - SECG website (which shall host all information concerning the SMP2 and link to the FRMS website);
  - Consultation leaflets (bilingual);
  - 3 x public exhibitions during the public consultation (Autumn 2009);
  - Public consultation process (Autumn 2009);
  - Publication of final SMP2 (including a bilingual summary leaflet).

Many people could be represented by more than one group e.g. home owners could be represented by their local parish council, their elected Councillor or they could represent themselves as a member of the public. It has been up to the individual to decide the best way for them feed into the SMP2 development process. The Severn Estuary Coastal Group (SECG) website (www.severnestuary.net/ secg) has provided a single point of access to information and documents for all stakeholders throughout the project.

Meetings/Fora were held in January with the EMF and KSG, to introduce the SMP2 process and outline links with the FRMS; at these meetings the opportunity was also taken to raise awareness of the SEA Scoping Report, which was also posted on the SMP2 website comments invited. A second round of meetings/fora were held with the same groups in Summer 2009 to discuss

features, issues, objectives and policy drivers. A final round of fora and three public meetings are scheduled for autumn/winter 2009, during the public consultation process. This will allow feedback on the preferred SMP2 policy options and the SEA to be gathered and reviewed prior to production of the final SMP2 report in April 2010.

Appendix B of the Main SMP2 report (Stakeholder Engagement and Consultation) provides more detailed information on stakeholder consultation, responses received and how these been incorporated into the development of the SMP2 and SEA. In addition, on completion of the public consultation process a summary of comments received and how they have been taken in consideration in the development of the SEA will be documented within the Statement of Environmental Particulars.

## 4.2 Consultation on the SEA

Consultation on the SEA has been incorporated within the wider consultation on the SMP2. In December 2008 the PMG were given the opportunity to comment on the draft Scoping Report for the SEA. The SEA Scoping Report established the environmental baseline (including key environmental issues) and developed a suite of objectives which have been used within this report for the assessment of SMP policy options**.** The final version of the Scoping Report was then placed on the SMP2 website for wider public consultation and comment in January 2009. Attendees at the January EMF and KSG meetings were also invited to comment on the report.

Questions posed during the consultation period on the SEA scoping report were as follows:

1 Has the study area been adequately defined?
2 Have all plans relevant to the SMP2 been considered and have all the relevant themes been identified?
3 Are there any other major development proposals within the study area of which we should be aware?
4 Is the baseline data collected at this stage of an appropriate level and depth in the context of the SMP2?
5 Are there any other environmental issues in the study area that should be considered within the SEA and have all significant opportunities and constraints been identified?
6 Are the draft SEA objectives, targets and indicators proposed at this stage suitable in the context of the SMP2 and are there any objectives that should be removed or included?
7 Do you have any further comments on the proposed approach and scope of the SEA

Feedback was received from:

- CCW
- The Environment Agency
- Caldicot and Wentloodge IDB
- Somerset County Council
- Cadw and
- Gloucestershire County Council.

The feedback focussed on:

- ensuring integration of the SMP, with CFMPs and the FRMS;
- suggested amendments to the objectives, indicator and targets;

- suggested clarification on issues scoped into and out of the SEA;
- suggested clarification on trends, opportunities and constraints;
- comments regarding potential impacts of European sites and species and requirement to create compensatory habitat;
- suggested additional plans and policies to consider as part of the SEA.

No feedback was received from the general public. All comments have been considered and included in the SEA process and this report as appropriate. In addition, the consultation process provided the opportunity to scope out certain SEA receptors which were deemed as not being pertinent to the assessment of SMP policy; this includes air quality, terrestrial geomorphology and noise.

This SEA report will also be circulated for comment and feedback. The report will be placed on the project website as part of the public consultation exercise. In addition, it will be discussed at the EMF and KSG meeting scheduled for this autumn and winter, and made available at the public exhibitions programmed for the same period. Any feedback from this phase of consultation will be reviewed and should major changes to the SEA report be required an addendum will be published. In addition, in accordance with Part 4 of the Environmental Assessment of Plans and Programmes Regulations 2004, a post Adoption Statement will be prepared to document the way in which the Severn Estuary Coastal Group have taken environmental considerations and the views of consultees into account in the adopted SMP2. Consultation with stakeholders will continue through the life of the SMP2, by means of reporting and feedback, and the monitoring of issues and review of action plans. The FRMS will also be subject to consultation and as individual projects are implemented from the Strategy they too will be subject to their own consultation process.

# 5. Review of Relevant Plans and Strategies

Annex 1(a) of the SEA Directive, requires:

> "*An outline of the contents and main objectives of the plan or programme and of its relationship with other relevant plans and programmes*";

Annex 1(e) requires identification of:

> "*The Environmental Protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation*".

The interaction of the SMP2 with other relevant plans and policies including land use plans and relevant Government and Environment Agency strategies and policies has been addressed as part of the SEA process. As part of this process it was necessary to review other policies, plans and programmes that might be affected or those that present a significant constraint or opportunity for the SMP2, to evaluate their relevance, including any potential synergies and conflicts. This is required to ensure the SMP2 is robust, realistic and compliant with SEA requirements. The relationship of the Strategy with the wider planning framework is shown within Figure 5-1.

Numerous proposals for harnessing tidal power in the Severn Estuary are currently being discussed by a range of organisations. However, we cannot assume any one particular tidal power solution will be pursued and so need to develop SMP that can be implemented independently of others. The Flood Risk Management Strategy for the Severn Estuary being developed by the Environment Agency will identify any investment in new defences that should be held back because tidal power options could make it unnecessary.

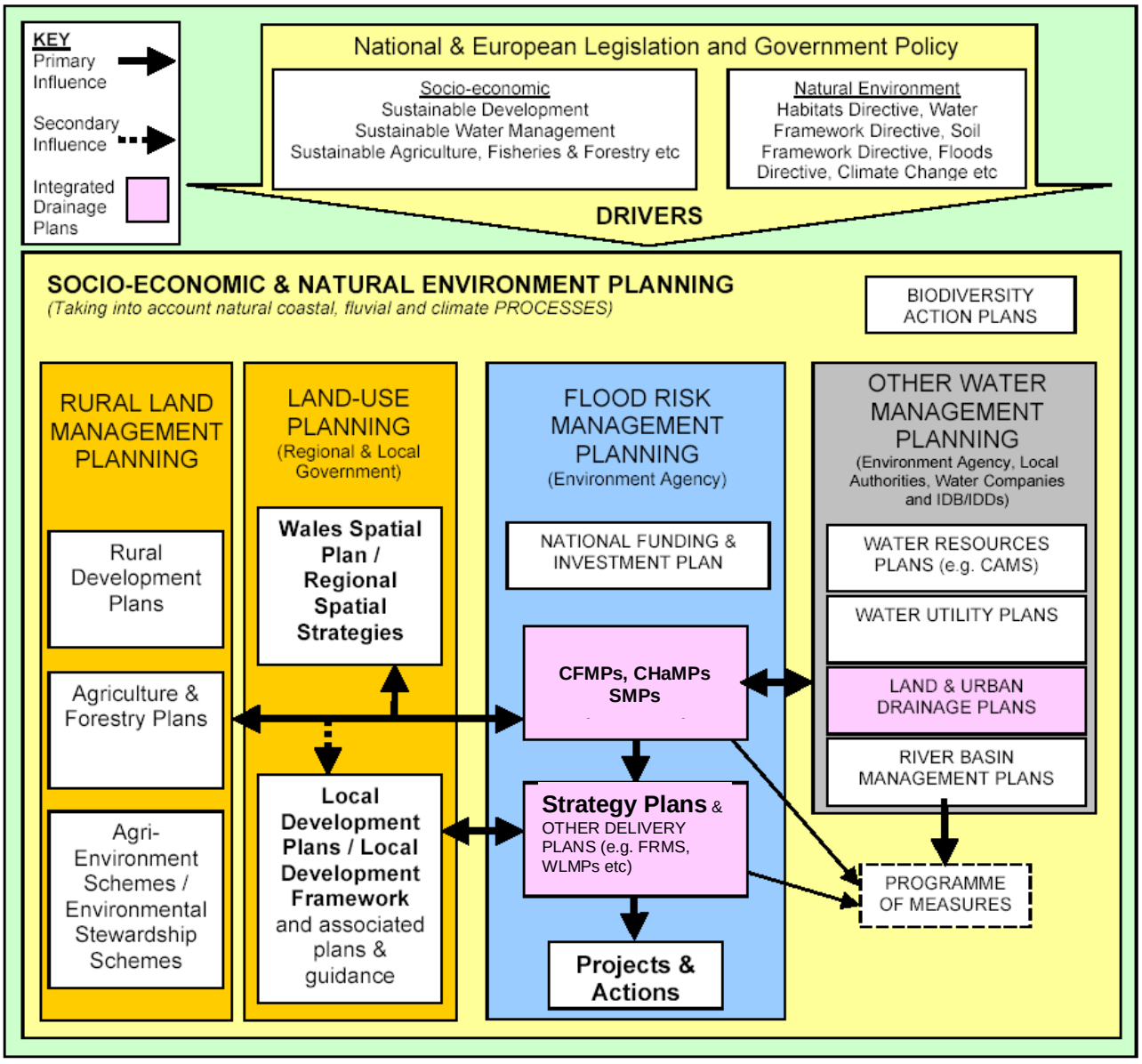
The full policy and plan review is documented in Annex A. The table summarises the main environmental themes and objectives that emerge from the plans, programmes and policies that have been reviewed. These themes and objectives have been taken into account when setting the SEA objectives that will be used to assess the environmental effects of the different coastal management options.

The major environmental themes identified by the review to date include:

1. promote sustainable development
2. seek to improve quality of life and protect the most vulnerable communities
3. Protect and enhance recreation, tourism and access to and along the coast
4. Conserve and enhance biodiversity including endangered species and habitats
5. Maintain, improve and develop fisheries
6. Maintain and enhance landscape character
7. Improve and protect inland, coastal and groundwater quality
8. Manage the risk of flooding and coastal erosion
9. Protect coastal resources and natural coastal processes
10. Adapt to climate change and reduce contributions to climate change by reducing the emissions of greenhouse gases
11. Conserve and where appropriate enhance the historic and cultural environment
12. Encourage the sustainable use of natural resources
13. Minimise the use of energy and optimise the use of renewable resources
14. Maintain and improve air quality

15. Manage waste in accordance with the waste hierarchy in all sectors (i.e. household, commercial and industrial). Maximise proportion of waste recycled
16. Conserving the best and most versatile agricultural land and/or promoting the diversification of agriculture to accommodate market and land use changes
17. Promotion of remediation of contaminated land

**Figure 5-1 – Relationship of the SMP2 with the wider Planning Framework**



# 6. Deriving Objective Indicators and Targets

This section describes the framework of objectives, targets and indicators that forms the basis for predicting and assessing the effects that are likely to arise from the implementation of the SMP2. This is achieved by translating the baseline information and the key environmental issues identified into a series of environmental objectives against which each option can be assessed. The list of objectives incorporates the relevant environmental themes and objectives identified from other plans, programmes and policies, where relevant to the nature and aims of the SMP2. For each objective, one or more targets are set. Objectives, indicators and targets are intended to be quantitative where possible and measurable as they provide the basis for monitoring the effects of the SMP2 over the long-term following implementation. The objectives and associated indicators and targets are presented in Table 6-1.

The objectives focus on key issues that would have a significant influence on the development of the SMP2 and that could be used to appraise alternative policy options or strategic measures. Discussion with stakeholders was used to further refine and develop these objectives and sub-objectives.

Baseline data collection was and will continue to be guided by these objectives and sub-objectives to avoid gathering too much, or too detailed, information not relevant to the study area. The objectives and sub-objectives will also be used as a benchmark against which the effects of implementing the Strategy are assessed and monitored once it is implemented.

**Table 6-1 : Objectives and Targets for the Severn Estuary SMP2 SEA**

| Objective (*Relevant factor derived from Annex I f of the Directive)* | Suite of Sub-Objectives | Suite of Indicators (*Reference*) | Suite of Targets |
|---|---|---|---|
| Protect and enhance biodiversity (b*iodiversity, flora and fauna)* | • Avoid significant adverse impact on integrity of internationally designated sites and/or the favourable condition of their features.<br>• Reduce significance of adverse impact on nationally or locally designated conservation sites**.**<br>• Maintain and/or enhance Biodiversity Action Plan habitats and species in line with targets<br>• Allow natural processes and to maintain the visibility of geological exposure throughout the SSSI | • Reported levels of damage to designated sites.<br>• Reported condition of international and national sites.<br>• Achievement National or Local Biodiversity Action Plan objectives and targets.<br>• Area of BAP habitat created | • No significant adverse effect to designated wildlife sites.<br>• No detrimental effect on site achievement of favourable condition<br>• Creation of new areas of BAP habitat.<br>• Increase the area of land actively managed for conservation.<br>• Contribution to Defra biodiversity outcome measure |
| Provide opportunities to improve human health and avoid adverse effects on population (*human health, population*). | • Avoid/minimise adverse environmental impacts which may have long term health impacts (including stress and anxiety associated with flood risk)<br>• Reduce significance of adverse impact associated with flooding and erosion to key community, recreational and amenity facilities. | • Injuries/illness due to flooding etc.<br>• Area and quality of recreational and amenity faculties.<br>• Numbers of users of recreational facilities<br>• Change in area and quality of public open spaces. | • No of new homes/businesses built within at risk area<br>• No reduction in area, length or quality of recreational or amenity facilities;<br>• Zero valid noise and traffic related complaints. |

| Objective (*Relevant factor derived from Annex I f of the Directive)* | Suite of Sub-Objectives | Suite of Indicators (*Reference*) | Suite of Targets |
|---|---|---|---|
| Material Assets and Critical Infrastructure | • Reduce significance of adverse impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism<br>• Reduce significance of adverse impact associated with flooding and erosion to critical infrastructure. | • Area of land under agricultural production and type of production<br>• Change in Agricultural Land Classification Grade (*Defra*).<br>• % change in the proportion of different Land Cover typologies (*Cranfield University*).<br>• Reported damage or disruption to transportation infrastructure from flooding<br>• Reported damage to services from flooding<br>• Reported damage to resources. | • No change in Agricultural land Classification Grade<br>• No reported damage or disruption to transportation infrastructure.<br>• No detrimental effects to services.<br>• No detrimental effects to resources |
| Reduce flood risk (Population and Human Health) | • Reduce significance of adverse impact associated with flooding and erosion to people and property | • Number of properties/businesses at risk of flooding.<br>• Standard of flood protection taking into account predicted sea level rise and climate change.<br>• Rate of coastal erosion<br>• Indicative floodplains | • No increase in number of properties at risk from flooding<br>• Reduce impact of coastal erosion |
| Protect and enhance land quality (geology soils and contaminated land) | Captured under other objectives (see Table 3.1) | Captured under other objectives (see Table 3.1) | Captured under other objectives (see Table 3.1) |

| Objective (*Relevant factor derived from Annex I f of the Directive)* | Suite of Sub-Objectives | Suite of Indicators (*Reference*) | Suite of Targets |
|---|---|---|---|
| Protect and enhance water environment (*water*) | • Water resources are protected<br>• No detriment to water quality | • Groundwater levels and quality (*Agency Vision Indicator)*<br>• Variation in chemical and biological GQA *(Agency Vision Indicators).* | • Maintain existing groundwater levels and quality.<br>• No detrimental change in water quality (chemical or biological GQA)<br>• Compliance with RQOs |
| Mitigate impacts from climate change and reduce contribution to green house effect *(climatic factors)* | • Flood management strategy is designed to adapt to or accommodate climate change trends. | • Indicative floodplains under current conditions and under climate change scenarios<br>• $CO_2$ emissions per person and per sector. | • No increase in vulnerability to climate change. |
| Sustainably manage the historic environment (*cultural heritage*). | • Reduce significance of adverse impact to scheduled and locally, regionally and nationally important cultural historic environment sites and their setting | • Number of listed buildings at risk;<br>• Number of archaeological evaluations and other studies that have been produced as a result of implementing the strategy.<br>• Reported damage to sites | • No increase in number of listed buildings at risk<br>• Damage to sites of national importance is minimised<br>• Archaeological mitigation where archaeology is affected. |
| Protect and enhance landscape character /visual amenity *(landscape)* | • Avoid detrimental effects to landscape character | • Landscape character assessment (qualitative indicator) | • No detrimental effects on landscape character (qualitative target.) |

| Objective (*Relevant factor derived from Annex I f of the Directive)* | Suite of Sub-Objectives | Suite of Indicators (*Reference*) | Suite of Targets |
|---|---|---|---|
| Contribute towards Sustainable Development *(none)* | • Natural coastal process are promoted e.g. through managed retreat of defences.<br>• Minimise whole life costs of defences. | • Length of new defences outlined by strategic measures<br>• Area of land under managed or retreat or do nothing<br>• whole life cost of defences | • Losses of intertidal habitat due to climate change and planned construction of defences compensated/replaced on at least a 1:1 basis<br>• No increase in whole life costs of defences |

# 7. Baseline Data

## 7.1 Introduction

Baseline data has been obtained from consultees and a review of available documents. Sources used have been referenced throughout the Section. Baseline information provides the basis for predicting effects on the environment and helps to identify any relevant environmental trends and existing problems that may be affected by the Strategy. This section sets out the key environmental information that will be used in the SEA. The baseline information presented in this section is at a strategic level, appropriate to the scale of the study. A prediction of the likely evolution of the baseline environment without the implementation of the strategy is also provided along with a summary of key opportunities and constraints.

## 7.2 Population and Human Health

### 7.2.1 Planning and Development Control

The study area covers the following local authorities:

- Cardiff County Council
- Newport County Council
- Vale of Glamorgan County Council
- Monmouthshire County Council
- Forest of Dean District Council
- Gloucester City Council
- Gloucestershire County Council
- Stroud District Council
- South Gloucestershire Council
- Bristol City Council
- North Somerset Council
- Somerset County Council

The tidal floodplain throughout the estuary is under pressure from development. This is partly due to the pressure on planning authorities to expand their allocation of land for housing, commercial and industrial uses, and partly due to commercial pressures to find inexpensive, available land.

Planning Policy Guidance (PPG) 20 - Coastal Planning and PPS25 Development and Flood Risk (in England) and Technical Advice Note (TAN) 14: Coastal Planning and Technical Advice Note (TAN) 15: Development and Flood Risk (in Wales) state that existing development should not be put at further risk from flooding and that development should not be allowed in areas at risk of flooding, erosion or land instability. The guidance promotes a precautionary (risk based) approach to development within the floodplain that incorporates possible effects from climate change. The goal is that floodplains are used for their natural purposes (i.e. they flood). Due to extensive development within the estuary and existing flood defences the floodplain of the Severn is not functioning naturally or effectively. These guidance notes state the need for future development to shift away from the floodplain. They state that hard defences and increasing protection may not be the most sustainable solutions to flooding, particularly as increasing protection for existing ‘at risk’ properties can lead to further development infill. Naturally functioning floodplains also provide habitat and landscape value.

The Scoping study has reviewed local development plans, regional policies relating to development, development targets and proposed locations for development across the study area; key development proposals in or adjacent to the study area include:

- the new M4: 24 miles of three lane motorway between Junction 23a (Magor) and Junction 29 (Castleton). The road, which will run through Newport County Borough, will have a major adverse impact on the Gwent Levels;
- Severn Tidal Power Generation – numerous feasibility studies are currently being undertaken into the development of barrages across the Severn and its tributaries, as a means of generating tidal power; any such development may have adverse impacts on the hydrology, morphology, biodiversity and landscape of the estuary;
- wind turbines – there are several proposals across the study area to develop alternative energy sources including onshore or offshore wind turbines; this may affect the landscape character of the estuary as well as result in bird collisions and mortalities;
- the regeneration of ports and waterfronts will bring new opportunities for recreation, housing and tourism development to coastal locations such as Portishead, Watchet and Weston.
- Bristol Port Company's proposed Deep Sea Container Terminal at Avonmouth, will potentially adversely affect estuarine processes and encroach into the Severn Estuary European site;
- Severn Power are developing a new gas fired power station at Uskmouth; works will also involve the construction of a 6km pipeline between Uskmouth and Marshfield; given the existing developed nature of this site, long term strategic level impacts are considered unlikely;
- the Marine Bill will include proposals for a coastal footpath along the entire British shoreline; within Wales WAG have already given a commitment in its strategic agenda " Wales - A Better Country" to further extend public access to the coast of Wales and allocated £1.5 million towards achieving this; this will enhance recreation opportunities, but alignments may conflict with SMP2 policies.
- The UK Government's Nuclear White paper 2008: 'meeting the energy challenge' identified new nuclear power stations as having a role to play in the country's future energy mix alongside other low carbon sources; potential sites for new nuclear power plants along the estuary include Oldbury and Hinkley. As any new developments are likely to be located on existing power station sites, conflicts with the SMP2 policy options are considered unlikely. Impacts of the development are likely to include potential effects on the Severn European site.

It is anticipated that the final SMP2 will provide guidance to Local Planning Authorities by setting future policies for flood and erosion risk management which will be implemented over the next 50 to 100 years.

### 7.2.2 Population

Significant conurbations within the SMP2 study area with populations of more than 10,000 include Penarth, Cardiff, St Mellons, Newport, Caldicot/PortSkewett, Lydney/Allaston/ Chepstow, Gloucester, Quedgely, Bristol, Portishead, Clevedon and Yatton/Congresbury.

Key strategic planning documents including the Regional Spatial Strategies, Wales a Better Country and the local plans advocate that population growth across the study area be contained within the urban areas where possible. Population growth is having a secondary impact on the capacity of other systems including infrastructure and utilities.

### 7.2.3 Deprivation and Regeneration

The Index of Multiple Deprivation is a statistically generated output that that can be used to identify small geographical areas that are deprived. The measure combines information from a range of datasets including:

- Income;
- Employment;
- Health deprivation and disability;
- Education, skills and training;
- Barriers to housing and services;
- Crime, and
- Living environment.

Areas within the study area with high levels of deprivation include Gloucester, Weston-Super-Mare, Burnham, Newport and Cardiff. The general trend across the area is one of an ageing population and an ongoing lack of access to basic services, particularly in rural areas. A number of towns within the study area are experiencing regeneration and redevelopment of areas around watercourses including Gloucester Docks, Newport and the area around the Cardiff Bay Barrage. Regeneration brings investment and improvement to waterside areas but this can also add pressures on the existing transport networks and water systems.

### 7.2.4 Economic Activity

The majority of the study area is dependent on farming, with grazing being the dominant activity. Centres of commercial and industrial development exist at Avonmouth, Gloucester, Newport, Cardiff, Lydney and Bristol.

In the 1960s - 1980 peat extraction was a major industry in Somerset but this is starting to decline following public concern over peat conservation issues. It is, however, still locally important.

Marine sand and gravel extraction take place along the estuary. These activities have the potential to lead to increased coastal erosion due to changes in sediment transport patterns and alterations in beach levels with resultant implications for coastal defence, nature conservation amenity beaches and possibly tourism. As part of the regulation of the marine dredging industry monitoring is undertaken on a regular basis to assess any impact on the coastline

### 7.2.5 Material Assets

Three major transport routes cross the lower Severn Estuary: the older M48 Severn Road Bridge between Aust and Beachley Point, and the newer M4 crossing between Severn Beach/Pilling and Caldicot, and the Severn rail tunnel which crosses just to the north of the M4 crossing – connecting rail services between London Paddington and South Wales runs parallel to the coast and in places is within 2300m of the defences. Another important strategic rail route is the Chepstow to Gloucester line which runs close the right bank of the estuary from Tidenham to Blakeney. The majority of the roads within the immediate flood risk area are minor roads,

lanes, tracks and byways. Public footpaths and the Severn Valley Way are located along or adjacent to much of the existing defences.

There are numerous key water management assets (sewage treatment works, pumping stations and outfalls) along the coast and electricity transmission lines and pylons are located within the study area between Magor Pill and Mathern Pill.

Much of the development along the Severn Estuary is around ports, which are centres of maritime industry, including heavy industry and transport, commercial fisheries and mineral and aggregate extraction. There are also power generation plants based at Avonmouth, Berkeley, Oldbury, and Uskmouth.

### 7.2.6 Tourism and Recreation

Tourism is recognised by both the Welsh and English Governments as a key wealth creator and it is already an integral part of the economy and way of life around the Estuary. Spatial plans and strategies for the area recognise the importance of tourism and seek to encourage its growth as it brings economic, environmental and social benefits and supports local services. Tourism along both sides of the Estuary is shaped by the pattern of principal towns and cities, traditional coastal resorts, small historic market towns, villages and natural landscape features. There are traditional holiday locations such as Burnham-on-Sea and Weston-super-Mare as well as a number of areas that are becoming tourist centres associated with regeneration including Gloucester Docks and Cardiff Bay. Developments at Cardiff Bay cater for a new generation of tourism with its concentration on the arts, music, shopping and business.

The coast also offers intrinsic value and provides centres for exploring the Quantocks, Mendip Hills and Somerset Levels. The network of small historic market towns and villages, and associated historic and wildlife attractions are important to the fabric of the area, particularly Chepstow and the Wye Valley, Lydney and Berkeley and Slimbridge in the higher reaches of the Estuary. Other visitor attractions include boat trips to the islands of Steep Holm and Flat Holm as well as fishing and pleasure trips from most other resorts. The main growth potential lies in the short holiday market and in business-related tourism.

The cities of Gloucester and Bristol, along with the visitor centre at Slimbridge are recreational and tourist hotspots. There is also a developing Community Forest, the Forest of Avon, which stretches from Thornbury, south westwards beyond Weston-super-Mare. This comprises forest paths, long distance paths and nature reserves. Long distance paths such as the Severn Way along the river form another attraction to the area. The Severn Bore, a tidal wave up to 1.2m high caused by tides sweeping up the narrow funnel of the estuary, is another attraction.

Recreation related to the coast is limited due to the difficulty of access, limited sandy beaches, high tides and strong currents. Despite this, the Estuary offers a diverse and often challenging environment for a wide variety of sporting and recreational interests particularly in the vicinity of Oldbury, Chepstow, Portishead, Cardiff, Newport, Penarth and Barry.

SMP2 policy options have the potential to facilitate or constrain future recreational actives along the coastal zone. A Hold the Line Policy is likely to ensure existing activities behind the defence line are maintained, whilst features in front of the defence may be at future risk of flooding and/or erosion.

**Sailing and boating**

Sailing and boating are popular, with each part of the Estuary being host to a different range of activities, such as sailing, dinghy-ing, canoeing and large cruisers. Moorings within Cardiff Bay Barrage are expected to increase from 1,000 boats to 2,500 in the next five years. Marinas exist at Penarth, Bridgwater and Sharpness, with facilities having been recently developed at Portishead. Many other craft are based on the Estuary on river moorings and in local harbours. Other craft, from sailing dinghies and speedboats to personal watercraft, are able to launch at public slipways and may travel from far a field to use the Estuary.

**Bird watching**

Large numbers of waders and wildfowl can be seen around the Estuary, particularly in winter. Thousands of people come to the Estuary to watch the birds and visit nature reserves. Wildfowling clubs affiliated to the British Association for Shooting and Conservation, and

recognised for integrating their activities with conservation in estuaries, own or lease sporting rights over the foreshore and adjacent land. The Wildfowl and Wetlands Trust have a visitor centre at Slimbridge, and on the Welsh side of the estuary, the Newport Wetlands Centre run by the RSPB provides a similar facility.

**Angling**

Angling from the shore and from boats on the Estuary is a popular leisure activity, with private and charter boats operating from ports and harbours in the area. Leisure fishing for sea fish makes a significant contribution to the economy as well as providing recreation. Although it has declined in recent years, there are many plans to try to restore this trend. The Severn Estuary is one of the most important elver fisheries in Europe bringing benefits to the local economy. However, there have been concerns recently regarding declining stocks due to over exploitation and loss of habitat.

### 7.2.7 Ports and Navigation

The Severn Estuary's ports are extremely important to the regional and, in some cases, national economy. Coastal shipping typically uses around 20% of the energy used by road transport and can help to lead to substantial reductions in road congestion. The good motorway connections on both sides of the Estuary mean that there are significant environmental as well as economic benefits to be gained from transporting goods by boat.

The major ports within the Estuary area are Bristol (Royal Portbury and Avonmouth), Cardiff and Newport, with smaller facilities at Sharpness, Gloucester and Bridgwater. The Port of Bristol, which is privately owned, has undergone significant expansion over the last ten years and handles cars (import and export), timber and forest products, coal and coke, animal foodstuffs, petroleum products (including Liquid Petroleum Gas), raw materials for manufacturing, container traffic and marine dredged aggregates.

The ports of Cardiff and Newport are operated by Associated British Ports (ABP). Cardiff handles mainly petroleum products, steel, timber, dry bulks, containers and fruit juices. Newport handles steel imports and exports, agri-bulks, solid fuels, timber, plywood and glass. Both handle marine dredged aggregates.

British Waterways is the port authority for Sharpness Dock where cargo operations are carried out by private companies. Sharpness Dock handles dry bulk, grain, foodstuff, fertiliser, scrap metal and other goods. Gloucester Harbour Trustees are the competent harbour authority for the tidal waters of the River Severn from a point seaward of the Second Severn Crossing to Gloucester, and the tidal River Wye to Bigsweir Bridge. Newport Harbour Commissioners control the tidal waters of the River Usk.

Sedgemoor District Council is the Harbour Authority at the Port of Bridgwater, where all the commercial wharves are in private hands. Trade at Bridgwater is currently increasing, particularly dry bulk imports from the near continent.

Port maintenance dredging takes place at most of the ports in the Severn Estuary area. The material dredged comprises almost entirely fine silts which are disposed of at designated disposal sites, licensed by Defra or WAG under the 1985 Food and Environment Protection Act Part II.

### 7.2.8 Other

Walking, horse riding and cycling are favoured pursuits and there is demand for further long distance routes (e.g. Gloucestershire Coastal Path and the Wales Coastal Footpath). The Marine Bill will make provisions for creating a coastal footpath around the shoreline of the UK. Recreational pastimes such as bathing, land yachting, kite buggies and beach racing occur at various locations around the Estuary where lengthy stretches of sand form the primary tourist attraction. In general, however, the use of the Severn Estuary by recreational craft is significantly less than around "honey pot" areas of the south and east coasts of England and South and West Wales.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Ongoing housing and infrastructure development could lead to increases in the number of properties and economic assets at risk of flooding as well as increasing the population at risk of flooding.

Increased risk of flooding could in the longer term result in increased levels of stress and anxiety amongst populations living in at-risk areas.

An increased resident population and changes in lifestyle are likely to result in increased demand for recreation, including access to the coast, countryside and water related recreation. This is expected to include the development of a new long distance footpath.

There is expected to be key development in or near to the study area. This will be in relation to power generation by nuclear/gas fired powers stations and/or renewable energies. There is also expected to be development and of ports and waterfronts.

Tourism is expected to continue to be an integral part of the economy and way of life around the Estuary. This is expected to continue to grow with further investment to the area.

Further development of access to and along the coast is likely to occur in accordance with political drivers

Climate change and sea level rise will increase the tidal flood and erosion risk to populations along the estuary

**Environmental Issues Constraints and Opportunities**

Populations are predicted to increase with associated development and pressure on the coastline

Increased risk of flooding will increase stress and anxiety amongst at risk populations. Insurance premiums and property prices may be affected.

Opportunity to reduce significance of flooding impacts and erosion impacts on to key community recreational and amenity facilities.

Opportunities for recreation and health benefits

Material and economic assets along the coastal strip including transport, communications links, services, businesses, utilities need to be safeguarded. The strategy may also influence the potential for future development.

Coastal regeneration is increasing economic development, particularly in relation to tourism and recreation. Opportunities to work in partnership with developers, local authorities and other bodies to incorporate recreational and amenity enhancements into coastal management schemes.

Marine extraction can affect coastal processes and has the potential to lead to increased erosion.

## 7.3 Biodiversity, Flora and Fauna

The study area supports a variety of habitats and a diverse flora and fauna, with protected species of national and international importance present. There are seven Natura 2000 sites (sites of European importance, comprising Special Areas of Conservation, designated under the Habitats Directive (92/43/EEC) and Special Protection Areas (SPA), designated under the Birds Directive (79/409/EC)), two Ramsar sites and over 50 SSSIs within the SMP2 study area. Potential impacts on flora and fauna are complex and will depend on the SMP2 policy option adopted and the nature of the habitat/species affected (e.g saline/freshwater, terrestrial/aquatic etc.). For example a hold the line policy would protect terrestrial habitats and species behind a defence, but coastal squeeze would in the medium to long term affect intertidal habitats in front of the defence.

### 7.3.1 Sites of International Nature Conservation Importance

The Natura 2000 European network of protected sites represents areas of the highest value for natural habitats and species of plants and animals that are rare, endangered or vulnerable in the European Community. Ramsar sites are wetlands designated as internationally important under the Convention on Wetlands (Ramsar, 1971). A summary of the sites within or immediately adjacent to the study area is provided below. Additional information can be found in Appendix I Part B: Assessment of Likely Significant Effect.

#### Severn Estuary SPA

Key features of the Severn Estuary SPA include:

- internationally important populations of regularly occurring Annex 1 species, Bewick's swan;
- internationally important populations of regularly occurring migratory bird species: including: white-fronted goose, gadwall, shelduck, dunlin and redshank;
- internationally important assemblage of wintering waterfowl.

#### Severn Estuary Ramsar Site

The Severn Estuary is a Wetland of International Importance under the 1971 Ramsar Convention for the following reasons:

- its immense tidal range affecting the physical environment and biological communities;
- supporting four Habitats Directive Annex I features present on the SCI (including sandbanks, estuaries, mudflats and Atlantic salt meadows).
- unusual estuarine communities, reduced species diversity and high productivity;
- the run of migratory fish between the sea and rivers via the estuary;
- important site for migratory birds during spring and autumn
- assemblages of waterfowl of international importance.
- a rich assemblage of breeding birds of international importance.
- important feeding and nursery ground for many fish species including allis shad and twaite shad.

### Severn Estuary SAC

Qualifying features include of the Severn Estuary SAC include:

- populations of the species twaite shad, river lamprey and sea lamprey.
- the Annex 1 Habitats it supports; the area is considered to be one of the best in the UK for the habitats Atlantic salt meadows, reefs, estuaries, intertidal mudflats and sandflats and subtidal sandbanks.

### Walmore Common SPA and Ramsar Site

This is a relatively small area of improved grassland and ditches primarily designated for the internationally important numbers of overwintering Bewick's swan it attracts. The grassland used for feeding and roosting is maintained by grazing and natural winter flooding.

### River Usk SAC

The River Usk is designated as a SAC. The designation extends from the mouth of the River Usk into its headwaters beyond the village of Sennybridge. Species and habitats of international conservation importance for which the river is designated include:

- the populations of twaite shad, allis shad, sea lamprey, brook lamprey, river lamprey, bullhead, Atlantic salmon and otter it supports;
- ranunculus habitat (watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation).

### River Wye SAC

The River Wye SAC extends from the mouth of the Wye upstream into Gloucestershire, Herefordshire and Powys. Details of species and habitats of international conservation importance for which the site is designated include:

- ranunculus habitat (watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation), transition mires and quaking bogs.
- the populations of White-clawed (or Atlantic stream) crayfish, twaite shad, allis shad, sea lamprey, brook lamprey, river lamprey, bullhead, Atlantic salmon and otter it supports.

### North Somerset and Mendip Bats cSAC

This cSAC is characterised by scrub, heath, woodland and grassland areas. The key habitats that have resulted in its designation include; semi-natural dry grassland and scrubland facies; *Tilio-Acerion* forests of slopes, screes and ravines; and caves. These habitats support greater and lesser horseshoe bats, which are the primary species for which the SAC is designated.

### Wye Valley and Forest of Dean Bat Sites SAC

The species that are a primary reason for selection of this site are greater and lesser horseshoe bat. This complex of sites contains about 26% of the national population of lesser horseshoe bats. It supports an exceptional breeding population, and the majority of sites within the complex are maternity roosts. The bats are believed to hibernate in the many disused mines in the area. The site also supports about 6% of the UK population of greater horseshoe bats. The site contains the main maternity roost for bats in this area, which are believed to hibernate in the many disused mines in the Forest.

**Wye Valley Woodlands SAC**

The Wye Valley contains abundant and near-continuous semi-natural woodland along the gorge. The habitats that are the primary reasons for the selection of this site are**:** beech forests, forests of slopes, screes and ravines (Priority feature) and woods of the British Isles (Priority feature). Lesser horseshoe bats are also a feature of the site.

**Avon Gorge SAC**

The primary reason for the designation of the is site is the *Tilio-Acerion* forests of slopes, screes and ravines, the limsestone cliffs and screes that the River Avon gorge supports. The semi-natural dry grasslands and scrubland habitat located on the limestone soils are also a site feature.

In addition to the above sites there are a number of European sites within neighbouring SMP2 study areas which could potentially be affected by the SMP2. These include:

- Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC
- Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC
- Castlemartin Coast SPA, Burry Inlet SPA Ramsar, Dunraven Bay SAC
- Kenfig/Cynffig SAC
- Exmoor Heaths SAC
- Lundy SAC
- Tintagel Marsland Clovelly Coast SAC
- River Tywi/Afon Tywi SAC, Pembrokeshire Marine/Sir Benfro Forol SAC
- Carmarthen Bay/ Bae Caerfyrddin SPA, Carmarthen Bay Dunes/Twyni Bae Caerfyrddin SAC
- Crymlyn Bog SAC Ramsar
- Somerset Levels and Moors SPA, Ramsar
- Exmoor and Quantocks Oak Woods SAC
- Braunton Burrows SAC

### 7.3.2 Sites of National Importance

**Sites of Special Scientific Interest**

Sites of Special Scientific Interest (SSSIs) are of national importance for nature conservation and are afforded protection under the Wildlife and Countryside Act (1981) (as amended) and the Countryside and Rights of Way Act (2000). There are over 50 SSSIs within the study area; the sites. A number of the SSSIs are also internationally important for their wildlife and habitats and are therefore designated covered by the SAC, SCI, SPA and Ramsar sites designations outlined above.

**National Nature Reserves**

In addition to the SSSIs, there are also four NNRs within the SMP2 study are: Newport Wetlands, The Hudnalls, Leigh Woods and Gordano Valley. National Nature Reserves were established to protect the most important areas of wildlife habitat and geological formations in Britain as places for scientific research.

**Sites of Local Importance**

There are nine Local Nature Reserves within the SMP2 study area.

### 7.3.3 Biodiversity Action Plans

The government has a commitment to maintain biodiversity. The overall goal is "to conserve and enhance the biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms. Biodiversity Action Plans (BAPs) have been created at a national and local level to protect and enhance the diversity of flora and fauna. The UK BAP (Biodiversity: The UK Action Plan, 2004) sets out action plans for priority species and habitats. Local Biodiversity Action Plans (LBAPs) are used to identify the local contributions that can be made to achieving the UK BAP priorities as well as identifying other local biodiversity priorities. LBAPs covering the study area include:

**Wales**

- Wild About Cardiff, March 2002;
- A Local Biodiversity Action Plan for Newport (date unknown);
- Monmouthshire Local Biodiversity Action Plan, Development and Biodiversity Supplementary Planning Guidance, July 2005;
- Vale of Glamorgan Local Biodiversity Action Plan, Vale of Glamorgan Council May 2002.

**England**

- Biodiversity Action Plan for Gloucestershire, 2000;
- South Gloucestershire Local Biodiversity Action Plan, March 2008;
- Bristol Biodiversity Action Plan, 2008;
- North Somerset Biodiversity Action Plan – Action for Nature, 2005;
- Sedgemoor Local Biodiversity Action Plan, 2008;
- West Somerset Local Biodiversity Action Plan, May 2008;
- The Somerset Biodiversity Strategy 2008-2018 : " Wild Somerset 2008".

The Severn Estuary and its hinterland support a number of important BAP habitats and species. The priority habitats most relevant to the study area are identified as follows:

- floodplain and coastal grazing marsh;
- coastal saltmarsh;
- mudflats
- sub-littoral sands and gravels;
- grasslands;
- reedbeds;
- ancient and/or species-rich hedgerows;
- old meadows and pastures (encompassing lowland calcareous grassland, lowland meadows and lowland dry-acid grassland);
- ponds, rhynes, rivers and water bodies (chalk rivers);
- orchards.

Habitats around the estuary have been lost in the past due to increased urbanisation, draining of land and intensification of agriculture. Many of the plans covering the study area highlight the

importance of reversing decline in habitats, particularly for wetlands. Initiatives and partnerships are trying to reverse this trend including the Severn Vyrnwy Land Management Initiative, the Severn and Avon Vales Wetland Partnership and areas within Environmentally Sensitive Areas where land owners are provided with targeted agri-environmental support to maintain landscape and biodiversity features.

The large tidal range on the estuary provides an extensive intertidal zone of coastal grazing marsh, saltmarsh and mudflats. Mudflats are dominant around the Cardiff Grounds and central parts of the estuary and on the lower tributaries.

Saltmarsh is confined to low energy, sheltered environments such as on the Wentloodge, Gwent and Caldicot Levels and inner estuary. Areas of saltmarsh are dwindling in the UK as a whole, therefore the Severn Estuary saltmarsh (over 1100 hectares in total) is increasing in value as a wildlife habitat. It is an important component of the Severn Estuary SSSI, SPA and SAC. Saltmarsh vegetation holds sediment from the Estuary, in some cases maintaining a natural intertidal "buffer" for to flooding and high waves. The management of the saltmarsh, including the intensity of grazing, affects not only the wildlife value of this habitat, but also maintenance of the net area of saltmarsh on the Severn Estuary. Larger areas of saltmarsh and mudflat are found around New Grounds (at Slimbridge – Headquarters for the Wildfowl and Wetlands Trust), Lydney, Beachley and Sedbury. These habitats provide important feeding grounds for wading birds, migratory wildfowl and fish (at some, or all stages of their life cycles). However, these areas have been declining over recent years due to coastal squeeze and pressure from development.

Man has had a major impact on the environment of the Severn Estuary leading to the decline of habitats. However, in some areas manmade influence is maintaining the habitat. The low-lying ground of the Severn Levels has been reclaimed from tidal inundation by a complex network of sluices and drainage channels (rhynes and reens) for agriculture. The artificially high water table in summer now supports a variety of nationally rare species. Some of these areas are designated as SSSIs, which have been classified as being in unfavourable condition in recent years due to the lack of management of the ditches and poor water quality.

Ancient orchards are listed as a locally important habitat and are scattered around the upper sections of the study area, for example at Rodley and Minsterworth. The orchards comprise mature species of local and native pear, plum and apple trees, e.g. the Berkeley Pippin. These old specimens provide important landscape and habitat value for insect eating birds and dead wood eating invertebrates

Floodplain grazing marsh exists in the upper areas of the study area, e.g. around Minsterworth and Elmore. These areas experience regular inundation as they are low-lying, have few or low defences, and are in the bottle-necks of meander bends. As floodwaters are brackish, a specialised vegetation community develops, which can grade into saltmarsh at the channel edges. Other habitats that are found around the Severn Estuary and lower tributaries include rocky intertidal platforms and beaches near the Severn bridges, sub-tidal channels around the Newport Deep and sea cliffs.

Many of the habitats along the estuary such as the Gwent Levels are also under pressure from expanding arable production, and development. The Habitat Action Plans (HAPs) outlined within regional and local BAPs provide some level of protection to these habitats. These plans identify habitats of particular local and regional value and set out targets for their management. Many habitats, e.g. old orchards, have declined over the past century and recent initiatives are in place to maintain, improve and extend them.

Key BAP species within the study area include:

- bats;
- dormouse;
- great crested newt and other amphibians;
- otter;

- water vole;
- allis and twaite shad;
- lapwing;
- Bittern.

The SMP2 will consider the impacts of polices and strategic measures on the sites and BAP species and habitats identified above.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Existing plans and policies which specifically aim to halt the decline of biodiversity, protect existing resources and reverse losses are already in place. Particularly stringent protection from development is given to international sites.

PSA targets in place to ensure that the majority of nationally important sites are in Favourable Condition by 2010. The Severn SSSI is currently at risk of failing this target due to coastal squeeze

Climate change and sea level rise will have implications for the habitats and species for which sites are designated, for example distribution of bird species. This may have implications for the number and distribution of species for which the Severn Estuary SPA/Ramsar site is designated

The Water Framework Directive will have an increasing influence, as there will be a statutory requirement for inland and coastal water bodies to meet 'good ecological status' (see baseline for Water). This is likely to be a significant driver to improvements in aquatic biodiversity in the area.

**Environmental Issues Constraints and Opportunities**

There is a need to avoid significant impact on integrity of internationally designated sites and the favourable conditions of their features.

Biodiversity Action Plan habitats and species should to be maintained and enhanced in line with targets.

Designated sites are at ongoing risk from development and coastal squeeze. SMP2 will need to consider coastal squeeze implications.

The impacts of the SMP2 on European sites will need to be subject to assessment under the requirements of the Habitats Regulations. There is likely to be a need to create compensatory habitat.

Strategic options for capital schemes may give rise to opportunities to improve ecological connectivity both as part of protected sites and by the enhancement and/or restoration of other key habitats.

## 7.4 Fisheries

The River Severn and its tributaries including the Wye and Usk have in the past been important salmon fisheries, however over the past decade populations have been decreasing In addition, there were concerns that mixed stock salmon fishing was reducing the numbers of rare shad as by-catch. Controls on fishing, aimed at increasing stocks, have since been imposed by the Environment Agency who own the fishery.

The River Severn has the biggest migration of eels of any river in England and Wales and the elver fishery is an important commercial fishery, with the juveniles being exported to Europe and the Far East, while there still remains a limited adult eel fishery for export or local smoking. Elver stocks have declined by as much as 98% in recent years and this has prompted Europe to expect all member states to produce Eel Management Plans. The main issues affecting populations on the Severn are exploitation, loss of habitat (river connectivity with its floodplain), proposed hydropower schemes and barriers to migration. The elver and sea trout enter the saltmarsh across the levels during high tides to feed, and then retreat out as the tide recedes.

The Severn is one of a few rivers in England and Wales that supports a twaite and an allis shad population. Shad are members of the herring family that live in salt water but spawn in fresh water. Historically, the River Severn supported a huge commercial shad fishery with fish spawning upstream of Shrewsbury, but with the creation of the Severn Navigation in the 19th Century, shad were excluded from their historical range by the creation of the navigation weirs.

The population of the allis shad in the UK has declined since the mid-nineteenth century to the point where it has a sporadic distribution around the coast with no known spawning grounds/rivers. The twaite shad has also declined, although spawning populations are known to be present on the Severn downstream of Worcester and on the Usk and Wye. The main issues facing shad are barriers to migration, poor stock assessment, navigation activities and habitat loss.

The Severn contains three types of lamprey (brook, river and sea). River and Sea Lamprey enter the river to spawn each year. Sea lamprey make long upstream movements to above Shrewsbury on the main Severn and are quite visible spawning on the gravel shallows. The migration of river lamprey is less well understood, but it is thought that they spawn further down the river. The sea lamprey stock is thought to be healthy but inter year variations are not uncommon; it is generally accepted that river lampreys have declined over the last 25 years. The reasons for this decline are not fully understood.

Salmon, twaite shad and the lamprey species (sea and river) are all features of the Severn Estuary SAC and consequently afforded a very high level of statutory protection. Allis shad is also a feature of the River Usk and River Wye SACs and listed within the Ramsar citation for the Severn Estuary. Shad also spawn on the River Tywi in Camarthenshire and are a feature of the River Tywi SAC.

Commercial salmon fishing has declined in productivity and importance. Drift nets, draft nets (seine or long nets), the traditional methods of ‘fixed engines’ (putts and putchers), and hand-held lave nets are methods once employed, but all these fisheries have reduced. This has occurred partly due to Government supported buyouts and Net Limitation Orders such as the closure of the drift net fishery which operated off the Welsh coast between Newport and Chepstow and the putcher fishery at Goldcliff near Newport.

There is very little shell fishing on the Estuary, but traditional activities include the use of ‘mud horses’ by a small number of fishermen, taken out over the intertidal mud in Bridgwater Bay to fish for shrimps.

Commercial fishing for white, sea fish also takes place on the Estuary, including trawling, longlining, and the use of beach nets for cod, whiting, bass, sole, plaice and mullet. As previously mentioned there are several small eel and elver fisheries along the Severn.

**Likely Evolution of the Baseline without the Implementation of the Plan**

The coastline and Severn Estuary rivers are likely to continue to be important recreational and commercial fisheries and fish migration routes.

The River Severn and the Rivers Wye and Usk have had controls imposed on fishing them with the aim of increasing stocks. Salmon and other species are expected to see a reverse in decline of the populations.

Eel Management Plans are being produced by the Environment Agency to conserve eels and elvers in the River Severn, as a result the risk to eel populations should reduce and numbers are hoped to recover

Commercial salmon fishing in the Severn Estuary has declined in productivity and importance, partly due to Government buyouts and net order limitations. It is unlikely that there will be an increase in commercial salmon fishing. Commercial fishing for other species is also unlikely to rapidly increase.

**Environmental Issues Constraints and Opportunities**

The salmon fishery has in the past been over exploited and elver numbers are in decline. Increased development and/or recreational activity along the coast may affect fish and elver populations. The implementation of strategic options has the potential to affect fish stocks.

Access to estuary is an important consideration for recreational fisheries and the ability to keep and launch boats from the coast is a consideration for commercial interests.

Biodiversity Action Plan habitats and species need to be maintained and enhanced in line with targets. Eel Management Plan targets need to be taken into account.

## 7.5 Soil Geology and Geomorphology

### 7.5.1 Soils

Soils play a fundamental role in the quality and distribution of water within a catchment. They have a significant impact on how an area responds to rainfall, being responsible for the relative proportions of the rainfall that are retained in the soil, pass to groundwater or contribute to surface water runoff. Loosely packed, deep soils retain more rainfall and have a slower response than shallow or densely packed soils. The permeability of catchment soils has an important influence on the speed and magnitude of a river's and a catchment's response to rainfall:

- impermeable soils will allow rainwater to run off the catchment very quickly and flow into surface water bodies such as lakes and rivers. In severe circumstances, this can lead to flash flooding;
- permeable soils with a low porosity can allow more water to infiltrate into the ground but at a slow rate. This allows the soil to store water where it is used by plants and other organisms in the soil;
- permeable soils with a greater porosity will allow rainwater to infiltrate into the ground which may contribute to groundwater flow. The rate at which it does this is dependant on the pore sizes and structure of the soil.

There are a wide range of soil types across the study area affecting permeability and land use The lowland coastal areas along much of the estuary including the Gwent and Somerset Levels are characterised by fertile peaty soils.

### 7.5.2 Geology

The impact of geology on flood risk and erosion is determined by the effects on topography, the permeability of rocks and their resistance to erosion. Permeability, along with other factors such as vegetation cover and topography, will influence the response of an area to a rainfall event. The hardness of the rocks across the study area have heavily influenced the evolution and shape of the estuary and continue to exert an influence on topography and rates of erosion.

The Severn catchment exhibits a very varied geology. The bedrocks of the Estuary and its surrounds consist of clays, mudstones, sandstones and limestones, ranging in age from Ordovician to Jurassic, and represent past marine and terrestrial environments.

During the late Permian and Triassic, the 'mountains' formed by the folding of the Carboniferous Limestone were weathered down to form low hills in an arid landscape. Eventually the hills were submerged beneath an extensive desert lake which was then inundated by the Jurassic sea. Limestones, clays and sandstones were deposited over the region during the Jurassic and Cretaceous. During the Tertiary, western Britain was uplifted by events related to the opening of the Atlantic. This resulted in the stripping off of much of the Cretaceous and Jurassic cover, leaving low-lying areas on which soft Jurassic clays and Triassic marls now outcrop and commonly form and surround the broader parts of the funnels of the Estuary.

The resistant Carboniferous Limestone now forms many of the east-west trending hills and ridges which surround the Estuary and provide the headlands and islands (Brean Down, Steep Holm, Flat Holm, and Sully Island) which contribute to the Estuary's funnel shape. The lower reaches of the River Severn flow over non aquifer Triassic Mercia mudstone group strata and Jurassic Lower Lias clays. The Cotswold escarpment (Jurassic Limestones) delineates the watershed.

More recent Quaternary deposits lain down over the past two million years have served to provide the drift geology coverage for the area. These typically consist of riverine alluviums, peats and marine clays together with glacial deposits of sands clays and gravels. High sea levels during the Quaternary interglacials were responsible for many of the coastal features fashioned out of bedrock, while sand and mud were deposited in the low-lying embayments (e.g. Wentlooge, Caldicott and Somerset Levels). Reworked glacial sediments have also been deposited in the main Estuary flats.

### 7.5.3 Geomorphology

Geomorphology is the study of the landforms and the continuing natural processes that have created the physical environment we see today. Coastal and fluvial geomorphological processes shape the landscape and river channels by eroding, transporting and depositing sediment. Changes in the way sediment is created, transferred and deposited in one area can result in geomorphological changes elsewhere, and can influence present and future erosion and flood risk. We need to consider geomorphology within the SMP2 because an understanding of coastal and estuarine processes is critical to achieving sustainable flood risk management, and a diverse and healthy environment in terms of habitats and ecology.

Sediment erosion, transport and deposition processes are controlled by factors that govern the balance between water and sediment inputs to any length of river or coastline. These factors include geology, topography, soil type, climatic trends, land management practices, sediment size, structure of the bed and bank materials, valley floor slope, and the channel morphology. These factors together determine the distribution of energy at different flows and hence the energy available to transport sediment.

**Sediment and Morphology**

A summary of key morphological characteristics for the Severn and its main tributaries is provided below:

The River Severn ranges from a fluvially dominated channel (less than 50m wide) downstream of Gloucester to a predominantly tidally dominated channel that is over 8,000m wide at Avonmouth. The dynamic nature of the estuary is partly due to its large tidal range, reaching in excess of 14.5m at Avonmouth at spring tide. The estuary has the second largest tidal range anywhere in the world. This means that large volumes of water enter the estuary, often at high speed, and rapidly change the estuary's physical character through erosion, deposition and sediment transport. Some reaches within the estuary are eroding rapidly as a consequence, for example erosion at Cone Pill is currently up to 5m/year.

The existing shoreline of the estuary is very varied with mudflats, sandflats and saltmarsh fronting an alluvial backshore. Some higher ground of easily eroded sandstone and limestone is present between Clevedon and Portishead and again at Aust (near the first Severn Bridge).

The shape (cross-section and plan form) of the Severn Estuary is determined by the underlying geology. Zones of harder Silurian, Devonian and Cambrian rock are interspersed with softer

Triassic Marls and Mudstones. The varying rates of erosion experienced by such rocks has led to a series of tight meander bends and exposed limestone cliff, for example at Aust. These are interspersed with larger, flatter embayments filled with estuarine muds and fine sands, for example at New Grounds (Slimbridge). The estuary and the coastal floodplain is a dynamic environment that is constantly evolving by both natural processes, including sediment deposition and erosion, and by human influences such as the reclamation of land.

The lower Severn is funnel shaped and orientated in a south-west to north-east direction. Areas of resistant bedrock hold the funnel shape for example at Sudbrook, Beachley and Aust. The funnel shape of the estuary concentrates large volumes of flow from the Bristol Channel into an ever-decreasing width of channel, and so accentuates the tidal range so that the estuary experiences the 'Severn Bore' or tidal wave, associated with rising tides. The tidal wave moves at the front of the rising tide and can rise to 2m high and travel at 16km per hour. This is a local phenomenon and tourist attraction.

The Lower Severn estuary has been experiencing tidal inundation throughout the Holocene, which has caused the estuarine system to move slowly inland as a result of sea-level rise. The estuary has also widened due to the increasing amount of tidal water in the system.

**Coastal and Estuarine Processes**

An extensive amount of work has previously been carried out analysing the geomorphological processes both within the wider Estuary and focussing on the estuary fringes. Whilst a large number of studies have resulted in generally accepted conceptual sediment transport models of the Severn Estuary, detailed prediction of the natural evolution of sandbanks, mudflats and saltmarsh over time is difficult and prone to large uncertainties, as highlighted by the Severn Estuary CHaMP (ABPmer, 2006).

There is a recent history of continuing coastal erosion of beaches and salt marshes which are natural/soft coastal defences. The natural shoreline movements are now largely curtailed by artificial defences against the continuing threat of erosion.

The coastal processes of erosion, deposition and flooding are driven by natural forces acting on the materials forming the bed and sides of the estuary. These natural forces are:

- tides and currents;
- winds and waves;
- meteorologically driven surges;
- flood water flows down rivers.

The estuary is subject to a great tidal range and also to fairly strong currents. Seaward areas tend to be dominated by tides and waves whilst upstream areas are dominated progressively by fresh water flow and the incidence of river flood waters. Flooding in seaward areas depends on the joint occurrence of high waves occurring at times of high water levels at spring tides, either from the tide alone or from the contribution of tide and surge. Flooding towards the head of the estuary depends on the joint occurrence of high flood discharges at the time of high water levels - waves are less of a problem but in downstream areas are still of significance.

The sediment budget of the estuary is a balance between the inputs and outputs of the fluvial system. Studies undertaken for the Severn Coastal Habitat Management Plan (ABPmer, 2006) suggest that the main sediment source for the Severn Estuary is from the river systems including the Wye, Avon, Usk and Severn itself. Minor sources of sediment come from minor cliff recession and other forms of erosion making up a total sediment source of between 4.16M to 5.4M tonnes a year. Some of this sediment is deposited in the system in the form of saltmarsh and mudflat accretion and subtidal deposition in the Newport Deep, this amounts to between 1.06 to 2.06M tonnes a year. However large amounts of sediment (30M tonnes per year) are being transported within and through the system.

Current understanding indicates that in the short term (up to year 2028) the predicted geomorphological evolution along the estuary fringes for policy units PEN1-2, CAR 1-2, WEN 1-2, CALD1 and BRIS 1-3, PORT 1-4, KIN 1-4 is marginal erosion (a loss of saltmarsh of 10-30%), although there is local evidence of intermittent accretion. For TID1-2, GLOU 1-8, MAI 1-5, SHAR 1-8 and SEV 1-6 the short term trend is for both marginal erosion and accretion (±20% variation in saltmarsh coverage). In the medium to long term (2058 and 2108) uncertainties significantly increase. In relation to flood risk, virtually all flood defences are predicted to have structurally failed due to degradation under the Do Nothing scenario after the year 2058.

**Human Influence**

Man has influenced the geomorphology of the rivers within the Severn Basin in a number of ways including:

- Construction of structures that alter flow and deposition of sediment e.g. navigation weirs such as at Gloucester and the Cardiff Bay Barrage; these have all had an effect on the sediment budget. The completion of the Cardiff Bay Barrage in 1999 has changed the lower reaches of the River Ely from a tidally dominated system to a fluvial system. The barrage governs flow and level in the lower parts of the catchment and has altered the channel processes and geomorphology.
- Change of land use along the edge of the estuary which affects bank stability and influences the amount of sediment entering the system. Soil that is grazed or susceptible to trampling by animals can be less resistant to erosion and wash into watercourses following heavy rain.
- Draining land that would otherwise have flooded by constructing channels, re-routing watercourses or by pumping water away. e.g. the Gwent and Somerset Levels.
- By constructing flood defences or hard bank engineering which reduces natural interaction with the floodplain. This can increase water conveyance and energy and cause erosion of natural features.
- Navigational or maintenance dredging is undertaken around ports to maintain a deep enough channel for ships such as at Bristol, Cardiff, Newport and Sharpness. In addition, dredging for mineral and aggregate extraction takes place. In terms of the latter, an estimated 1.5M tonnes per year is extracted from the Severn Estuary. Dredging can remobilise sediment within the estuary system and may increase erosion as the estuary tries to rebalance the sediment budget.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Marine and estuary aggregate removal for channel maintenance around ports such as Bristol, Cardiff, Newport and Sharpness will continue as there is likely to be net accretion of these aggregates, so an ongoing requirement for dredging.

If no work is undertaken all defences are likely to have structurally failed due to degradation in the medium term (that is by the year 2058).

There is a risk of marginal erosion along some parts of the estuary; no significant erosion is predicted

**Environmental Issues Constraints and Opportunities**

Coastal management has the potential to affect natural processes along the frontage. The strategy will seek opportunities to maintain and restore natural processes along the coast.

## 7.6 Land Use and Land Management

The character of land cover and different types of land management practices influence how floods are generated, where and when they may occur and how much damage they cause. This is because land use and land management can have a significant effect upon rainfall runoff and infiltration rates.

Land use affects the amount of rainfall that runs off the land. For example, urbanisation, intensive agriculture or short vegetation tends to increase run-off rates, whilst forest cover can increase interception and the ability of the ground to absorb rainfall, thereby decreasing run-off. Land use can be greatly affected by humans. Changes in land management have the potential to disrupt natural flow paths and flood storage patterns. This may take the form of faster and increased runoff from deforested fields or loss of floodplain to housing developments. It is also possible for human actions to work in harmony with nature, in the creation of wetland environments and by reconnecting floodplains where flood defences are no longer considered appropriate.

There are significant areas of residential, commercial and industrial development at Avonmouth, Weston-Super-Mare, Gloucester, Lydney, Clevedon, Cardiff, Newport and Chepstow. Development in floodplains, even behind flood defences can significantly increase flood risk as defences rarely exclude all magnitudes of flooding. Urban areas may also be at risk of flooding from inadequate drainage systems resulting in surface and groundwater flooding.

Most of the study area is rural, with agriculture being the major land use. Pasture still dominates, but its extent has reduced in recent years due to increasing conversion to arable farming. Agricultural land use is interspersed with patches of woodland, and remnants of old orchard systems.

Since Roman times, land has been reclaimed from the estuary and drained for agricultural purposes. This has led to a complex pattern of man-made drainage channels (also known as reens or rhynes) in many areas. Some of the land that is now drained is below mean high-water level, and would otherwise flood, but due to the location of flood defences and drainage ditches, the land is available for agricultural use. Internal Drainage Boards within the study area manage the drainage of this land.

Defra classifies agricultural land into five grades, based on climate, land gradients, aspect, flood risk and underlying soil characteristics, with Grades 1 to 3a being considered the ‘best and most versatile’ soils. Over 87 per cent of agricultural land within the SMP2 study area is Grade 1 to 3 classification (very high to high quality agricultural land). There is continued financial pressure for farmers to diversify their activities, such as providing facilities for commercial re-use, recreation and tourism with a view to increasing their income, and to provide for public access. Conservation initiatives may also be a source of income, whilst providing positive help for farmers to conserve and enhance wildlife. These measures are positively encouraged by Government initiatives.

Other businesses depend on the rural environment independent of farming practices, such as those associated with tourism and leisure activities. It is essential to ensure that they are conducted in sympathy with the rural character of the Estuary.

Due to the risk of regular fluvial and tidal flooding, much of the estuarine land is defended by formal and informal structures. Many of the more recent formal structures have been constructed and are maintained by the Environment Agency, but farmers, private estates and industrial depots have also constructed local defences. In the main, the defences comprise earth embankments, some with stone pitching to withstand erosion, but there are also concrete and stone defences.

### Welsh Agri-Environment Schemes

A number of agri-environmental schemes are run by the Welsh Assembly Government; the flagship scheme is Tir Gofal. The scheme was established in 1999 as an integral part of the first Rural Development Programme for Wales. It is a whole farm scheme and is available on farmed land throughout Wales. It rewards farmers for caring for the environmental, historical and cultural features on their land and is designed to support the farming community in protecting and enhancing the environmental and cultural landscapes of Wales. It provides the opportunity to encourage landowners to pursue more sustainable land use management across the whole farm, protecting and enhancing terrestrial habitats and features.

The Tir Gofal scheme sits within Welsh Assembly Government's wider Tir Cymru programme which also includes Tir Cynnal, Tir Mynydd, The Better Woodland for Wales and Organic Farming.

The Welsh Assembly Government is also currently piloting a project to give advice and support to farmers on a catchment basis to improve the environment and reduce their impact on local streams, rivers and lakes. The project includes guidance on manure and nutrient management, free soil analysis and other technical advice and funding for capital work to reduce run-off and erosion. A whole range of other issues will be supported including;

- managing livestock access to streams etc;
- separating clean and dirty water;
- improving slurry-handling facilities.

### English Agri-Environment Schemes

The Rural Development Programme for England includes support for conservation and improvement of the rural environment, largely through the Environmental Stewardship Scheme, which provides funding to farmers and other land managers in England who deliver effective environmental management on their land. Its primary objectives are to:

- Conserve wildlife (biodiversity);
- Maintain and enhance landscape quality and character;
- Protect the historic environment and natural resources;
- Promote public access and understanding of the countryside;
- Natural resource protection.

Within the primary objectives it also has the secondary objectives of genetic conservation and flood management.

UK agriculture has been subject to some significant changes in the past five years.

- Common Agricultural Policy (CAP) reform largely delivered by agricultural subsides and incentives has resulted in some areas of land being removed from agricultural production and the reallocation of grazing land to arable use.
- Variations in wheat prices has influenced farmers cropping choice and amount of land in production (agricultural land prices have also increased);
- cultivation of crops for biofuels;
- increased cultivation of genetically modified (GM) crops and
- changes in set-aside legislation.

Land use management has a role to play in controlling future run-off, controlling diffuse pollution and mitigating the effects of climate change. It is important that our policies and actions for managing future flood risk are aligned with existing and future agri environment policy.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Without intervention, the risk of coastal and fluvial flooding of agricultural land is expected to increase with the predicted effects of climate change.

Drained land such as the Gwent and Somerset Levels is likely to be continued to be drained in the future for agricultural purposes, and because of European and National designations which are in place to conserve habitat and species which are present at specific sites. However sites will be at increased risk of coastal flooding in the future.

The nature and type of future agricultural production is uncertain; political drivers include increased emphasis on self sufficiency in food production, use of land for production of bio fuels and fluctuating prices of wheat and land.

**Environmental Issues Constraints and Opportunities**

Environmental stewardship schemes will continue to promote good agricultural practices which protect soil and biodiversity.

A requirement to maintain viability of agricultural land in the context of changing political/ economic drivers and sea level rise

The strategy will seek opportunities to maintain natural processes along the coast. The management of estuarine features and adjoining land, including the re-establishment of wetlands and traditional grazing regimes, is important.

## 7.7 Water

### 7.7.1 Surface Water Quality

Water quality in the catchment is important for potable water supply, maintaining fisheries and recreation and for aquatic and riparian habitats.

Inputs to the Estuary that affect water quality include sewage effluents, abandoned mines, diffuse runoff from agricultural and forestry activities, industrial effluents and marine vessel discharges. Much of the heavy industry in the Estuary area is centred around Avonmouth and between Newport and Barry in South-East Wales. Most of these process facilities are large and are located on the Estuary to take advantage of water available for cooling and the high dilution available for large volume trade effluent discharge into the Estuary. Contaminated land, industrial facilities and those subject to the COMAH (Control of Major Accident Hazards) 1999 all have the potential to pose a risk to water quality.

The water quality of the Estuary is controlled by UK legislation, including that derived from International conventions and EC Directives and implemented via UK Regulations. In the future, management and monitoring requirements are likely to be determined by the implementation of the EC Water Framework Directive. Under the Directive there is a requirement to:

- prevent a decline in quality and achieve good chemical and ecological status in surface water by 2015;
- achieve good ecological potential in heavily modified water bodies by 2015.

At present the Environment Agency monitors the quality of the Estuary to assess compliance with the Environmental Quality Standards (EQS) stipulated by the EC Dangerous Substances

Directive. The Environment Agency also monitors designated bathing waters in line with the EC Bathing Water Directive (1976). Many of the industrial effluent discharges will fall under the Pollution Prevention and Control (PPC) Regulations which require continued reductions in specific contaminants released. The River Wye is also designated as a sensitive area under the European Urban Wastewater Treatment Directive due to high levels of nitrates. Where waste water is released to these areas, it must undergo a secondary treatment in order to reduce its impact on the environment.

The legislation above and policy drivers (such as Catchment Sensitive Farming (CSF) Initiatives are likely to result in further improvements in water quality over the next ten years and beyond. However, flood and erosion risk management at the strategic level presents limited scope to directly improve water quality, although, initiatives such as CSF may present opportunities to work with others to achieve this objective.

### 7.7.2 Groundwater Quality

Groundwater provides vital resources for public supply, industry, agriculture and for numerous rural communities. They also feed rivers and support wetlands. If groundwater becomes polluted it is extremely difficult to clean up. The Environment Agency has published groundwater vulnerability maps for England and Wales. In addition Source Protection Zones (SPZ) have been identified for groundwater sources used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution and underpin the Environment Agency's Groundwater Protection Policy. Issues potentially affecting groundwater quality within the study area include:

- tidal influence within coastal areas could result in saline intrusion into freshwater bodies;
- increased levels of nitrate and phosphates in agricultural areas;
- contamination from industrial land use or landfills.

### 7.7.3 Water Resources and Surface Water Management

Abstractions from the main rivers flowing to the Estuary and from the Estuary and associated tidal stretches of rivers include:

- major abstractions direct from the Estuary for cooling water for power stations. This water is returned rapidly to the Estuary;
- large abstractions from the rivers Severn, Wye and Usk for public water supply;
- a major abstraction from the Severn at Gloucester by British Waterways in order to feed the Gloucester Sharpness Canal and the abstractions from it, including a large abstraction for public water supply by Bristol Water Company at Purton.

Estuary processes such as salt-water intrusion and the landward movement of sediment can affect abstractions near the tidal limit. A recent operating agreement with British Waterways was put in place to modify the pumping regime from the Severn to the Gloucester-Sharpness Canal from the East Parting at Gloucester, so that the amount of water taken during adverse conditions is reduced.

In addition to the main rivers within the study area, there are also numerous drainage ditches (also known as reens or rhynes) bisecting the low lying land adjacent to the estuary. The smaller reens and watercourses on the levels are maintained by the relevant Internal Drainage Board; they also regulate water levels and carry out maintenance on behalf of the Environment Agency on a rechargeable basis.

The reens typically have flap vales on them and are subject to a tide lock period of up to 4 hours on every 12 tidal cycle. The watercourses within the levels (i.e. behind the defences) are largely oversized trapezoidal channels, maintained to store peak flows of water when the tidal flap

valves cannot discharge to the estuary during high tide. They are not routinely subject to tidal inundation, and are predominantly freshwater habitats, except where saline intrusion occurs on a periodic or regular basis creating brackish habitats.

The drainage boards undertake annual maintenance of all their adopted watercourses which typically consists of flail mowing the banks twice a year and weed clearance typically once a year dependant on weed growth. In addition, major re-profiling of the ditches is undertaken once every 5-7 years.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Climate change will increase the risk of flooding water supplies and treatment facilities along the estuary; there is also an increased risk of pollution or salinisation of freshwater bodies and water resources.

The need to meet Water Framework Directive water quality objectives for water bodies, and for all inland and coastal water bodies to reach 'good ecological status' in the future will lead to measures being taken to improve surface water quality in the medium to long term.

The Environment Agency will continue to monitor water quality and regulate abstraction and discharges into surface and ground waters. The Environment Agency's work is expected to result in improvement in the water quality of failing waterbodies in the catchment and the maintenance of, or a steady improvement in good and very good quality waters.

Many of the surface and groundwater sources within the study area are already classed as having no water available, being over-licensed or over-abstracted. This is unlikely to change in the future, as there will be increased demand for water as population grows within the area. Changes in rainfall patterns predicted with climate change could further reduce the availability of water resources.

**Environmental Issues Constraints and Opportunities**

The Strategy will seek to maintain or reduce flood risk to water resource, supply and treatment assets from coastal flooding.

The Strategy will consider the implications of policy options and strategic measures on water quality.

The Strategy should not impact on the abstractions from the Severn Estuary or its tributaries.

The Strategy will seek to minimise the risk of saline intrusion into important freshwater bodies.

Past current and future land use has the potential to affect water quality.

## 7.8 Air and Climate

The implications of climate change for flood risk and coastal erosion have been discussed in Section 1.3. The SMP2 will take the most up to date climate change predictions into account when identifying policies and strategic options for the future management of the coast.

The SMP2 will not have a significant effect on air quality at a regional level. The effects of SMP2 policy on air quality would be considered further at project EIA stage

**Likely Evolution of the Baseline without the Implementation of the Plan**

Climate change is predicted to result in increased storminess and combined with sea level rise is likely to result in more frequent and severe incidences of coastal flooding.

Increased rainfall in the winter is likely to result in increased river flooding and reduced summer

rainfall increases risk of flood conditions in summer months.

Without intervention, climate change is expected to increase the risk of flooding and erosion to people, property, the natural environment and other assets within the study area.

Further measures (including improved treatment technologies and policy changes) are likely to be in place to reduce greenhouse gas emissions in the future.

**Environmental Issues Constraints and Opportunities**

Climate change is likely to increase tidal flood risk in the Severn Estuary. Flood risk is exacerbated in low lying areas where increases in sea level can inhibit land drainage.

The selection of strategic options must account for the predicted effects of climate change and sea level rise and aim to adapt to these changes. It is important that CFMPs, the SMP2 and FRMS are fully integrated.

Option selection should seek to reduce the potential to contribute to climate change through the production of greenhouse gases through construction and operation of individual schemes.

## 7.9 The Historic Environment (Cultural Heritage)

The Severn Estuary is a phenomenally rich and varied archaeological landscape. It is perhaps the most archaeological significant estuary in Europe. People have been living in this area since before the Severn Estuary was formed in the Mesolithic, some 8,000 years ago, when rising post-glacial sea levels saw the inundation of low lying ground. Evidence of early human activity is preserved in the mud-flats and inter-tidal zones of the Gwent Levels and Somerset Levels, including the footprints of Mesolithic children. It is the wet and waterlogged conditions of much of the Severn Estuary area – in particular its rich peat deposits – buried under later alluvium that has led to the preservation of so much archaeological material. Evidence includes Bronze Age settlements and trackways, Iron Age villages, houses and trackways, Romano-British farmsteads and land drainage, medieval fishtraps, rheens/rhines (drainage ditches) and sea walls, post-medieval drainage and land reclamation, enclosure landscapes, as well as later activities that have shaped this landscape, including agriculture, industry, urban expansion, communication, tourism and defence. Palaeo-environmental evidence is particularly significant due to the extent of its survival in this area.

The River Severn meanders over a course that has altered over time; areas that are now well inland may once have been inter-tidal with huge potential for archaeological deposits; much of this land has been reclaimed from the river. Furthermore maritime areas also contain archaeological remains, including shipwrecks, artefacts, submerged landscapes and World War II aircraft crash sites. The Severn has a rich maritime heritage, including the remains of boats at Newport (medieval), Barland's Farm (Roman) and Caldicot (Bronze Age). It is not simply the route and former course of the river that is significant: The adjacent Levels are an essential element of the Severn landscape that contain archaeological remains arising from the activities that took place along the river such as industry, farming, transportation, settlement, and the way of life of the people living on its shores.

The built heritage of the Severn Estuary is defined predominantly by the history, function and development of its major urban centres and use of vernacular traditions and materials in more rural areas. Gloucester, with its Roman origins and later industrial significance, includes a diversity of building types, styles and materials, reflecting its strategic position at the head of the estuary. Other settlements, such as Newport, Cardiff and Penarth reflect the predominance of industry in Wales in the 19$^{th}$ and early 20$^{th}$ centuries, and include examples of industries, docks and workers housing. Clevedon, Weston-super-Mare and Burnham-on-Sea reflect the growth of tourism and the popularity of sea-side resorts, characterised by villas, piers and promenades. There are also thousands of other smaller historic houses and buildings (many of which are designated Listed Buildings) within the more rural areas of the Study Area. These reflect the

development of housing and settlement in both England and Wales, illustrating the use of vernacular materials and styles and the later influence of imported materials.

The 20th century influence on the Severn Estuary was considerable. Mass communication by train and car replaced shipping as the predominant form of transport. Prominent aspects of the landscape were appropriated for defence during World War II. Large scale industries developed along shore close to the major port at Avonmouth. The two islands in the estuary (Flat Holm and Steep Holm) also reflect the importance of the waterways for safe shipping, communication and defence in first the 19th and later 20th centuries.

### 7.9.1 Scheduled Monuments

There are approximately 107 Scheduled Monuments within the Study Area. These include the most prominent, best conserved and significant monuments and features. However, they represent only a small proportion of the entire archaeological record of the Severn Estuary (nationally, only 6% of all archaeological features and deposits are protected through scheduling). Those that are scheduled comprise earthworks or masonry remains, including Neolithic and Bronze Age barrows, Iron Age hill forts, Roman sites, a short length of Offa's Dyke, Norman and later motte and baileys and castles, medieval moated settlements and religious sites, historic sea defences and twentieth-century military structures. Scheduling to date has not included areas of inter-tidal or palaeo-environmental deposits.

### 7.9.2 Listed Buildings

The total number of Listed Buildings with the Study Area runs into the thousands. The greatest concentrations of Listed Buildings are those within the larger towns and villages found within the Study Area: Gloucester, Berkeley, Thornbury, Clevedon and Weston-super-Mare on the English side, and Newport, Cardiff Bay and Penarth on the Welsh. Gloucester, Berkeley, Thornbury and Newport have medieval or earlier origins, and many of the Listed Buildings date to the medieval and early post-medieval periods (i.e. dating from the 13th/14th centuries through to the 18th/19th centuries). Clevedon and Weston-super-Mare largely owe their development to the growth of sea-side tourism in the 19th century. Cardiff Bay and Penarth developed as a result of industrial expansion in the 19th and 20th centuries. Newport is also significant for its industrial heritage.

There are many other single Listed Buildings or clusters of Listed Buildings within the Study Area. These relate to individual houses, smaller villages and hamlets within predominately rural settings, and are mostly domestic in origin and purpose, reflecting the vernacular traditions and materials of different areas (i.e. stone, timber framing, brick, thatch) as well as the influence of imported materials and styles (i.e. slate, engineered brick, dressed stonework, etc).

### 7.9.3 Conservation Areas

Most of the large groupings of Listed Buildings are also included within designated Conservation Areas and are a major contributor to the landscape character of the Severn Estuary.

### 7.9.4 Registered Parks & Gardens (England)

There are ten Registered Parks and Gardens within the Study Area. This is a non-statutory designation, but a material planning consideration under Planning Policy Guidance 15 (Planning and the Historic Environment).

### 7.9.5 Register of Landscapes, Parks and Gardens of Outstanding Historic Interest (Wales)

The Gwent Levels Historic Landscape of Outstanding Historic Interest in Wales is included within the Register of Landscapes, Parks and Gardens of Outstanding Historic Interest of Wales (No 17). This site falls within the SMP2 study area.

### 7.9.6 World Heritage Sites

There are no World Heritage Sites (WHS) within the study area.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Flood and erosion risk to the historic environment would be likely to increase.

Further developments within the floodplain and increasing tourism use are likely to put additional pressure on the historic environment.

**Environmental Issues Constraints and Opportunities**

As time passes the risk of erosion and/or flooding to some Scheduled Monuments and other archaeological sites will increase. The strategy will seek to minimise the significance of impacts on the historic environment.

The SMP2 will seek to sustainably manage and where appropriate conserve and enhance features of architectural, historical and archaeological interest in their setting.

The Severn Estuary is a phenomenally rich and varied archaeological landscape. The potential for unknown or unevaluated features existing is high

In delivering the SMP2 there will be opportunities to learn more about the heritage value of the estuary

## 7.10 Landscape and Visual Amenity

### 7.10.1 Landscape Character

The landscape is an important national resource and though subject to natural evolution and change, it must be considered in its current condition as a valuable resource for future generations. It is character that makes each part of the landscape distinct and gives it a particular sense of place. This section involves the identification of those features or combinations of elements that contribute to the character of the landscape, thereby enabling the special character and qualities of an area to be understood.

Landscape character assessments exist for different scales. These include, at the larger scale, the National Landscape Character Map of England sub-divided by Region into the more detailed Joint Character Area assessments prepared by the Countryside Agency and the local assessments prepared by County and District Councils. For the purposes of this baseline condition study the landscape character has been identified at a regional level.

**National Countryside Character (England)**
There are six Landscape Character Areas applicable to the English study area. These include;

105 Forest of Dean and Lower Wye
106 Severn and Avon Vales
118 Bristol, Avon Valleys and Ridges
141 Mendip Hills
142 Somerset Levels and Moors
146 Vale of Taunton and Quantock Fringes

**105 Forest of Dean and Lower Wye:** The Forest Dean and Lower Wye plateau opens out above the low-lying river valley of the Severn vale to the north of the study area. This area is characterised by a rolling, agricultural landscape of medium sized arable and pasture fields bound by hedges, and intermittent trees, and fragmented coniferous plantations. There are

prominent views toward the rolling hills of Monmouthshire to the north and west and over the Severn to Cotswold ridge in the east.

The character of the Forest of Dean and Lower Wye in relation to the Severn Estuary includes the confluence with the River Wye, noted for its designated status under an AONB, although this area does not fall within the study area, the context of the Wye Valley in relation to the study area is an important element to consider as the AONB is described as being one of the finest lowland landscapes in Britain.

**106 Severn and Avon Vales:** The Severn and Avon Vales is characterised by an open riverside landscape with fragmented woodland and low lying valleys of the Severn and Avon rivers. In the east, there is a distinct boundary against the Cotswolds, in the west, the edge of the Forest of Dean confines the Severn Vale to narrow riverside levels. South of the City of Gloucester the Severn is a unifying feature drawing together the surrounding network of fields. As the Severn gradually broadens out into the estuary it is a dominant feature, flanked on both sides by the slopes of the Forest of Dean to the west and the Cotswold escarpment to the east.

The Severn and Avon Vales are further characterised by expansive floodplains, open farmland and prominent views of surrounding hills at the edges of the study area – including the Cotswolds, Bredon and the Malverns. On the west bank of the Severn, small villages sit on the edge of steeply rising agricultural land. The southern section of the area is characterised by the industrial sites of Avonmouth and the estuary power stations at Berkeley and Oldbury which dominate the landscape setting.

**118 Bristol, Avon Valleys and Ridges:** This character area occupies a limited section within the eastern boundary of the study area and includes the limestone ridge east of Thornbury, contrasted by the low-lying, Severnside levels to the west. The area further south encompasses the urban areas of Portishead, Clevedon and Nailsea. South west of Bristol the area is bound by the Mendip Hills and the Severn side levels extending from the Severn and Avon Vales.

**141 Mendip Hills:** The western extents of the Mendip Hills character area occupy a relatively small section of the study area. The Mendip Hills provide expansive views across the flat landscape of the Somerset Levels and Moors to the west. In the south west of the area the landscape narrows towards the rough grassland ridge at Brean Down. Beyond the coast the limestone islands of Flat Holm and Steep Holm rise from the Bristol Channel and are visible for long distances from lowland Somerset and the coastline of South Wales.

**142 Somerset Levels and Moors:** This character area occupies a large section of the study area including the coastline between Clevedon and Burnham on Sea, including Stolford village. The area is characterised by the flat, open landscape of pasture and wetland divided up by ditches (known as rhynes or reens) which co-exist with the sea wall structures, sluices and pumping stations. The seasonal flooding across large areas of the levels creates a distinctive transient characteristic to this landscape. The Somerset levels around Bridgwater Bay and Parrett estuary abut areas of extensive mudflats, sand dunes stretch northwards to Brean Down, where caravan parks and camp sites are prominent features.

**146 Vale of Taunton and Quantock Fringes:** To the west of the Somerset Levels and Moors the study area extends into the north eastern fringes of the Vale of Taunton area. This area is characterised by an open and rolling landscape comprising fragmented settlements with individual trees and blocks of wet pasture descending onto the remote coastline of Bridgwater Bay. The power station at Hinckley Point is a prominent landmark on the shoreline, with views of Steep Holm and Flat Holm and beyond to the Welsh Coast.

### Countryside Character (Wales)

The terrestrial landscape character of Wales is assessed through the Welsh Assembly Government, compiled by Landmap, whereby information about the landscape is gathered,

organised and evaluated into a nationally consistent data set based on Cultural, Historical, Habitat and Visual/Sensory elements. The approach undertaken by Landmap evaluates the classification of distinct Aspect Areas, which differs to that of the Countryside Agency's classification of the landscape character of England into numerically classified character areas, as outlined above.

Although not all of Wales has been mapped, (i.e.; the Cities of Cardiff and Newport), the areas that have been classified to date show a diversity of landscapes.

The Landmap classification identifies the study area as a landscape that is distinctly estuarine with open expanses of valued salt marsh and mudflats The open estuarine landscape provides dramatic long distance views of the wider Severn Estuary with the backdrop of the English coast; however these views are interrupted by the prominent Severn bridges and infrastructure associated with the transport corridors and electrical pylons which flank the coastline. The Gwent Levels are noted for their national significance, as the largest levels system in the UK.

The baseline review of available information identifies the landscape of South Wales as far more fragmented than that of the English area, with a distinct transition from the low-lying estuarine levels to the rolling open lowlands surrounding the conurbations of Cardiff and Newport. Also of note is the strong distinctive character of the meandering River Wye and its context as part of the lower tidal reaches of the Wye Valley (AONB). Penarth forms the western extents of the study area, and is identified as a suburb of Cardiff, characterised by its Victorian core and sea front.

In addition, a study to characterise the seascapes of Wales has recently been completed (White Consultants 2008). This will be reviewed in more detail as part of the SEA.

### County Countryside Character

Following a baseline review of the relevant county and district development bodies within the study area, the following authorities have carried out landscape character assessments and strategies, these include;

- Forest of Dean Landscape Strategy (Forest of Dean District Council, 2004) and Landscape Supplementary Planning Document (Forest of Dean District Council, 2007),
- Gloucestershire Landscape Character Assessment (Gloucestershire County Council, 2006),
- Stroud Landscape Assessment Supplementary Planning Guidance (Stroud District Council, 2000)
- South Gloucestershire Landscape Character Assessment Supplementary Planning Document (South Gloucestershire Council, 2005);
- North Somerset Landscape Character Assessment Supplementary Planning Document (North Somerset Council 2005),
- The Landscape Study of Cardiff (Cardiff County Council, 1999), and

### Landscape Designations

Landscape designations are applied to areas of special value at international, national, regional or local level in response to particular qualities or historical or cultural associations. These areas are generally considered to be of a higher sensitivity to change and therefore the potential effects and impacts of measures proposed for the Severn Estuary on designated landscapes

must be considered both independently and as contributors to sensitivity and ability to accommodate change.

### National Parks

Under the National Parks and Access to the Countryside Act 1949 both National Parks and Areas of Outstanding Natural Beauty (AONBs) were given legal designation to protect the countryside and to conserve and enhance their natural beauty. There area currently no National Parks or those pending designation within the study area.

In April 2008 the Government published the draft Marine Bill for consultation. The draft bill outlines the Government's commitment to introduce a new framework for the English coastline and contains provisions for improving access to the English coast. A consultation paper was put to the English National Park Authorities Association in September 2007 whilst Natural England published an outline of the scheme which it will use to decide where the new coastal access rights will apply at local level.

### Area of Outstanding Natural Beauty (AONB)

The Wye Valley AONB falls within the SMP2 study area and extends from Mordiford (approx 4km south east of Hereford) to Chepstow.

### Heritage Coasts

The baseline review of information has revealed there are currently no sections of Heritage Coastline designations within the study area.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Increase in tourism-related developments and activities may impact on the landscape.

Ongoing protection to wider landscape and character through the AONB designation.

The intensification of agricultural practices and changes in land use have the potential to affect the landscape character of the Severn Estuary.

Progressive pressure on developing land on the fringes of urban settlements has the potential to affect the landscape character of the Severn Estuary.

Under a scenario of continued climate change coastal landscapes are likely to change as a result of increased frequency and duration of inundation, resulting in amongst other things a change in vegetation composition; this is likely to be particularly significant in low lying areas where the land has been reclaimed and drained.

Potential for loss of trees, unimproved grassland and historic hedgerows due to agricultural intensification in areas outside of agri-environment schemes.

**Environmental Issues Constraints and Opportunities**

The SMP2 and subsequent FRSM will need to consider the impacts of policy options on the character of the landscape within the study area, as part of the optioneering process to ensure the implications of alternatives on the landscape and views are fully considered at the strategic level, and uncertainties and issues for further assessment at the project level identified.

In delivering SEA policies at the project level the Environment Agency and/or Local Authorities proposing schemes will be required to undertake a full assessment of the existing landscape character and quality, and identify key views within a study area. This baseline assessment will inform the landscape and visual impact assessment, EIA process, selection of preferred option and any mitigation that may be required.

The SMP2 will seek opportunities to identify, conserve and enhance landscape character and important landscape features such as wetland areas and areas of historical interest, whilst protecting their setting within the wider environment.

Diversion of coastal footpaths may be necessary along some stretches of coastline. This may have an impact on the landscape character or views.

## 7.11 Contaminated Land

Land that is contaminated includes any land where intense industrial activity such as chemical manufacturing, metal refining and finishing, steel production, old landfill sites, oil refining, oil storage and gas production has occurred. There are many of these sites around the Estuary.

Under the 2006 Contaminated Land Regulations (Si 2006, No 1380), Local Authorities are responsible for surveying their areas and identifying sites which may give rise to environmental or human health problems. Local Authorities and the Environment Agency will then discuss the nature of the sites and those that are designated as 'special' will become the responsibility of the Environment Agency. Sites will then have action plans to remedy the contamination.

**Likely Evolution of the Baseline without the Implementation of the Plan**

Contaminated land sites will be assessed by Local Authorities and those identified as high risk will have action plans produced to remedy the contamination by the Environment Agency.

Without intervention, climate change is expected to increase the risk of flooding and erosion to contaminated sites within the study area.

**Environmental Issues Constraints and Opportunities**

The Strategy will seek to maintain or reduce the risk of flooding at or near to sites which have contaminated land issues to reduce adverse water quality impacts.

## 7.12 Data Gaps and Uncertainties

The above provides an initial framework for assessing, monitoring and reviewing the SMP2, however there are inevitably areas where data is currently sparse or absent. Some of these areas include:

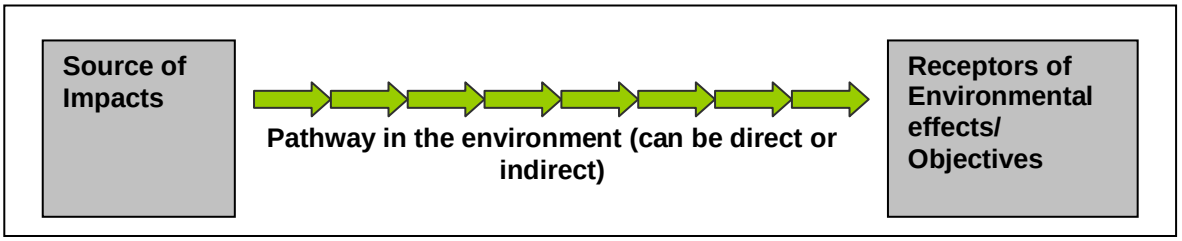
- coastal processes forecasting: coastal process within the Severn Estuary are complex and little understood, ongoing monitoring is required as outlined in the FMP in order to provide reliable data on coastal process which can be used with confidence in implementing flood management options.
- Infrastructure plans over the life of the SMP2: There are a wide range of plans and proposals, many of which are outside the direct influence of the Strategy teams, which could influence or be affected by flood risk and erosion management, as detailed in Annex A.

# 8. SEA Methodology and Approach

## 8.1 Methodology

The environmental effects of implementing the alternative policy options within each policy unit have been assessed using an evidence based expert judgement system and have been based on the Source – Pathway - Receptor model as shown in Figure 8-1.

**Figure 8-1 The Source-Pathway-Receptor Model as Applied to SEA.**




The source of impacts was determined by reviewing the policy options and was informed by our knowledge of the existing environment and predicted environmental trends. The pathways of impacts in the environment can be direct, for example habitat loss through land take or indirect through a number of links; for example, increased flooding over time affecting habitats or other features of interest. The pathways were again identified by expert judgement and consultation. The receptors for the SEA were identified as part of the baseline study and captured by the objectives and indicators.

The significance of potential impacts has been evaluated by taking account of the status and level of importance of receptors and the magnitude of any impacts.

Importance has been defined in relation to the scale of the impacts:

- International (at a scale greater than the UK)
- National (England or Wales or UK);
- Regional (Local Authority, groups of Local Authorities, Severn Estuary SMP2 study area);
- Local (Individual towns, villages or parishes or smaller).

Magnitude has been determined on the basis of vulnerability, sensitivity, spatial and temporal incidence of any impacts and ability of receptors to recover. In determining the significance of an impact experience and professional judgement has been used to derive an assessment of major/minor positive, major/minor negative or no impact (where it has been determined that no change from the current situation will occur). The Project Management Group (PMG) has been consulted on the determination of impacts and agreed the assessment. Each policy option has been appraised against the SEA objectives to determine an environmentally preferred option. This evaluation was then used as part of the wider SMP2 policy option selection process, which also took economics and future management requirements into consideration. In most instances, consideration of whether an objective is met is based on the predicted position (e.g.

the extent of retreat), form (e.g. existence of a beach) of the estuary shoreline or extent of flood risk and/or erosion from tidal inundation. In the majority of cases the environmentally preferred option is also the preferred SMP2 policy. However where the two differ, justification for the selection of the SMP2 policy option is provided.

The SMP2 outlines broad policy options to be adopted across each of the policy units, and many if not all of the policy options are likely to result in the identification of some potentially adverse effects. This does not necessarily mean that the policy is unacceptable, but that measures to avoid or mitigate these impacts will need to be identified in the SMP2 Action Plan or at the FRMS or implementation (project) stage.

## 8.2 Assumptions

In developing the SMP2 and assessing how different policy options perform against the SEA objectives, a number of assumptions have had to be made about what particular phrases (as defined within the Defra Procedural Guidance (Shoreline Management Plan guidance Volume 1: Aims and requirements and Volume 2: Procedures, March 2006) actually mean in the context of this SMP2. These assumptions are set out below with the reasons for decisions made and the consequences of those decisions. It should be emphasised that this SMP2 is unique in terms of it totally encompassing a European conservation designation, it represents the only totally estuarine SMP, has flooding (not erosion) as the dominant management risk and straddles two countries. For these reasons, the Guidance has needed to be clarified in places to accommodate this.

### 8.2.1 Property, Land Use & Human Health

The SMP2 considers the impacts on people, human health and land use over a large area and long time. Nationally important centres of population have been judged to be those containing more than 10,000 people within one area. With this criterion in mind, major centres of population include:

- Penarth
- Cardiff
- St. Mellons
- Newport
- Caldicot / Port Skewett
- Lydney / Allaston/ Chepstow
- Gloucester
- Quedgely
- Bristol
- Portishead
- Clevedon
- Yatton / Congresbury

Quedgely and Yatton / Congresbury are only partly within the SMP2 area, but as they contain more than 10,000 people, they are included as major centres of population.

### 8.2.2 Critical Infrastructure

Critical infrastructure is the transportation, communication and service features that are vitally important for the region and potentially difficult and costly to relocate. They include motorways, railways, large electricity power stations and large water treatment works. In some more rural areas where there is only one access road into / out of a location, this is also considered to be critical infrastructure, as there is no alternative route available (critical for emergency access and community well being etc). Critical infrastructure has been assessed as being a feature of national importance.

### 8.2.3 Agricultural Land

A large area of the SMP2 is agricultural land and its importance at a local, regional and national level is recognised. However there is no national policy or guidance on how important agricultural land is in making decisions about managing the risk of coastal flooding and erosion. Based on the lack of such guidance or policy, the SMP2 and SEA have not placed a national importance on agricultural land with the study area.

### 8.2.4 Nature Conservation

There are many designated nature conservation sites in the SMP2 area of local, national and international importance. The SMP2 considers the European sites within the study area and those outside, potentially affected by the SMP2 as being of international importance. This includes SACs, SPAs and Ramsar sites. Nationally designated sites such as SSSIs and NNRs have been assessed as being of national importance. Key Wildlife Sites (KWS) and LNRs have been assessed as being of local importance.

As the SMP2 is a high level document, impacts on biodiversity habitats and species have been made at a very broad scale. It is not practicable to assess biodiversity impacts within individual policy units to any level of detail, so generic assumptions have been made regarding habitats likely to be present and affected. Further assessments of the impacts of flood risk management on biodiversity features will be undertaken as part of the FRMS and the delivery of individual projects. This will ensure that significant adverse impacts are avoided or mitigated.

Where impacts on European sites have been identified as a result of active intervention e.g. due to a Hold the Line or Advance the Line policy this has been assessed as an adverse impact, largely due to the effects of coastal squeeze. In the case of No Active Intervention, natural processes will be allowed to continue to dominate and no adverse impacts are identified; however in some instances roll back of habitats may be restricted by high cliffs or natural geology. This impact is not a direct result of the SMP2 and the fact that natural processes are continuing to operate means the policy has been assessed as performing well against the relevant SEA objective. Therefore while effects that might be considered as adversely affecting the site might occur under this option, this will not be as a consequence of a the SMP2.

There will inevitably be impacts on the Severn Estuary European site, largely where a policy of Hold the Line in combination with sea level rise will result in loss of intertidal habitat. The HRA will quantify predicted habitat loss across the estuary. A separate project is being undertaken by the Environment Agency to identify potential habitats creation sites around the estuary to offset intertidal and other habitat loss. This is being undertaken in consultation with statutory and non-statutory nature conservation bodies.

### 8.2.5 Landscape Character & Visual Amenity

The Mendips AONB designation has been assessed as being of national importance. Other designated and non-designated landscape sites are not considered to be of national importance.

### 8.2.6 Historic Environment (Cultural Heritage)

The historic environment of the Severn Estuary is important. There is no clear guidance on how the historic environment should be prioritised when considering coastal flooding and erosion. Individual listed or scheduled structures occur throughout the majority of policy units and impacts on some features are inevitable. Where clusters of nationally designated features occur these have been assessed as being of national importance at a strategic level; in addition the Gwent Levels Historic Landscape Area has been considered to be of national importance.

### 8.2.7 Amenity & Recreation

The All-Wales Coastal Path and the intention to create a coastal path in England has been assessed as being of national importance. This is because national government in England and Wales has a clear policy in place in relation to these features. This shows that national government considers these recreational features to be particularly important in the management of the coast In addition the Severn Valley Way has also been assessed a being of national importance. Other recreational features have not been given the same level of importance.

### 8.2.8 Water Quality and Resources

The Severn River basin district relies on groundwater and rivers for drinking water. The main responsibility for implementing actions that secure sustainable use and availability of water falls on a number of different sectors, including the water industry, agriculture and consumers. Impacts on the water environment have being assessed as being of local importance.

A separate assessment of the compliance of the SMP2 policies with the Water Framework Directive (WFD) environmental objectives has been undertaken by the Environment Agency and the results of this assessment can be found in Appendix J of the main SMP2 Report.

### 8.2.9 Cardiff Bay Barrage

The SMP2 assumes that the Cardiff Bay Barrage remains operational throughout the entire SMP2 period (100 years) and operates as it was designed to. It does not consider risks associated with the failure of the barrage or its infrastructure. These assumptions are consistent with those made in the Taff and Ely Catchment Flood Management Plan (CFMP). This means that even under No Active Intervention (NAI), the Cardiff Bay Barrage prevents coastal flooding along its length during all three SMP2 epochs.

### 8.2.10 Flood Risk Management (FRM) Benefit

As a minimum a HTL policy will maintain the location and height of the existing defence line; this may in some instances result in an increased frequently of overtopping of defences; in others work may be undertaken to maintain or increase the standard of protection provided. In undertaking the SEA it has been assumed that adopting a HTL policy will maintain or increase the current standard of protection.

Managed realignment undertaken in the upper estuary is likely to provide both habitat creation opportunities and tidal FRM benefit. However moving downstream, the dominance of coastal and tidal process increases, which means that it would not be possible to provide storage for the volumes of tidal water that would move up the estuary under a tidal surge. It has therefore been assumed that any realignment undertaken downstream of Awre and Arlington will not provide any FRM benefit,.

## 8.3 Strategic Options

### 8.3.1 Policy Options

An initial brief review of all four generic Defra policy options was undertaken to determine which policies could be appropriate, considering not only the defined objectives but also their technical feasibility, and likely economic justification. In order to determine the likely economic justification, a broad assessment was made of assets potentially at risk under the baseline scenario No Active Intervention (NAI). The definitions of each policy option for this SMP2 are set out below:

#### Hold the Line (HTL) by maintaining or changing the standard of protection.

***Hold the Line (HTL)*** means keeping the line of the defence in approximately its current location. This may mean repairing or replacing defences. HTL may include some minor adjustment to the position of the defence to suit new defence structures and the particular engineering solutions developed when defences are designed. There are three ways in which HTL may be implemented:

- HTL to increase the amount of protection that the defences provide – this will mean changing the height, width or size of defences to cope with more severe floods than they do today. Using flood risk management terminology this means improving the ***Standard of Protection (SoP)***. It is sometimes referred to as an

***Improve*** policy in EA River or coastal strategy studies (e.g. the Severn Estuary Flood Risk Management Strategy (***SEFRMS***).

- HTL to counter increases in sea level rise and climate change impacts - this will mean changing the height, width or size of defences to cope with changes caused by climate change and sea level rise. Using flood risk management terminology this means maintaining the same ***Standard of Protection (SoP)*** as today. It is sometimes referred to as a ***Sustain*** policy in EA River or coastal strategy studies (e.g. the Severn Estuary Flood Risk Management Strategy (***SEFRMS***).
- HTL but not increasing the size of defences so that, as climate change and sea level rise impacts increase, the level of protection may gradually decrease and other actions may be needed to cope with the impacts of flooding (e.g. flood warnings, demountable defences, changes in building materials). Using flood risk management terminology this assumes the ***Standard of Protection (SoP)*** will gradually decrease over time. It is sometimes referred to as a ***Maintain*** policy in EA River or coastal strategy studies (e.g. the Severn Estuary Flood Risk Management Strategy (SEFRMS).

Whether or not a HTL policy means increasing the size of built defences or not is not considered at an SMP2 level. The decision on how a HTL policy will be implemented will be considered in more detail by the ***SEFRMS*** (see ***Section 1.5***).

A HTL policy does not guarantee funding for defence maintenance and / or capital works along these sections of the shoreline. All actions to manage the risk of flooding and erosion compete for a limited amount of funding. Decisions will have to be made on how to prioritise management measures.

**Advance the Line (ATL)**

The Advance the Line (ATL) policy option means reclaiming land from the sea by building new defences further seaward. This option assumes land reclamation and increased standard of protection from flooding and erosion to the current assets. Using this policy should be limited to those Policy Units where significant land reclamation is considered.

ATL is not considered to be a suitable policy choice in rivers/tributaries flowing into the Severn Estuary or in the Estuary upstream of Awre (upstream of the Noose). ATL would reduce the amount of water and the flood conveyance in these locations. This policy option could lead to greater flooding and / or increase erosion.

### Managed Realignment (MR)

Managed Realignment involves allowing the shoreline to move backwards or forwards, with management, to control or limit movement (such as reducing erosion or building new defences on the landward side of the original defences). The landward movement of defences, giving up some land to the sea to form a more sustainable defence in the long-term, may create additional habitat such as mud flats or saltmarsh, which provide natural flood risk management benefits.

Managed realignment is used where there is a need for continued intervention to achieve a specific outcome. It may arise from a series of different circumstances. The overall aim is that management of the shoreline would be improved by either allowing or creating the conditions for the coast to realign. One example of this is moving a linear flood defence back from the active coastal zone, providing a more secure position for defences, while also allowing the shoreline to adjust. In other cases the coast may be allowed to retreat before intervention is undertaken, which may create the opportunity to retain a beach in front of a set back hard defence. Managed realignment should also take account of how adjacent Policy Units function together.

For example, it may be that in one Policy Unit the policy is to hold the line and in doing so; the coast in an adjacent unit is allowed to function more naturally.

How and when a MR policy will be implemented, the location of the new line of defence and what the new defences will be built from will be considered in more detail by the SEFRMS. A MR policy does not guarantee funding for new realigned defences or their future maintenance along these sections of the shoreline. All actions to manage the risk of flooding and erosion compete for a limited amount of funding. Decisions will have to be made on how to prioritise management measures.

### No Active Intervention (NAI), where there is no investment in coastal defences or operations.

The No Active Intervention (NAI) policy option is based on assuming that no maintenance, repair or replacement of the existing defence structures takes place. It is a 'do nothing' scenario against which different policies can be tested. It is also a viable policy choice for some stretches of coast e.g. where there is a low risk of flooding or erosion now or in the future.

NAI does not mean that defences will be allowed to fail in an uncontrolled or unsafe manner. An NAI policy option will require defences to be monitored and may require some engineering works to be undertaken to ensure that the defences do not pose a threat to public health and safety. This may include minor repairs in some places or safe removal of defences in others.

Overall, the NAI policy option means that defences will gradually be removed, either manually to ensure the safety of the public, or through weathering, and will not be replaced. Information on the NAI assessment and the condition of the defences is contained in Appendix C of the main SMP2 document. A No Active Intervention policy can arise from two distinct sets of circumstances:

- The coast needs to be allowed to develop naturally. Typically, it may be that erosion of a frontage is providing sediment to other sections of the coast. It may, therefore, be important that the coast is allowed to continue to erode if sustainable intervention is to be achieved elsewhere.
- Where it is unlikely that operating authorities would provide funding for defence. In such cases, privately funded works may still be permissible but there may be conditions associated with this to ensure that private works do not result in negative impacts on other interests.

In setting policy there will be important caveats. There is undoubtedly uncertainty associated with behaviour of the estuary, in particular in relation to the ability to maintain defences in relation to the estuary's response to sea level rise. In addition to the above there are potential impacts on the important natural conservation interests that need to be considered. While the proposed management plan is realistic set against anticipated change this will need to be monitored and reviewed.

# 9. Environmental Effects of Alternatives and the Preferred Strategy

## 9.1 Introduction

As described in Section 8, the four SMP2 policy options have been assessed against the SEA objectives for each of the policy units, and the environmental effects identified have been recorded in a matrix for each option. Environmental effects were identified for the three SMP2 epochs. The matrices provide a detailed assessment of impacts resulting from each of the policy options, without mitigation, including an assessment of the relative significance of impacts for each of the four SMP2 policy options and can be found in Annex B of this report and Appendix F of the main SMP2 document. In order to provide additional context to the assessment process, maps summarising key features within each of the policy units and showing areas at risk under a No Active Intervention scenario are contained in Annex C of this report. The evaluation of the policies against the SEA objectives was used as part of the wider SMP2 policy option selection process, which also took economics and future management requirements into consideration.

## 9.2 Selection of the Preferred SMP2 Policy Options

The preferred SMP2 policy options have been identified through analysis of the options against environmental, engineering and economic criteria. In deriving the preferred option the Strategy has therefore considered for each option:

- Whether it will have an adverse or beneficial impact on the environment and whether it could provide opportunities to protect or improve the built or natural environment;
- How it would address the specific flood and erosion risk to people, property and critical infrastructure within each policy unit, now and in the future;
- Whether it is technically feasible; and
- What the economic costs are versus the benefit in terms of reducing damages to property and the risk to the population.

The preferred policy options produced for public consultation for each policy unit over the three epochs are summarised in the Table 9-1 below.

It should be noted that some policies have been amended as a result of the public consultation. The SEA has not been amended to reflect these changes. If the policy changes are considered to be significant, an addendum to the SEA will be produced and publicly advertised to ensure that stakeholders are aware of the changes. Any addendum produced will be made available on the SECG website, along with all the other SMP2 documents.

In addition, in accordance with Part 4 of the Environmental Assessment of Plans and Programmes Regulations 2004, a post Adoption Statement will be prepared to document the way in which the Severn Estuary Coastal Group have taken environmental considerations and the views of consultees into account in the adopted SMP2.

**Table 9-1 SMP2 Preferred Policy Options**

| Policy Unit | 0 to 20 years | 20-50 years | 50-100 years |
|---|---|---|---|
| PEN 1 | NAI | NAI | NAI |
| PEN 2 | NAI | NAI | NAI |
| CAR 1 | HTL | HTL | HTL |
| CAR 2 | HTL | HTL | HTL |
| CAR 3 | HTL | HTL | HTL |
| WEN 1 | HTL | HTL | HTL |
| WEN 2 | HTL | HTL | HTL |
| NEW 1 | HTL | HTL | HTL |
| NEW 2 | HTL | HTL | HTL |
| NEW 3 | NAI | NAI | MR |
| NEW 4 | HTL | HTL | HTL |
| NEW 5 | HTL | HTL | HTL |
| CALD 1 | HTL | HTL | HTL |
| CALD 2 | NAI | NAI | NAI |
| CALD 3 | HTL | HTL | HTL |
| WYE 1 | NAI | NAI | NAI |
| WYE 2 | NAI | NAI | NAI |
| WYE 3 | NAI | NAI | NAI |
| WYE 4 | NAI | NAI | NAI |
| TID 1 | NAI | NAI | NAI |
| TID 2 | NAI | MR | MR |
| LYD 1 | HTL | HTL | HTL |
| GLO 1 | NAI | NAI | NAI |
| GLO 2 | NAI | MR | MR |
| GLO 3 | NAI | NAI | NAI |
| GLO 4 | HTL | HTL | HTL |
| GLO 5 | HTL | HTL | HTL |
| GLO 6 | NAI | NAI | NAI |
| GLO 7 | HTL | HTL | HTL |
| GLO 8 | HTL | HTL | HTL |
| MAI 1 | NAI | MR | MR |
| MAI 2 | HTL | HTL | HTL |
| MAI 3 | NAI | NAI | NAI |
| MAI 4 | HTL | HTL | HTL |
| MAI 5 | HTL | HTL | HTL |
| MAI 6 | HTL | HTL | HTL |

| | | | |
|---|---|---|---|
| SHA 1 | NAI | MR | MR |
| SHA 2 | NAI | MR | MR |
| SHA 3 | HTL | HTL | HTL |
| SHA 4 | NAI | MR | MR |
| SHA 5 | NAI | NAI | NAI |
| SHA 6 | HTL | HTL | HTL |
| SHA 7 | NAI | MR | MR |
| SHA 8 | NAI | NAI | NAI |
| SEV 1 | HTL | HTL | HTL |
| SEV 2 | HTL | HTL | HTL |
| SEV 3 | HTL | HTL | HTL |
| SEV 4 | HTL | HTL | HTL |
| SEV 5 | HTL | HTL | HTL |
| SEV 6 | NAI | NAI | NAI |
| BRIS 1 | HTL | HTL | HTL |
| BRIS 2 | HTL | HTL | HTL |
| BRIS 3 | HTL | HTL | HTL |
| BRIS 4 | HTL | HTL | HTL |
| BRIS 5 | HTL | HTL | HTL |
| BRIS 6 | HTL | HTL | HTL |
| PORT 1 | NAI | NAI | NAI |
| PORT 2 | NAI | NAI | NAI |
| PORT 3 | NAI | NAI | NAI |
| PORT 4 | NAI | NAI | NAI |
| KIN 1 | NAI | MR | MR |
| KIN 2 | NAI | NAI | NAI |
| KIN 3 | HTL | HTL | HTL |
| KIN 4 | NAI | NAI | NAI |
| HOL 1 | NAI | NAI | NAI |
| HOL 2 | NAI | NAI | NAI |

Key

| | | | | | |
|---|---|---|---|---|---|
| MR | Managed Realignment | HTL | Hold the Line | NAI | No Active Intervention |

## 9.3 Option Selection and Impacts of the Preferred Strategy

As part of the SEA process, for each policy unit all the SMP2 policies have been assessed against the full range of the environmental objectives, to give an environmentally preferred option. A summary of the environmentally preferred option, the preferred SMP2 policy options

and key impacts, for each policy unit is provided below. Where the environmentally preferred option differs from the selected SMP2 policy option, justification for the decisions made is provided. A more detailed summary of all the impacts resulting from each of the SMP2 policy options can be found in Annex B.

One of the major potential impacts occurring across the estuary largely as a result of adopting a Hold the Line policy is the loss of intertidal habitats from within the Severn Estuary European sites. The Severn Estuary Flood Risk Management Strategy (FRMS) that is being developed by the Environment Agency includes work to create a Habitat Delivery Plan to identify replacement areas of habitat to compensate for any areas of EU protected habitat lost through coastal erosion and flood risk management. Initial findings suggest that enough areas for compensation can be identified within the SMP2 study area but more work is required to identify the most appropriate areas to create replacement habitat. The FRMS project will continue after the SMP2 has been completed. Additional mitigation measures are detailed within the text below and in Section 10 which summarises implementation and monitoring proposals for the SMP2.

### 9.3.1 Penarth Theme Area (PEN)

**PEN 1 - South of Forest Road: No Active Intervention** is the environmentally preferred option and the selected SMP2 policy for PEN1; there are no features at risk from current or future tidal flood or erosion risk. A policy of NAI will allow natural processes to continue to operate and designated sites will evolve as a result of these processes, a minor positive impact. No adverse impacts are likely to arise from the implementation of this policy in this location.

**PEN 2** - **Forest Road to Penarth Head:** Overall **No Active Intervention** is the environmentally preferred option and the selected SMP2 policy for PEN2; there are some features behind the existing defences at risk from current or future tidal flood risk from overtopping, but it is thought that these can be dealt with by actions other than HTL. A policy of NAI will allow natural processes to continue to operate and designated nature conservation sites will evolve as a result of these processes, a minor positive impact. There are however some features in front of the exiting defence line (including the pier, esplanade and lifeboat station) that may be at risk of increased overtopping and /or erosion in the long term (years 50-100), this impact has been assessed as a minor negative impact that would occur under any of the selected options; measures to manage and mitigate these impacts will be explored further by the relevant Coastal Group members.

### 9.3.2 Cardiff Theme Area (CAR)

**CAR 1 - Cardiff Bay:** No Active Intervention and Hold the Line both perform favourably against the SEA objectives, as there is no existing flood risk in this unit due to the presence of the barrage, although there is some limited risk of erosion to the dock area. However under No Active Intervention the condition of the barrage would deteriorate and the risk of it failing post year 100 would increase; given the economic investment made in delivering the barrage this is considered an unacceptable option and the environmentally preferred option and the selected SMP2 policy option along this unit is therefore **Hold the Line**. The **Hold the Line** option will restrict natural processes operating along the coastline in this location (minor adverse impact) and coastal squeeze in front of the defence line will result in the medium to long term which, given the status of the Severn as a site of European nature conservation importance, is considered a major adverse impact. Intertidal habitat will need to be created elsewhere within the estuary to offset this loss. In addition, this option will require ongoing capital input, and so does not perform well against the sustainability objective, resulting in a minor adverse impact.

**CAR 2 - Barrage to River Rhymney, Rover Way:** Both the Hold the Line and No Active Intervention polices result in major adverse effects. Adopting NAI will allow natural coastal processes to operate and the intertidal habitats of the Severn estuary to evolve naturally. However it will not protect people, property and critical infrastructure (in particular Cardiff Docks) from flood risk, resulting in a major adverse impact, primarily to the critical infrastructure of the docks; therefore **Hold the Line** is the preferred policy option, as flood risk to the human

environment will be managed. Adverse effects associated with this option include loss of intertidal habitat within the Severn Estuary European sites, a major impact which will need to be mitigated by habitat creation elsewhere in the estuary, the restriction of natural process and the requirement for ongoing capital input The latter two are both considered to be minor impacts and habitat losses are not expected to be significant in this area until the 20-50 year epoch. Raising of defences, if undertaken, may have an adverse effect on the local landscape and views. A full landscape and visual impact assessment as part of an EIA will need to be undertaken at the project level to influence the preferred option and identify any mitigation required to offset adverse impacts.

**CAR 3 - River Rhymney to Lamby Way landfill site drain / sewer outfall: Hold the Line** is the environmentally preferred option and the selected SMP2 policy option for this policy unit as there is an overriding requirement to manage the flood risk to people, property and infrastructure within Cardiff, during and beyond the life of the SMP2. Adverse effects that may result include the restricted operation of natural coastal processes (minor impact) and loss of intertidal habitats within the Severn Estuary European site/SSSI as a result of coastal squeeze in the mid to long term (major impact); this loss of habitat will need to be mitigated for by habitat creation elsewhere within the estuary. This policy option could potentially affect the Rhymney River Section geological SSSI. The site is maintained by erosional processes maintaining the geological exposure. Assuming any defences that might be constructed are behind the site with sufficient space for the necessary erosion of the exposure over time adverse effects will be avoided. Further development of options at the FRMS and scheme level will ensure that full consideration of potential impacts on the SSSI are incorporated into the decision making process and impacts avoided wherever possible. Selection of a **Hold the Line** option will continue to restrict the operation of natural coastal processes in this location and will require an ongoing capital input to maintain the defences, both of which are considered to be minor adverse impacts. Maintaining or raising defences may have an adverse effect on landscape and views; any projects developed will required a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

### 9.3.3 Wentlooge Theme Area (WEN)

**WEN 1 - Lamby Way Landfill site drain/sewer outfall to Sluice House Farm / Tarwick Rhyne:** the environmentally preferred option and the selected SMP2 policy option is **Hold the Line**. This protects key aspects of the human environment including residential properties and the Great Western Railway line running from Swansea to Bristol, and an electricity substation from future erosion and flood risk (major beneficial impacts). In addition the Gwent Levels Historic Landscape Area and SSSI are protected from increased flooding (major beneficial impact). Adverse impacts will however include coastal squeeze in the mid to long term, adversely affecting the Severn European sites (major impact), which will need to be mitigated by habitat creation elsewhere in the estuary. In addition, the HTL option does not perform favourably on sustainability grounds and the defences will require ongoing maintenance (minor adverse impact). Local landscape impacts may arise as a result of maintaining or raising the defences. A landscape and visual impact assessment will need to be undertaken as part of an EIA at the project level will inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated. Attention to detailed design of any new defences to ensure visual integration within the existing landscape is an example of such mitigation. Despite some adverse impacts, the requirement to protect properties and critical infrastructure from increased flood risk mean the overall **Hold the Line** is the preferred option.

**Policy Unit WEN 2 – Sluice House Farm / Tarwick Rhyne to west bank of River Ebbw at Maesglas railway bridge:** the environmentally preferred option and the selected SMP2 policy option is **Hold the Line**. This protects key aspects of the human environment including residential properties, the main line railway between Swansea and Bristol and an electricity substation (major beneficial impacts). In addition the Gwent Levels Historic Landscape Area and SSSI are protected from increased flooding (major beneficial impact). Adverse impacts will however affect the Severn European sites with loss of intertidal habitat resulting in the mid to

long terms. Habitat will need to be created elsewhere within the estuary to mitigate this major adverse impact. In addition the HTL option does not perform favourable on sustainability grounds and the defences will require an ongoing capital input (minor adverse impact). Maintaining or raising defences may have a local adverse effect on landscape and views; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts (e.g. attention to detailed design to ensure visual integration of any new defences within the existing landscape) Despite these adverse impacts, the requirement to protect properties and critical infrastructure from increased flood risk mean the overall Hold the Line is the preferred option.

### 9.3.4 Newport and the River Usk Theme Area (NEW)

**Policy Unit NEW 1 – East bank of River Ebbw at Maesglas railway bridge to west bank Usk at transporter bridge:** Overall a policy of **Hold the Line** is the environmentally preferred option for this unit, as well as the selected SMP2 policy. This will ensure critical infrastructure and isolated residential properties are protected from increased flood risk (major beneficial impact). No European or nationally designated nature conservation sites are affected by this policy and its implementation will ensure both the historic environment and water quality are protected. There is a minor adverse effect in relation to sustainability, as the defence will require ongoing capital investment and natural coastal processes will be restricted in this location. Raising of defences, if undertaken, may have an adverse effect on the local landscape and views. A full landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to influence the preferred option and identify any mitigation required to offset adverse impacts.

**Policy Unit NEW 2 – West bank of Usk at transporter bridge to west bank of Usk at M4 crossing**: Overall a policy of **Hold the Line** is the environmentally preferred option as well as the selected SMP2 policy for this unit. This will ensure critical infrastructure and isolated residential properties are protected from increased flood risk (major beneficial impact). No European or nationally designated nature conservation sites are affected by this policy and its implementation will ensure both the historic environment and water quality are protected (minor beneficial impacts). Minor adverse effects include the requirement for ongoing capital investment and potential local landscape impacts if defences need to be raised or altered. A landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated at the scheme level. Attention to detailed design to ensure visual integration of any new defences within the existing landscape is an example of mitigation that might be proposed to mitigate this impact.

**Policy Unit NEW 3 - River Usk (both Banks) at M4 crossing to Newbridge on Usk:** No properties, critical infrastructure or designated sites are at risk of flooding within the policy unit either now or in the future; **No Active Intervention** is therefore the environmentally preferred policy option, as well as the selected SMP2 policy for this unit; this will potentially result in an increased risk of flooding of agricultural land along the River Usk east of Caerleon. As part of the development of the Action Plan for the SMP2 further discussions with IDBs and the NFU/FUW are proposed to discuss how these potential impacts can be avoided or mitigated.

**Policy Unit NEW 4 – East Bank of Usk at M4 crossing to Spytty Pill, North of A48 crossing:** Significant numbers of properties and several elements of critical infrastructure (including M4, main line railway, electricity substation, and Gwent Police station) within this policy unit are potentially at future risk of flooding; therefore **Hold the Line** is the environmentally preferred and selected SMP2 policy option in this unit. Adopting this policy option will not affect any European or nationally designated nature conservation or heritage sites, but may result in minor local landscape impacts should defences be altered or raised in the future; the requirement for ongoing capital input is also assessed as a minor adverse impact. A landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated at the scheme level.

**Policy Unit NEW 5 – Spytty Pill, north of Uskmouth Power station point:** Several important economic assets and elements of critical infrastructure are located behind the defences including an electricity substation and Uskmouth Power Station. A **Hold the Line** policy is therefore the environmentally preferred option for this reach as well as the selected SMP2 policy. Potential adverse effects include possible loss of intertidal habitats within the Severn European sites (major) and the requirement for capital investment (minor). Intertidal habitat will need to be created elsewhere within the estuary to offset adverse impacts on the Severn European sites and SSSI. Maintaining or raising defences may have an adverse effect on landscape and views; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

### 9.3.5 Caldicot Levels Theme Area (CALD)

**Policy Unit CALD 1 – Uskmouth Power Station point to Sudbrook Point, north of M4 Severn Crossing:** the environmentally preferred option and the selected SMP2 policy is **Hold the Line**. This policy protects key aspects of the human environment including residential areas of Caldicot, Magor and Undy, isolated properties across the levels, Llanwern Steel works and other industrial facilities and critical infrastructure including the Swansea-Bristol main line railway, the M4, electricity transmission lines and sewerage infrastructure. In addition, the Gwent Levels SSSI will be protected from increased inundation (major positive impact). Adverse impacts resulting from adopting this policy will include loss of intertidal habitats, within the Severn European sites/SSSI (major impact); this will need to be mitigated by habitat creation elsewhere within the estuary. Minor adverse impacts on the local landscape may result from the requirement to raise existing defences, but adopting a Hold the Line policy will ensure the Gwent Levels Historic landscape area and numerous SAMs and Listed structures will be protected (major beneficial impact). Any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

**Policy Unit CALD 2 – Sudbrook Point, north of M4 Severn Crossing to Black Rock at Black Rock Road:** No elements of the human or natural environment are at risk of flooding or erosion now or in the future; **No Active Intervention** is therefore the environmentally preferred option and the selected SMP2 policy; this will allow coastal processes to function and maintain the natural interactions at the shoreline that generate the current habitats. No adverse impacts are predicted to result from the implementation of policy options.

**Policy Unit CALD 3 – Caldicot – Black Rock at Black Rock Road to west bank of River Wye at Park Redding, Thornwell :** Within this unit residential properties (including Thornwell, Mathern and isolated properties) and critical infrastructure (including Electricity transmission network, the M48, and the Swansea to Bristol mainline Railway are at risk of flooding. **Hold the Line** is therefore the environmentally preferred option and the selected SMP2 policy which will ensure these features are protected (major beneficial impact). In addition, adopting this policy will ensure that nationally recognised historic features (including the Gwent Levels Historic landscape) as well as the Gwent Levels SSSI are protected (major beneficial impact). However the Severn Estuary European sites and the SSSI are likely to be affected by coastal squeeze (major adverse impact). There may be minor local adverse impacts associated with increasing the height of defences and the structures will require ongoing capital investment. A full landscape and visual impact assessment will be required at the scheme level as part of an EIA to influence the selection of the preferred option and detailed design, and to identify measures required to mitigate any adverse impacts on landscape and /or views. Habitats will need to be created elsewhere in the estuary to compensate for the loss of intertidal habitat. This option was selected due to the overriding need to protected property, life and critical infrastructure in this location.

### 9.3.6 Chepstow and the River Wye Theme Area (WYE)

**Policy Unit Wye 1 – West bank Wye at Park Redding, Thornwell to west bank River Wye at Alcove Wood:** No features of the natural human environment are at risk from current or future flooding and erosion. **No Active Intervention** is therefore the environmentally preferred option. No adverse impacts will arise from the adoption of this option.

**Policy Unit Wye 2 – West bank River Wye at Alcove Wood, Chepstow to Bigsweir Bridge & east bank River Wye at Bigsweir Bridge to Bridge Street bridge, Sedbury:** No features of the natural human environment are at risk from current or future flooding and erosion. **No Active Intervention** is therefore the environmentally preferred option and the selected SMP2 policy. No adverse impacts will arise from the adoption of this option.

**Policy Unit Wye 3– East bank River Wye at Bridge Street bridge, Sedbury to Sedbury STW:** No features of the natural human environment are at risk from current or future flooding and erosion. **No Active Intervention** is therefore the environmentally preferred option and the selected SMP2 policy. No adverse impacts will arise from the adoption of this option.

**Policy Unit Wye 4– east bank River Wye at Sedbury STW to End of Beachley Road, Beachley Point:** No features of the natural human environment are at risk from current or future flooding and erosion. **No Active Intervention** is therefore the environmentally preferred option and the selected SMP2 policy. No adverse impacts will arise from the adoption of this option.

### 9.3.7 Tidenham and Surrounding Villages Theme Area (TID)

**Policy Unit TID 1– Tidenham and surrounding villages – End of Beachley Road, Beachley Point to Guscar Rocks:** No properties or recreational features are at risk from flooding within this policy unit. Limited flood risk to agricultural land exists within the first 20 years increasing from year 20 onwards; there is also increased risk of marginal flooding or flood water erosion to the railway line. In addition, two scheduled monuments (Broad Stone to the south of Stroat and a Roman villa south west of Woolaston) are at increased risk of flooding from year 20 onwards. For these reasons Hold the Line is the environmentally preferred option. However given the limited extent of flooding and isolated nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued, **No Active Intervention** is therefore the SMP2 policy option which has been selected. This option will help maintain the condition and features of the Severn European sites (major beneficial impact) but in the medium to long term there will be an increased risk of flooding to agricultural land and the Scheduled monuments identified. Discussions with IDBs and the NFU/FUW will be held as part of the development of the Action Plan for the SMP2 to identify measures to avoid, offset or mitigate potential impacts on agriculture. Liaison with English Heritage regarding measures to mitigate potential impacts on the scheduled monuments will help mitigate adverse impacts on these features. Local defence measures will mitigate potential impacts on the railway line.

**Policy Unit TID2 – Tidenham and surrounding villages – Guscar Rocks to Lydney Harbour:** Due to the large number of residential properties in Ayleburton and outskirts of Lydney, industrial operations on the outskirts of Lydney and a considerable length of the mainline railway all at risk from year 20 onwards, the environmentally preferred option and the selected SMP2 policy for this policy unit is **Hold the Line**. Adverse impacts will include loss of intertidal habitats from within the Severn European sites and SSSI, a major adverse impact which will need to be mitigated by habitat creation elsewhere in the estuary. Defences will require ongoing capital investment and there may be local impacts on landscape resulting from raising of defences, both considered to be minor adverse impacts. A landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated at the scheme level. Attention to the detailed design of any new defences to ensure visual integration within the existing landscape is an example of such mitigation.

### 9.3.8 Lydney Harbour Theme Area (LYD)

**Policy Unit LYD 1 – Lydney Harbour basin:** No assets are at risk from flooding within this policy unit. However the adoption of a No Active Intervention policy would mean maintenance of the harbour would cease and the condition of the harbour, which is an important economic, recreational and historic asset, would be affected, potentially affecting its future operation. Flooding in this unit could affect features in adjacent policy units. For this reason **Hold the Line** is the environmentally preferred option and the selected SMP2 policy. Apart from the ongoing capital investment commitment and potential for local landscape impacts, both minor adverse impact; there are no other adverse effects associated with this policy option. A full landscape and visual impact assessment will be required aspart of the EIA process to inform the development of any scheme, and to allow appropriate mitigation to be developed.

### 9.3.9 Lydney to Gloucester Theme Area (GLO)

**Policy Unit GLO 1– Lydney to Gloucester – Lydney Harbour to Brims Pill (GLO 1)**

No aspects of the human or natural environment are at risk of flooding either now or in the future; the preferred environmental option and the selected SMP2 policy is therefore **No Active Intervention**. Under this option natural coastal processes will continue to operate and maintain the features of the designated nature conservation sites. No adverse impacts have been identified under this option.

**Policy Unit GLO 2– Lydney to Gloucester – Brims Pill to Northington Farm:** Hold the Line, No Active Intervention and Managed Realignment all have both positive and negative environmental outcomes and there is no clear preferred environmental option. Within the policy unit there are a few isolated properties, approximately 200m of the railway at Blakeney and agricultural land on the Awre peninsular at risk of increased flooding under the NAI /MR policy option; however adopting these options could help to ensure the features for which the Severn Estuary European site is designated sites are maintained; they will also offer a more sustainable approach to flood risk management.

Adoption of a Hold the Line policy would protect the features of the environment identified as being at risk above; however adverse effects on the Severn Estuary European site would result and this option would require ongoing capital investment to deliver and maintain.

Given the small number and localised nature of features at risk it is unlikely that the costs of implementing a Hold the line policy would be justified by the economic benefits accrued and **No Active Intervention followed by Managed Realignment** from year 20 are the preferred policy options. Impacts on property, critical infrastructure, landscape and visual amenity, economic, historic and recreational assets will depend on the alignment selected and the defence line will be located to minimise adverse impacts; where appropriate local measures to protect features will be considered. A landscape and visual impact assessment would need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated. This option will offer opportunities for habitat creation which will contribute towards offsetting some of the losses resulting from the adoption of a Hold the Line Policy elsewhere. Delivery would require capital investment. Further details on avoid or reduce impacts will be considered as part of the Action Plan for the SMP and as an integral part of the development of the FRMS.

**Policy Unit GLO 3– Lydney to Gloucester – Northington Farm to Newnham Church:** For the duration of the SMP2 limited erosion and flood risk will not impact on residential properties, critical infrastructure or material assets and No Active Intervention is therefore preferred from an environmental viewpoint and is also the selected SMP2 policy. The only potential adverse impact is increased risk of flooding to recreational assets such as local footpaths, a minor adverse impact; measures to realign or divert these features will be explored with the Action Plan and as part of the FRMS.

**Policy Unit GLO4 – Lydney to Gloucester – Newnham Church to Farm north of Broadoak:** The town of Newham and its associated residential properties, critical infrastructure and

historical assets are located on top of the cliff and is therefore at risk if coastal erosion is allowed to proceed unchecked. This would be a major adverse impact and could potentially result in loss of life. The preferred environmental option is and the selected SMP2 policy is therefore **Hold the Line**. Coastal squeeze and loss of intertidal habitats will result (major adverse impact), however this could be mitigated by habitat creation elsewhere in the estuary. In addition there will be an ongoing requirement for capital investment, a minor adverse impact. Local landscape impacts may arise as a result of maintaining or raising the defences. A landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated.

**Policy Unit GLO 5 – Lydney to Gloucester – Farm to north of Broadoak to Hill Farm, Rodley:** Property and critical infrastructure are at risk of flooding along with recreational and historic assets. A **Hold the Line** policy is therefore the environmentally preferred option and the selected SMP2 policy for this policy unit. Adverse impacts will include loss of BAP habitat (intertidal) which will need to be compensated for by habitat creation elsewhere in the estuary and the requirement of ongoing capital investment, both of which are considered to be minor adverse impacts. Maintaining or raising defences may have a local adverse effect on landscape and views; any projects developed will required a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts

**Policy Unit GLO6 – Lydney to Gloucester – west bank at Hill Farm, Rodley to west bank at Goose Lane farm:** No aspects of the human or natural environment within this policy unit are subject to flood or erosion risk either now or in the future. The preferred environmental policy and the selected SMP2 policy is therefore **No Active Intervention**; no adverse impacts are predicted to arise as result of adopting this policy.

**Policy Unit GLO 7– Lydney to Gloucester – west bank at Goose Lane farm to west bank at Ley Road: Hold the Line** is the environmentally preferred option and the selected SMP2 policy as it will protect residential properties, critical infrastructure and Walmore Common SPA/NNR from tidal flooding (major positive impact). There may be some loss of intertidal BAP habitat as a result of coastal squeeze, a major adverse impact which will need to be mitigated by habitat creation elsewhere within the estuary There may be minor adverse local landscape impacts resulting from the requirement to maintain or raise the defences. Any projects developed will required a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts. This option would require ongoing capital investment.

**Policy Unit – Lydney to Gloucester – Ley Road to Drain from Long Brook (GLO 8): Hold the Line** is the environmentally preferred option and the selected SMP2 policy as it will protect residential properties, critical infrastructure and agricultural land from tidal flooding. There may be some loss of intertidal BAP habitat as a result of coastal squeeze, a major adverse impact which will need to be mitigated by habitat creation elsewhere within the estuary. There may be adverse local landscape impacts resulting from the requirement to maintain/raise the defences; a landscape and visual impact assessment will need to be be undertaken at the project level as part of an EIA; any adverse impacts will need to be avoided or mitigated wherever possible. Maintenance of defences would require ongoing capital investment.

### 9.3.10 Gloucester to Haw Bridge Theme Area (MAI)

**Policy Unit MAI 1– Gloucester to Haw Bridge** – west bank at Drain from Long Brook to west bank at railway/ A40 bridge: Up until year 20 defences will manage the risk of flooding to existing properties and land. From year 20 onwards a total of 349 ha of agricultural land will be undefended and subject to frequent flood risk; in addition a few isolated properties, and several public footpaths will be at increase risk of flooding**. Hold the Line** is therefore the environmentally preferred option for this policy unit

However given the small number and localised nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits

accrued and **No Active Intervention** is therefore the preferred policy option. Managing impacts on individual properties and public rights of way and avoidance or mitigation actions will an integral part of subsequent more detailed studies. This option will offer opportunities for habitat creation which could contribute towards compensating for some of the losses resulting from the adoption of a Hold the Line Policy elsewhere. Inundation of terrestrial habitats will alter the local landscape; further assessment of potential impacts will be undertaken by the FRMS and a full landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to characterise any impacts and allow appropriate mitigation to be identified.

**Policy Unit MAI 2 – Gloucester to Haw Bridge –Lower Parting to west bank at Haw Bridge, including River Leadon:** Isolated properties, some limited elements of critical infrastructure and agricultural land are the primary assets at risk in this unit and a **Hold the Line** policy is therefore the environmentally preferred option. Due to areas of low lying ground in this and linked Policy Units (MAI 1, MAI 2, MAI 3, MAI 4, MAI 5 and MAI 6) **Hold the Line** is also the overall preferred policy. There may be some loss of intertidal BAP habitat as a result of coastal squeeze, a major adverse impact which will need to be mitigated by habitat creation elsewhere within the estuary. Maintaining or raising defences may have a local adverse effect on landscape and views; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred scheme and detailed design, and identify measures required to mitigate adverse impacts. Ongoing capital investment would be required.

**Policy Unit MAI 3– Gloucester to Haw Bridge – East bank at Haw Bridge (B4213) to Upper Parting Hold** the Line, No Active Intervention and Managed Realignment all have both positive and negative environmental outcomes and there is no clear preferred environmental option within this policy unit. If a No Active Intervention and/or Managed Realignment policy were implemented, no properties or major elements of critical infrastructure would be at risk of flooding either now or in the future. Some recreational features such as local open space and footpath networks would be affected and agricultural land would be at risk. However adopting this policy option would allow the Severn Estuary European sites to evolve and function naturally and would require minimal resource input to deliver and maintain. A Hold the Line policy would protect all the assets at risk identified above, but would result in some intertidal habitat loss within the Severn European sites, as well as local landscape impacts.

Due to the fact that there are limited assets at risk and the extent of the floodplain is limited by high ground it unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued **No Active Intervention** is therefore the selected option. Under this option the existing flood defences will continue to afford protection to properties and land for the first 20 years. From year 20 onwards flooding will remain constrained to a strip along the river. Agricultural land will experience more frequent flooding and become unusable. Mitigation may include shoreline defences or other actions.

**Policy Unit MAI 4 – Gloucester to Haw Bridge – Upper Parting to Lower Parting (left bank of parting): Hold the Line** is the environmentally preferred and the selected SMP2 policy for this policy unit; it will protect property critical infrastructure, recreational and historical assets and agricultural land from increased flood risk. There may be some loss of BAP habitat (intertidal) as a result of coastal squeeze and potentially minor adverse local landscape impacts resulting from the requirement to maintain or improve defences. A landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated Loss of intertidal habitat will be mitigated by habitat creation elsewhere within the estuary.

**Policy Unit MAI 5 – Gloucester to Haw Bridge – Alney Island: Hold the Line** is the environmentally preferred option and the selected SMP2 policy for this policy unit; it will protect property critical infrastructure, recreational and historical assets and agricultural land from increased flood risk. This option will also serve to maintain the features of Alney Island LNR. There may be some loss of intertidal BAP habitat as a result of coastal squeeze, a major adverse impact which will need to be mitigated by habitat creation elsewhere within the estuary. In addition there may potentially be minor adverse local landscape impacts resulting from the

requirement to maintain or improve defences. Further assessment of potential impacts will be undertaken as part of the SEA for the FRMS; in addition, a landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated

**Policy Unit MAI 6– Gloucester to Haw Bridge – Lower Parting to Severn Farm: Hold the Line** is the environmentally preferred option and the selected SMP2 policy for this policy unit; it will protect property critical infrastructure, recreational assets, agricultural land and the water environment. There may be some loss of BAP habitat (intertidal) as a result of coastal squeeze, a major adverse impact that will need to be mitigated by habitat creation elsewhere within the estuary. In addition there may potentially be local landscape impacts resulting from the requirement to maintain or improve defences. Any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

### 9.3.11 Gloucester to Sharpness Theme Area (SHAR)

**Policy Unit SHAR 1 – Gloucester to Sharpness – Severn Farm to Wicks Green: Hold the Line** is the environmentally preferred option for this policy unit, as it will protect the isolated properties, recreational assets, agricultural land and water environment within the policy unit. However given the small number and localised nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued and **No Active Intervention/Managed Realignment** is therefore the preferred policy option. This option will offer opportunities for habitat creation which could help contribute towards compensating some of the losses resulting from the adoption of a Hold the Line Policy elsewhere.

Within the first epoch existing flood defences will continue to reduce the risk to existing properties and land. Following this, defences will be monitored and managed to ensure failures do not pose a H&S risk. A total of 156 ha of agricultural land will be undefended and will be subject to frequent flood risk. Realigned defences will manage the risk to properties and land behind new defences. Assets in front of realigned defences will be at risk from inundation. Potential impacts on individual properties, public rights of way and land use will also be taken into consideration as part of the development of the SMP Action Plan; discussions are planned to be held with the relevant IDBs, NFU and local authorities to inform this process and any measures identified will be incorporated into the development of the FRMS. Mitigation actions including use of local defences will be considered as an integral part of subsequent more detailed studies and prior to determining alignment of new defences. In addition tidal inundation will alter the local landscape. A full landscape and visual impact assessment will need to be undertaken at the scheme level as part of an EIA to influence the preferred option and detailed design, and to identify measures required to mitigate adverse impacts.

**Policy Unit SHAR 2– Gloucester to Sharpness – Wicks Green to Longney Green: Hold the Line** is the environmentally preferred option for this policy unit, as it will protect the isolated properties, the Severn Valley Way and other footpaths, agricultural land and water environment within the policy unit. However given the small number and localised nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued and **No Active Intervention/Managed Realignment** is therefore the preferred policy option.

Within the first epoch existing flood defences will continue to reduce the risk to existing properties and land. Following this, defences will be monitored and managed to ensure failures do not pose a Health & Safety risk. Under a No Active Intervention policy a total of 156 Ha of agricultural land will be undefended and will be subject to frequent flood risk, however realignment of defences may reduce this area. Realigned defences will manage the risk to properties and land behind new defences. Assets in front of realigned defences will continue to be at risk from inundation. Impacts on individual properties, public rights of way and land, and

mitigation actions to address them will need be considered as an integral part of the development of Action Plan for the SMP2. Potential impacts and avoidance and mitigation measures will be key factors in detrain the new defence alignment and will be explored further as part of the FRMS and subsequent more detailed studies. Increased tidal inundation will alter the local landscape. A full landscape and visual impact assessment will need to be undertaken at the scheme level as part of an EIA to influence the preferred option and detailed design, and to identify measures required to mitigate adverse impacts. This option will offer opportunities for habitat creation which could help contribute towards offsetting/compensating some of the losses resulting from the adoption of a Hold the Line Policy elsewhere.

**Policy Unit SHAR 3– Gloucester to Sharpness – Longney Green to Overton Lane:** Residential areas (including Saul, Framilode and isolated properties), recreational assets (including the Severn Valley Way), access to communities to the west (including Overton and Arlington), historical assets and agricultural land will all be at increased risk of flooding from year 20 onwards. **Hold the Line** is therefore the environmentally preferred policy and the selected SMP2 policy option. The only major adverse impact to result from adoption of this policy is the loss of intertidal habitat; however habitat creation sites are being identified around the estuary to offset any loss of intertidal habitat. Maintaining or raising defences may have a local adverse effect on landscape and views; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts..

**Policy Unit SHAR 4 – Gloucester to Sharpness – Overton Lane to upstream of Hock Cliff:** Arlingham and additional isolated properties, recreational assets including the Severn Valley Way, agricultural land and listed structures in Arlingham are at risk of flooding from year 20 onwards. **Hold the Line** is therefore the environmentally preferred option. However given the small number and localised nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued and **No Active Intervention/Managed Realignment** is therefore the preferred policy option. This option will offer opportunities for habitat creation which could help contribute towards offsetting/compensating some of the losses resulting from the adoption of a Hold the Line Policy elsewhere.

Within the first two epochs the existing flood defences will continue to reduce the risk to existing properties and land. Subsequently with No Active Intervention a total of 409 Ha of agricultural land on the seaward side of the new defence line would be undefended and be subject to frequent flood risk. Realigned defences will manage the risk to properties and land behind new defences and reduce impacts. Assets in front of realigned defences will still be at risk from inundation. Impacts on property, land and recreational and historic assets, will be key factors taken into consideration in determining the new defence alignment. Mitigation actions including use of local defences will be considered as an integral part of subsequent more detailed studies and prior to determining alignment of new defences. This will be addressed in more detail as part of the SMP2 Action Plan, FRMS Strategy and individual projects.

**Policy Unit SHAR 5 – Gloucester to Sharpness – Hock Cliff:** No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the environmentally preferred and the selected SMP2 policy option. No adverse effects are likely to result from adopting this option.

**Policy Unit SHAR 6 – Gloucester to Sharpness – downstream of Hock Cliff to Frampton Pill:** Frampton on Severn and Oatfield and agricultural land along the coast are predicted to be at increased risk of flooding in the future; flooding could also affect recreational assets such as the Severn Valley Way and listed properties within Frampton on Severn. **Hold the Line** is therefore the environmentally preferred policy option and the selected SMP2 policy. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse effect will need to be offset by habitat creation elsewhere within the estuary. Some minor, adverse, local landscape impacts may arise as a result of maintaining or raising the defences. any projects developed will require a landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

**Policy Unit SHA 7– Gloucester to Sharpness – Frampton Pill to Tites Point :** Slimbridge and isolated residential properties are at risk within this policy unit, as is the canal and potentially electricity transmission pylons. In addition, the recreational assets such as Slimbridge and Severn Valley Way are also at risk. For these reasons **Hold the Line** is the environmentally preferred option. However given the small number and localised nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued and **No Active Intervention/Managed Realignment** is therefore the preferred policy option. Increased tidal flooding will alter the local landscape; a full landscape and visual impact assessment will need to be undertaken as part of an EIA at the project level to characterise impacts and allow mitigation to be identified. This option will offer opportunities for habitat creation which could help contribute towards offsetting some of the losses resulting from the adoption of a Hold the Line Policy elsewhere, however, terrestrial and freshwater habitat will also be lost.

Up until the end of the second epoch (year 50) the existing flood defences will continue to reduce the risk to existing properties and land in this epoch. Following this a realigned defence will manage the risk of impacts to properties and land behind new defences. Assets in front of realigned defences will still be at risk from inundation. Impacts on property, land and recreational and historic assets and potential avoidance and/or mitigation measures will be key factors taken into consideration when determining the preferred defence alignment as part of the FRMS. These issues will be addressed in more detail as part of the SMP2 Action Plan, FRMS Strategy and individual projects. Increased tidal inundation will alter the local landscape. A full landscape and visual impact assessment will need to be undertaken at the scheme level as part of an EIA to influence the preferred option and detailed design, and to identify measures required to mitigate adverse impacts. Adopting this policy option will help mitigate the loss of habitat elsewhere in the estuary and maintain the condition and features of the Severn European sites, a major beneficial impact.

**Policy Unit SHA 8 – Gloucester to Sharpness – Royal Drift outfall to Sharpness Docks:** No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the environmentally preferred and SMP2 selected policy option. No adverse effects are likely to result from adopting this option.

### 9.3.12 Sharpness to Severn Crossings Theme Area (SEV)

**Policy Unit SEV 1 – Sharpness to Severn Crossings – South of Sharpness docks to Bull Rock:** The villages of Berkeley, Hook Street and isolated properties in the surrounding area, along with agricultural within this policy unit coast are predicted to be at increased risk of flooding in the future; flooding could also affect recreational assets such as the Severn Valley Way. In addition this unit is linked to the adjacent units within which Berkeley power station is located and potentially at increased risk of flooding in the future. **Hold the Line** is therefore the environmentally preferred and selected SMP2 policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse impact will need to be offset by habitat creation elsewhere within the estuary. Some minor, adverse, local landscape impacts may arise as a result of maintaining or raising the defences, any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures to mitigate adverse impacts.

**Policy Unit SEV 2 – Sharpness to Severn Crossings –Bull Rock to southern boundary of Berkeley power station:** Berkeley Power Station and residential areas within this policy unit are predicted to be at increased risk of flooding in the future; flooding could also affect recreational assets such as the Severn Valley Way and Sustrans route 41. **Hold the Line** is therefore the environmentally preferred and selected SMP2 policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse impact will need to be offset by habitat creation elsewhere within the estuary. Some minor, adverse, local landscape impacts may

arise as a result of maintaining or raising the defences; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts..**Policy Unit SEV 3– Sharpness to Severn Crossings –southern boundary of Berkeley power station to Oldbury Power station:** Residential properties and recreational assets such as the Severn Valley Way and Sustrans route 41 are at risk of flooding, as is agricultural land; in addition connectivity with adjacent units means both Berkley and Oldbury power stations are at increased risk of flooding if this policy unit floods. **Hold the Line** is therefore the environmentally preferred and SMP2 selected policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse will need to be offset by habitat creation elsewhere within the estuary. Maintaining or raising defences may have a local adverse effect on landscape and views; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

**Policy Unit SEV4 – Sharpness to Severn Crossings – Oldbury power station:** the presence of the power station within this unit means **Hold the Line** is the environmentally preferred policy option and the selected SMP2 policy. Adoption of this policy will also mean agricultural land along the coast and recreational assets such as the Severn Valley Way and Sustrans route 41 are protected from increased risk of flooding in the future. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse impact will need to be offset by habitat creation elsewhere within the estuary. Raising of defences, if undertaken, may have an adverse effect on the local landscape and views. A full landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to influence the preferred option and identify any mitigation required to offset adverse impacts. .

**Policy Unit SEV 5– Sharpness to Severn Crossings – Oldbury power station to Littleton Warth:** Oldbury on Severn and isolated residential properties along with agricultural land and heritage features within Oldbury are predicted to be at increased risk of flooding in the future; flooding could also affect recreational assets such as the Severn Valley Way. This unit is in hydraulic connectivity with SEV 4 so any flooding within this unit could place the power station at risk. **Hold the Line** is therefore the environmentally preferred and the selected SMP2 policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse will need to be offset by habitat creation elsewhere within the estuary. Maintaining or raising defences may have an adverse effect on landscape and views; any projects developed will require a landscape and visual impact assessment as part of an EIA to influence the preferred scheme and detailed design, and identify measures required to mitigate adverse impacts.

**Policy Unit SEV 6 – Sharpness to Severn Crossings – Littleton Warth to Aust Ferry :** No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the environmentally preferred and selected SMP2 policy option. No adverse effects are likely to result from adopting this option.

### 9.3.13 Severnside to Bristol and Avon Theme Area (BRIS)

**Policy Unit BRIS 1 – Bristol and Severnside Aust Ferry (site of) to New Passage:** Residential properties at Northwick and Redwick, critical infrastructure (including the M4. M48 and Severn tunnel) and agricultural land are all predicted to be at increased risk of flooding in the future; flooding could also affect recreational assets such as the Severn Valley Way. This unit is also hydraulically linked with units BRIS 2-5. **Hold the Line** is therefore the environmentally preferred policy option and the selected SMP2 policy. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse impact will need to be offset by habitat creation elsewhere within the estuary. Some minor, adverse, local landscape impacts may arise as a result of maintaining or raising the defences. A landscape and visual impact assessment will need to be undertaken at the project level as part of an EIA to inform the decision making

process and ensure any significant adverse effects on landscape and visual amenity are avoided or mitigated.

**Policy Unit BRIS 2 – Bristol and Severnside -New Passage to north extent of Severnside Works:** Residential properties at Severn Beach, critical infrastructure (including the M4. M5, Seabank power station 48 and Severn tunnel) and agricultural land are all predicted to be at increased risk of flooding in the future; flooding could also affect recreational and historic assets. This unit is also hydraulically linked with units BRIS 1 and 3-5. **Hold the Line** is therefore the environmentally preferred and selected SMP2 policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major, adverse impact will need to be offset by habitat creation elsewhere within the estuary. Some minor, adverse local landscape impacts may arise as a result of maintaining or raising the defences, any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred scheme and detailed design, and identify measures required to mitigate adverse impacts.

**Policy Unit BRIS 3 – North extent of Severnside Works to Avonmouth Pier**: Residential properties at Avonmouth, critical infrastructure (including the M49. M5, electricity substations, Avonmouth sewage treatment works and Avonmouth Docks) are all predicted to be at increased risk of flooding in the future. This unit is also hydraulically linked with units BRIS 1-2 and 4-5. **Hold the Line** is therefore the environmentally preferred policy and selected SMP2 policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major, adverse impact will need to be offset by habitat creation elsewhere within the estuary. Raising of defences, if undertaken, may have a local adverse effect on the local landscape and views. A full landscape and visual impact assessment will need to be be undertaken at the project level as part of an EIA to influence selection of the preferred option and identify any mitigation required to offset adverse impacts.

**Policy Unit BRIS 4 – Bristol and Severnside - Avonmouth Pier to Netham Weir:** Residential properties at Avonmouth, critical infrastructure (including the M49. M5, electricity substations, Avonmouth sewage treatment works and Avonmouth Docks) are all predicted to be at increased risk of flooding in the future. This unit is also hydraulically linked with units BRIS 1-3 and 5. **Hold the Line** is therefore the environmentally preferred and selected SMP2 policy option. Maintaining or raising defences may have a local adverse effect on landscape and views; any projects developed will require a full landscape and visual impact assessment as part of an EIA to influence the preferred schemes and detailed design and identify measures required to mitigate adverse impacts.

**Policy Unit BRIS 5– Bristol and Severnside - Netham Weir to Avon road (Eastern In Gordano):** There are limited flood and erosion risks to the human and natural environment within this policy unit, however as it is located within the centre of the city of Bristol with significant development immediately behind the defences a policy of **Hold the Line** is the environmentally preferred and selected SMP2 policy option. No significant adverse effects are considered likely to arise from adopting this option.

**Policy Unit BRIS 6 – Bristol and Severnside- Avon road (Eastern In Gordano) to Portishead Pier:** The residential developments of Portbury Wharf and Sheepway, economic activities within the docks and critical infrastructure including the M5, Avonmouth road and rail bridge and Portbury Wharf Sewage Treatment works are predicted to be at increased risk of flooding in the future; flooding could also affect recreational assets including footpath networks and a Sustrans route, as well as designated heritage features. Due to the local topography, flooding via this unit has the potential to affect large areas of agricultural land to the south of Portishead and to the north of the M4. **Hold the Line** is therefore the environmentally preferred and the selected SMP2 policy option. Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse impact will need to be offset by habitat creation elsewhere within the estuary. Some minor, adverse, local landscape impacts may arise as a result of maintaining or raising the defences; any proposals will require a landscape and visual impact assessment as part of

an EIA to influence the preferred option and detailed design, and identify measures required to mitigate adverse impacts.

### 9.3.14 Portishead and Clevedon Theme Area (PORT)

**Policy Unit PORT 1 – Portishead and Clevedon – Portishead Pier to swimming pool:** No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the environmentally preferred policy option and the selected SMP2 policy. No adverse effects are likely to result from adopting this option.

**Policy Unit PORT 2 – Portishead and Clevedon - swimming pool to southern extent of Esplanade: Road:** No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the environmentally preferred policy option and the selected SMP2 policy. No adverse effects are likely to result from adopting this option.

**Policy Unit PORT 3 – Portishead and Clevedon - southern extent of Esplanade Road to Ladye Point**: No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the is therefore the environmentally preferred policy option and the selected SMP2 policy. No adverse effects are likely to result from adopting this option.

**Policy Unit PORT 4 – Portishead and Clevedon - Ladye Point to Old Church Road:** No aspects of the human or natural environment are at risk of flooding or erosion now or in the future within this policy unit and **No Active Intervention** is therefore the environmentally preferred policy option and the selected SMP2 policy. No adverse effects are likely to result from adopting this option.

### 9.3.15 Kingston Seymour to Sand Bay Theme Area (KIN)

**Policy Unit KIN1 – Kingston Seymour to Sand Bay - Old Church Road to St Thomas' Head** Residential properties on the outskirts of Clevedon, isolated residential properties and large areas of agricultural land, recreational features such as footpaths and a golf course and designated heritage features (4 SMs and numerous isolated listed structures). The environmentally preferred option for this policy unit is therefore **Hold the Line.**

However given the isolated nature of features at risk it is unlikely that the costs of implementing a Hold the Line policy would be justified by the economic benefits accrued and **No Active Intervention/Managed Realignment** is therefore the preferred policy option. This option will offer opportunities for habitat creation which could help contribute towards offsetting some of the losses resulting from the adoption of a Hold the Line Policy elsewhere. For the first 20 years existing defences will remain in place managing the risk of impacts from flooding to properties and land. Within the second epoch realigned defences will manage the risk of impacts to properties and land behind new defences. Assets in front of realigned defences will be at risk from inundation. Impacts on property, land use, recreational features and historic assets and mitigation actions will need to be considered in determining the new alignment for the defences. This will be addressed in more detail as part of the SMP2 Action Plan, FRMS Strategy and individual projects. Inundation of terrestrial habitats will alter the local landscape; further assessment of potential impacts will be undertaken by the FRMS and a full landscape and visual impact assessment will need to be undertaken as part of an EIA at the project level to characterise any impacts and allow appropriate mitigation to be identified. A MR policy may benefit flood risk management in adjacent, linked Policy Units (KIN 3, KIN 4). Adopting these policy options will help maintain the condition and features of the Severn European sites, a major beneficial impact.

**Policy Unit KIN 2 – Kingston Seymour to Sand Bay – St Thomas' Head to Middle Hope car park (Sand Point): No Active Intervention** is the environmentally preferred and selected SMP2 policy option for KIN2; there are no features at risk from current or future tidal flood or

erosion risk. A policy of NAI will allow natural processes to continue to operate and designated sites will evolve as a result of these processes. No adverse impacts are likely to arise from the implementation of this policy in this location.

**Policy Unit KIN 3 – Kingston Seymour to Sand Bay - Middle Hope car park to southern extent of Beach Road:** Economic assets along the coast largely relating to tourism and agriculture and critical infrastructure including the M5 and two electricity substations are at increased risk of flooding. The environmentally preferred option and the selected SMP2 policy for this unit is therefore **Hold the Line.** Adoption of this policy is likely to result in loss of intertidal habitat within the European and nationally designated sites as a result of coastal squeeze; this major adverse impact will need to be offset by habitat creation elsewhere within the estuary. Active management of the sand dunes may adversely affect the condition of the SSSI. Some minor, adverse, local landscape impacts may arise as a result of maintaining or raising the defences; a landscape and visual impact assessment will be need to be undertaken at the project level as part of an EIA; any adverse impacts will be avoided or mitigated wherever possible.

**Policy Unit KIN 4 – Kingston Seymour to Sand Bay - southern extent of Beach Road to Birnbeck Island: No Active Intervention** is the environmentally preferred and the selected SMP2 policy for KIN 4; there are no features at risk from current or future tidal flood or erosion risk. A policy of NAI will allow natural processes to continue to operate and designated sites will evolve as a result of these processes. No adverse impacts are likely to arise from the implementation of this policy in this location.

### 9.3.16 The Holms Theme Area (HOL)

**Policy Unit HOL1 – The Holms – Flat Holm:** No features of the human environment are at risk from current or future flood risk or erosion. Similarly there are no heritage assets or water features at risk. Therefore **No Active Intervention** is the preferred policy option for this unit; this will allow natural processes to continue to operate and allow the Seven Estuary European sites and SSSI to evolve naturally. There are no adverse environmental impacts associated with the policy option.

**Policy Unit HOL2 – The Holms – Steep Holm: Policy Unit HOL1 – The Holms – Flat Holm:** No features of the human environment are at risk from current or future flood risk or erosion. Similarly there are no heritage assets or water features at risk. Therefore **No Active Intervention** is the preferred policy option for this unit; this will allow natural processes to continue to operate and allow the Seven Estuary European sites and SSSI to evolve naturally. There are no adverse environmental impacts associated with the policy option.

The significant environmental effects (both positive and negative) of implementing the preferred SMP2 policy options in each policy unit are described against each of the SEA objectives below. Where possible, mitigation measures have been suggested in order to avoid, reduce or offset any significant effects of the Strategy. Further details of the impacts of all of the options can be found in the accompanying SEA matrices, which are included in Annex B of this report.

## 9.4 Assessment of Cumulative Effects and Mitigation

The SEA Directive also requires an analysis of the cumulative effects of a plan or programme. The section below considers the in-combination effects of the options that make up the preferred Strategy on common features as well as the additive effects of a number of impacts and this is described in the following sections against each of the objectives.

### 9.4.1 SEA Objective: Population and Human Health

*Reduce significance of impact associated with flooding and erosion to people and property/Avoid/minimise environmental impacts which may have long term health impacts (including stress and anxiety associated with flood risk)*

All communities and properties located within policy units where a Hold the Line policy is proposed will be protected to some degree in the future. The standard of protection may however vary depending on whether defences are maintained at their current height or raised to accommodate sea level rise.

Within the following policy units a policy of No Active Intervention is proposed; however existing topography means that no people or properties are at risk: PEN1, PEN2, CALD2, WYE 1-4 SHAR 5, SHAR 8, SEV6, PORT 1-4, KIN2, KIN 4, HOL1-2.

Other policy units where a No Active Intervention is proposed include:

- TID 1: Within the first 20 years the remaining defences will remain intact; within the second epoch increased flooding will occur however no properties are identified as being at risk; by year 100 there may be some risk to residential properties.
- GLO 1: From years 1- 50 limited erosion and flood risk will not impact on existing property. From year 50 onwards there is an increased risk from flooding and erosion, however no residential properties are at risk.
- GLO3, GLO 6: For the duration of the SMP2 limited erosion and flood risk will not impact on existing property or human health.
- MAI 3: For the first 20 years the existing flood defences will continue to afford protection to existing properties. From year 20 onwards flooding will remain constrained to a strip along the river but no properties will be at risk.

The remaining units have polices of No Active Intervention changing to Managed Realignment at year 20 or 50. Likely impacts are as follows:

- NEW 3, TID 2, GLO 2, MAI 1, SHAR 1, SHAR 2, KIN 1: For the first 20 years it is proposed that the existing defences will remain in place managing the risk of impacts from flooding to properties. Within the second epoch realigned defences will manage the risk of impacts to properties behind new defences. Assets in front of realigned defences will be at risk from inundation. Impacts on property and avoidance or mitigation measures will be key factors taken into consideration when determining the new defence alignment.
- SHAR 7: Up until the end of the second epoch (year 50) the existing flood defences will continue to reduce the risk to existing properties and land. Following this realigned defences will manage the risk of impacts to properties behind new defences.

Reduce significance of impact associated with flooding and erosion to key community, recreational and amenity facilities.

Recreational or amenity facilities that provide the community with access to leisure or outdoor pursuits include long distance coastal footpaths, local footpaths, Sustrans cycle routes, seafront esplanades, campsites, leisure centres, boat launch points and areas of bird watching and fishing.

Assets that lie behind the defences within policy units where a hold the line option is proposed will be protected from flood and erosion risk. This includes CAR 2-3 (local open space), WEN 1-2 (coastal footpath), NEW 2,4,5 (local open space and other facilities), CALD 1,3 (coastal footpath across Caldicot levels), LYD1 (Lydney harbour), GLOS 4 (Public car park in Newnham), GLOS 5,7,8 (coastal footpath), MAI 2 (footbath on west bank), MAI 5,6 (Severn Valley Way and public open space), SHA 3,6 (Severn Valley way and Gloucester and Sharpness Canal), SEV1-5 (Severn Valley Way and public open space), BRIS 1-2 (local footpaths and camping and caravan site), BRIS 6 (Sustrans route, leisure centre protected, local footpaths protected), KIN 3 (local footpath, sea front esplanade, car park and campsite).

A non active intervention policy has been proposed for approximately one third of the policy units. Most of these units have high ground and / or hard geology so recreational assets are not at risk of flooding or erosion and recreation assets will not be affected by the adoption of this policy option. . There are however, two policy units PEN 2 and PORT 4 where No Active Intervention is the proposed policy option and assets are deemed to be at risk. In PEN2 and PORT4 the sea front esplanade and local footpath network (and also at Penarth the pier and gallery) are likely to be at increased risk of tidal flooding and erosion during the 20-100 year period.

For eight policy units a no active intervention policy for the first 20 years will then be superseded by managed realignment for the 20-100 year period. The nature of the impacts arising from this combination of options will depend on the exact locations and extent of the managed realignment. For example at SHA 1 and 2 the managed realignment could impact on the coastal Severn Valley Way footpath and require it to be realigned. In GLOS 2 the coastal footpath is located on the flood defence embankment so this would have to be diverted and repositioned under this policy. Once realignment has taken place coastal footpaths and other assets would however be protected from risk of future flooding and erosion. The Slimbridge wetland centre is located in SHA 7 which has managed realignment proposed for 20-100 years. Realignment along this reach is already being considered by the Wildfowl and Wetlands Trust. Managed realignment of this unit would ensure that the Gloucester and Sharpness Canal and other local footpaths are protected. Just south of Clevedon in KIN 1 there is a golf course and network of local footpaths. It is likely that the managed realignment policy will protect these features but specific impacts would depend on realignment plans. Impacts and avoidance or mitigation actions such as diversion of footpaths will be considered in determining the alignment for new defences and when determining the details of how a no active intervention policy will be delivered.

### 9.4.2 SEA Objective: Material Assets and Critical Infrastructure

Reduce significance of impact associated with flooding and erosion to critical infrastructure/ Reduce significance of impact associated with flooding and erosion to industrial, commercial and economic assets (including agricultural), and activities (including tourism

All critical infrastructure and economic assets located within policy units where a Hold the Line policy is proposed will be protected to some degree in the future. The standard of protection

may however vary depending on whether defences are maintained at their current height or raised to accommodate sea level rise.

Within the following policy units a policy of No Active Intervention is proposed; however existing topography means that critical infrastructure and economic assets remain protected from future flood and/or erosion risk: PEN 1, PEN 2, CALD 2, WYE 1-4, SHAR 5, SHAR 8, SEV 6, PORT 1-4, KIN 2, KIN 4, HOL 1-2

Other policy units where a No Active Intervention is proposed include:

- TID 1 Within the first 20 years the remaining defences will remain intact and limited flood risk to agricultural land exists; within the second and third epochs there is increased marginal flood risk to the railway line.
- GLO 1 From years 1- 50 limited erosion and flood risk will not impact on existing land use. From year 50 onwards the railway and Sewage Treatment Works could be at risk from erosion.
- GLO3 For the duration of the SMP2 limited erosion and flood risk will not impact on existing land use or critical infrastructure health.
- GLO 6 For the duration of the SMP2 limited erosion and flood risk will not impact on existing land use or critical infrastructure.
- MAI 3 For the first 20 years the existing flood defences will continue to afford protection to existing critical infrastructure, economic assets and land in this epoch. From year 20 onwards flooding will remain constrained to a strip along the river. Agricultural land will experience more frequent flooding and become unusable.

Local measures will need to be identified to avoid or mitigate these impacts at the more detailed strategy or project level; further information on this will be developed as part of the SMP2 Action Plan, FRMS strategy and individual projects. The FRMS will allow potential impacts and therefore mitigation to be identified with a greater degree of accuracy, both in terms of location of impacts and likely standard of protection to be provided. Mitigation which may be appropriate to those at increased flood risk includes advice and support for landowners and tenants from the Environment Agency regarding levels of flood risk, flood warning services and measures to increase flood resilience. At present at the SMP2 level it is not possible to quantify the impacts and associated mitigation so there remain risks that mitigation may not be possible or that the significance of flooding / erosion to critical infrastructure is not reduced. These issues will be addressed in more detail at the FRMS level and further at project level.

The remaining units have polices of NAI changing to Managed Realignment at year 20 or 50.

- NEW 3: For the first 20 years, present defences will remain in place reducing the risk of flooding to land. In the second epoch following failure of the defences flooding to agricultural land can be expected. After year 50 further flood risk to assets is prevented by realignment of the defences will occur.
- TID 2: For the duration of the first epoch flood risk to flood risk exists to some agricultural land and the railway line. From years 20 -100 realigned defences will protect land and assets behind new defences. Assets in front of realigned defences will be at risk from inundation.
- GLO 2: For the duration of the first epoch the existing flood defences will continue to reduce the risk of impacts to critical infrastructure, economic assets and land; From years 20 to 50 agricultural realigned defences will protect land and assets behind new defences. Assets in front of realigned defence including agricultural land will be at risk from inundation.

- MAI 1: Up until year 20 defences will manage the risk of flooding to critical infrastructure, economic assets and land. From year 20 onwards a total of 349 ha of agricultural land will be undefended and subject to frequent flood risk. Realigned defences will manage the risk to of land behind new defences. Assets in front of realigned defences will be at risk from inundation.
- SHAR 1: Within the first epoch the existing flood defences will continue to reduce the risk to critical infrastructure, economic assets and land. Following this, defences will be monitored and managed to ensure failures do not pose a H&S risk. A total of 156 ha of agricultural land will be undefended and will be subject to frequent flood risk. Realigned defences will manage the risk to critical infrastructure, economic assets and land behind new defences. Assets in front of realigned defences will be at risk from inundation.
- SHAR 2: For the first 20 years the existing flood defences will continue to reduce the risk to critical infrastructure, economic assets and land; within the second epoch a total of 352 Ha of agricultural land will be undefended and will be subject to frequent flood risk. Realigned defences will manage the risk to properties and land behind new defences. Assets in front of realigned defences will be at risk from inundation.
- SHAR 4: Within the first epoch the existing flood defences will continue to reduce the risk to critical infrastructure, economic assets and land. Subsequently a total of 409 Ha of agricultural land will be undefended and will be subject to frequent flood risk. Realigned defences will manage the risk to properties and land behind new defences. Assets in front of realigned defences will be at risk from inundation.
- SHAR 7: Up unit the end of the second epoch (year 50) the existing flood defences will continue to reduce the risk to critical infrastructure, economic assets and land. Following this realigned defences will manage the risk of impacts assets and land behind new defences
- KIN1 For the first 20 years it is proposed that the existing defences will remain in place managing the risk of impacts from flooding to critical infrastructure, economic assets and land. Within the second epoch realigned defences will manage the risk of impacts behind new defences. Assets in front of realigned defences will be at risk from inundation.

Where potential impacts on land use and potentially agricultural production have been identified mitigation actions will be taken into consideration in determining the new alignment for defences. Discussions with IDBs, NFU/FUW representatives and local authorities are planned as part of the development of the SMP2 Action Plan and the outcomes of these will further inform avoidance or mitigation actions to be adopted to when considering future defence alignments or developing policy implementation or development plans, in order to mitigate the impact of individual proposals on property and land. Mitigation which may be appropriate includes advice and support for landowners and tenants from the Environment Agency regarding levels of flood risk, flood warning services and measures to increase flood resilience.

It is not possible to quantify the impacts and associated mitigation needed at the SMP2 level so, there remain risks that mitigation may not be possible or that the significance of flooding / erosion to critical infrastructure is not reduced. These issues will be addressed in more detail at the FRMS level and further at project level. The SMP2 Action Plan identifies additional actions to help reduce these risks.

### 9.4.3 SEA Objective: Biodiversity Flora and Fauna

Avoid significant impact on integrity of internationally designated sites and the favourable condition of their features.

The assessment of likely significant effect undertaken for the SMP2 (see Appendix I Part B) concluded that the only European sites potentially affected by the implementation of the SMP2 are the Severn SPA, SAC and Ramsar sites and the Somerset Levels and Moors SPA and Ramsar site. The assessment undertaken for the SEA also identifies major adverse impacts to the Severn Estuary SAC, SPA and Ramsar sites as a result mainly of loss of intertidal habitat caused by coastal squeeze.

The sixteen policy units upstream of GLO 3 on the west bank and SHA 4 on the east bank are located outside of the Severn estuary and policies within these units are considered unlikely to significantly affect the European sites.

In addition polices for units along the tributaries of the Severn including BRIS 4-6 (HTL), WYE 1-4 (NAI), NEW 1-2 (HTL), NEW 3 (NAI) and NEW 4-5 (HTL) have been judged not to affect the Severn European Sites.

CAR 1-3, WEN 1-2, CALD1 and 3, SEV 1-5, BRIS 1-3 and KIN3 all have a Hold the Line polices which will result in coastal squeeze and loss of intertidal habitats within the sites. A Habitats Regulations Assessment has been undertaken to quantify habitat loss and has concluded that it is not possible to mitigate impacts resulting from coastal squeeze and cumulative loss of habitat arising form the footprint of new defences; in order for the plan to proceed, amongst other criteria compensatory habitat needs to be identified. A Habitat Delivery Plan is being prepared by the Environment Agency as part of the Severn FRMS to identify areas for habitat creation around the Estuary that could be used to compensate for losses that have been identified. These sites will be incorporated into the Environment Agency's Regional Habitat Creation programme. At present indicative areas have been identified, but habitat creation actions have not been implemented and no compensatory habitat has yet been created. There remain risks associated with habitat creation projects not going forward, such as securing the agreement of landowners and funding to undertake projects / actions. There is also uncertainty regarding creating the type of habitat that is needed and the timing of habitat creation, as there is imperfect understanding of the natural processes. It is not possible to quantify or eliminate these risks at the SMP2 level.

The SMP2 Action Plan identifies actions to help reduce these risks. The FRMS will help better understand the risks and help reduce them. The IROPI process will also help to reduce risks associated with habitat creation. It is unclear if all risks will be eliminated by these processes. The Action Plan identifies the need to monitor habitat losses against habitat creation and the progress of individual habitat creation projects. The Action Plan also identifies the need for all projects to undergo EIA in order to reduce / eliminate / mitigate the impacts of individual projects.

No Active Intervention or a combination of No Active Intervention and Managed Retreat are proposed for the remaining nineteen policy units. The precise nature of the impacts within these policy units will depend on the local geology and topography. However adopting a No Active Intervention Policy means that natural coastal processes will continue to operate within these units and any changes to the coastal environment will not be as a result of the implementation of the SMP2.

The Holms lie within the Severn European site designation and a policy of NAI will not affect the site. Within policy units PEN 1-2, KIN 2 and 4 the existing hard geology and resultant high topography means that even with no intervention the rate of sea level rise is likely to outpace the speed at which the cliff face erodes and habitats roll back resulting in some loss of intertidal habitats. Where managed realignment is proposed there are likely to be opportunities for habitat creation to offset losses of intertidal habitat that will result elsewhere around the estuary.

### Reduce significance of impact associated with managing adverse impacts on condition of nationally or locally designated conservation sites.

Impacts on the Severn SSSI will be similar to those outlined above for the Severn European sites; the nature of the impact will depend to a certain extent on further detail about how the preferred SMP2 policy might be implemented, but further assessment and, if necessary, impact avoidance or mitigation will be specified within the Severn FRMS and/or at the project level. Potential effects on individual sites are discussed in more detail below:

- All of the SSSIs that comprise the Gwent Levels will be protected by a Hold the Line policy (WEN1 Rhymney and Peterstone (WEN1), St Brides (WEN2 & NEW 1) Nash and Goldcliff (CALD 1) Whitson) (CALD1), Redwick and Llandevenny (CALD 1) and Magor and Undy (CALD 1)
- The Lower Usk SSSI is considered unlikely to be significantly affected by polices NEW 1-5. Hold the Line policies (NEW 1-2 and 4-5), may reduce intertidal habitat, but the tidal range of the Usk is large and intertidal habitat itself is not one of the features of the site. A No Active Intervention Policy ( NEW 3) may benefit the site
- Bushy Close SSSI will be protected by a Hold the Line policy at CALD 3
- The two SSSIs with the WYE policy unit: Lower Wye SSSI and Pennsylvania Fields will remain unaffected, as a NAI policy is proposed and coastal and estuarine processes will continue to operate in an unrestrained manner.
- Walmore Common NNR and SSSI is located within GLO 7 and will be protected from potential inundation by a Hold the Line Policy as will Frampton Pools SSSI (SHA 6), Ashleworth Ham SSSI (MAI 2) and Alney Island LNR (MAI 5).
- Although a No Active Intervention Policy is proposed for KIN 2, Middle Hope SSSI is located on top of the cliff and is considered unlikely to be significantly affected by the implementation of this policy over the lifetime of the SMP2.

It is not possible to quantify the impacts and associated mitigation needed at the SMP2 level due to the strategic nature of the plan. Further investigation is planned as part of the FRMS and will also be needed at the project level. At this stage it is not possible to state with certainty that all the risks to SSSIs will be eliminated / mitigated. The risks outlined above for habitat creation for European sites are also relevant for SSSIs.

The Action Plan identifies the need for all projects to undergo EIA in order to reduce / eliminate / mitigate the impacts of individual projects.

### Maintain and Enhance Biodiversity Action Plan habitats and species in line with targets

It is not possible to assess with any degree of detail or certainty impacts to BAP habitats or species within individual policy units. Where a Hold the Line policy is proposed, impacts are likely to include loss of intertidal habitats. No Active Intervention and/or managed realignment may offer the opportunity to create BAP habitats however impacts will depend on local characteristics and will need to be assessed in more detail and avoided/mitigated as part of the FRMS and/or individual project proposals.

Sites for habitat creation will identified within the Habitat Delivery Plan being prepared for the FRMS; these sites will be incorporated into the Regional Habitat Creation Programme.

At this stage it is not possible to state with certainty that all the risks to BAP habitats will be eliminated / mitigated. The risks outlined above for habitat creation for European sites are also relevant for BAP habitats / species. The Action Plan identifies the need for all projects to undergo EIA in order to reduce / eliminate / mitigate the impacts of individual projects.

#### Reduce significance of impact associated with maintaining the visibility of geological exposures throughout geological SSSIs

There are eleven coastal SSSIs and designated for geological features and one RIGS within the study area. Of these nine of the SSSIs and the RIGS all located within policy units where No Active Intervention is the preferred policy. This policy will ensure that the cliff faces continue to be exposed to natural coastal processes, which will help to maintain the features for which these SSSIs and the RIGS have been designated.

Rhymney River Section SSSI is located within policy unit CAR3 where a Hold the Line Policy is proposed. The site is maintained by erosional processes maintaining the geological exposure. Assuming any defences that might be constructed are behind the site with sufficient space for the necessary erosion of the exposure over time, adverse effects will be avoided. It is not possible to state with certainty that this would happen, so risks to the site potentially remain. Further assessment of potential impacts and mitigation measures will be undertaken at the FRMS, as further details of the nature, location and type of defence are identified. Scheme level EIA will also be undertaken and is identified as an action within the SMP2 Action Plan.

### 9.4.4 SEA Objective: Historic Environment (Cultural Heritage)

#### Reduce significance of impact to scheduled and locally, regionally and nationally important cultural historic environment sites and their setting

From a cultural heritage perspective any assets which lie behind defences within policy units where a Hold the Line Option is being pursued will continue to be protected from flood and erosion risk. This includes listed structures and scheduled monuments located behind the defences within the policy units CAR 1-3 (including listed structures and a SAM (Pen y Lan Roman Fort) within the city of Cardiff), WEN 1-2 (including a number of listed structures and St Mary's Churchyard Cross SAM at Marshfield), NEW1, 2, 4 and 5 (including listed structures and SAMs in urban and industrial areas of Newport), CALD 1 (including clusters of listed structures/SAMs in Magor and Undy) and CALD 3, LYD 1 (including Lydney Harbour, Lydney Docks and Village Cross Lydney SAMs), GLO 4 (including a density of listed buildings at Newnham on Severn), GLO 5 (including Westbury Court Gardens), GLO 7 (one listed structure) & GLO 8, MAI 2, 4, 5 & 6, SHA 3 (2 or 3 listed structures), SHA 6 (listed structures in Frampton on Severn) SEV 1-4 (numerous isolated listed structures across the floodplain and 3 listed structures at Oldbury on Severn), BRIS 1-6 ( including seven SAMs, six Registered Parks and Gardens and a high number of listed buildings).

As a HTL policy is proposed for WEN 1-2 and CALD 1 and 3 the Gwent Levels Outstanding Historic Landscape will remain largely unaffected by the SMP2, apart from potential minor local impacts associated with raising or reinforcement of existing defences. In addition there may be some loss of intertidal habitat as a result of sea level rise/coastal squeeze. However it is considered that this will not detract significantly from the landscape character of the area. However there is a SAM within policy unit WEN 1 (relict seawall Rumney Great Wharf) located along the defence line which could be affected by future work to the existing defences.

There are no designated heritage features within the following policy units at risk from current or future tidal flooding or erosion and the NAI policy option proposed for these units will therefore not have an adverse effect: CALD 2, NEW 3, WYE 1-4, GLO 1 GLO 3, GLO 6, MAI 3, SHAR 5, SHAR 8, SEV 6, PORT 1-4, KIN 2, KIN 4, HOL 1 and 2.

An NAI policy is proposed for PEN1 and 2. However, the majority of assets within the Penarth policy units are not at risk of current or future erosion due to the existing hard geology and resultant high topography. However the pier and esplanade (PEN2) will be at increased risk of flood overtopping from year 20 onwards.

An NAI policy is also proposed for TID1; within this policy unit two scheduled monuments are at increased risk of flooding with the 50-100 year scenario: Broad Stone to the south of Stroat and a Roman villa south west of Woolaston.

No Active intervention followed by managed realignment is proposed for nine policy units. Within GLO2 and TID2 no designated are features at risk from current or future erosion. However there are a number of policy units which support features potentially at risk from future tidal flooding or erosion. Whether or not these features are affected will depend upon the alignment line selected.

- MAI 1– listed structures in Minsterworth no assets at risk
- SHA 1 and SHA 2 – NAI/MR listed structures in Elmore Back and Downend potentially at risk from increased flooding in the medium to long term
- SHA 4 – few listed structures in Arlingham potentially at risk
- SHA 7 and 5 - six listed structures at risk – largely associated with the canal
- KIN 1 listed structures and schedule moments including those in the villages of Wick St Lawrence, Kingston Seymour, and Portbury Ho.

It is not possible to state with certainty that all the impacts to historic environment assets have been mitigated and risks potentially remain.

Further discussions with relevant heritage organisations including County Archaeologists (in England), Cadw, English Heritage and the Gwent Glamorgan Archaeological Trust (GGAT) will be undertaken as part of the development of the SMP2 Action plan to determine priorities for measures to avoid or mitigate potential impacts on the heritage environment. The Action Plan identifies a number of actions to better understand the historic assets around the estuary and, hence the risks to them from flooding and coastal erosion.

Potential impacts will also be in key consideration when determining the alignment for defences as part of the development of the FRMS. The Environment Agency is committed to assessing the impacts of its activities on the historic environment at the project level; assessment of potential impacts and any subsequent mitigation will focus on excavations undertaken for the construction or improvement of new defences.

The SMP2 Action Plan identifies the need for EIA as part of the development or maintenance of defences to fully understand the potential impacts to and mitigation needed to maintain the historic environment.

### 9.4.5 SEA Objective: Water Environment

#### Water resources are protected

In terms of water resources and surface water management, assets to be protected include power station abstractions, and public water supply abstractions from the lower sections of the Rivers Severn, Usk and Wye, as well as the Purton abstraction by Bristol Water from the Gloucester and Sharpness Canal.

The strategy is unlikely to impact on the power stations' ability to abstract water for cooling. Oldbury Power station (SEV 4 – HTL), Uskmouth (NEW 5 – HTL) and Berkeley Power station (SEV 2 – HTL). The Hold the Line policy proposed for these reaches will ensure they remain protected from flooding and are unlikely to impact on the operations including the use of sea water for cooling.

There are very few water resources abstractions from the lower sections of the Severn, Usk and Wye. No abstractions from the Rivers Usk or Wye are at risk of tidal flooding as all major abstractions are located upstream of the study area. British Waterways abstract water from the River Severn at Gloucester to the Gloucester and Sharpness Canal. The proposed option for this policy unit (MAI 5) is Hold the Line so there will be limited risk of tidal flooding to this abstraction.

The Purton abstraction (used by Bristol Water to abstract water for public water supply from the Gloucester and Sharpness Canal) is not itself at risk from tidal flooding because it is on higher ground. The Gloucester and Sharpness Canal is however at risk of flooding; the implementation of a Hold the Line in policy units MAI 5 and 6, SHA 3 and 6 will ensure the feature is not a risk from flooding via these policy units. A No Active Intervention /Managed

Realignment policy is identified for SHA 1, 2 and 7 the canal will be protected from flooding. The canal is not at risk of flooding from SHAR 1 and 2. Within SHAR 4 when determining the alignment of defences, potential impacts on the canal will be taken into account and the new defence alignment will avoid adversely affecting the canal. A further assessment of impacts and identification of avoidance or mitigation measures will be undertaken at the FRMS and/or project stage.

There are two Source Protection Zones (SPZ) which could be at risk from tidal flooding. In CALD 1 a level 3 SPZ will be protected by a Hold the Line policy; a level 1 SPZ is located in PORT 3 and 4, for which a policy of No Active Intervention is proposed. However the area beneath which the SPZ lies is not at current or future risk of tidal flooding.

Water resource abstractions of less than $20m^3$ per day are exempt from requiring an abstraction licence. There could be freshwater abstractions of small quantity (for example for irrigation purposes by farmers) which may be impacted on in areas where a no active implementation policy is to be implemented. There are only a limited number of areas which could still flood under this policy as most of the reaches where this policy is to be applied are on higher ground. Areas which could potentially be affected include agricultural land within in GLOS 3 and 6.

The Environment Agency has carried out a retrospective assessment of the potential impacts of the SMP2 on the Water Framework Directive (WFD), which is in Appendix J.

#### No detriment to water quality

Surface water and groundwater quality are unlikely to be significantly affected by the implementation of the SMP2 as impacts are typically restricted to coastal and estuarine reaches. There could be risks to the water quality of groundwater sources, and the surface water source the Gloucester and Sharpness Canal. Adverse effects on marine water quality impacts could occur if sewage treatment works, industrial or nuclear power plants or areas of contaminated land such as active or historic landfill sites are flooded.

There are two water Source Protection Zones which could be at risk from tidal flooding and therefore potentially an influx of saline water. In CALD 1 a level 3 SPZ will be protected by a hold the line policy and in KIN1 a level 1 SPZ will be protected by a policy of no active implementation in the first 20 years and my managed realignment between 20-100 years.

The Gloucester and Sharpness Canal is at risk of flooding and so could experience a change in water quality. However with the implementation of Hold The Line in policy units MAI 5 and 6, SHA 3 and 6, and No Active Intervention /Managed Realignment proposed for units SHA 1, 2 and 7 the canal will be protected from flooding. (Note: the canal is not at risk of flooding from SHA 4 or 5).

The Environment Agency has carried out a retrospective assessment of the potential impacts of the SMP2 on the Water Framework Directive (WFD), which is in Appendix J.

### 9.4.6 SEA Objective: Air and Climate

#### Flood management strategy is designed to adapt to or accommodate climate change trends

Where a hold the line policy is to be applied for the purpose of the SEA is has been assumed that the standard of protection will be maintained or increased over the lifetime of the SMP. It should be noted that defence height would have to be increased to provide the same consistent or increased standard of protection over time. This option is however not sustainable as the height of defences cannot be increased indefinitely as sea level rise continues to increase and so will not provide sustainable ongoing adaptation to climate change (CAR 1-3, WEN 1-1, NEW 1-2, NEW 4-5, CALD 3, LYD 1, GLO 4-5, GLO 7-8, MAI 2, MAI 4-6, SHA 3, SHA 6, SEV 1-5, BRIS 1-6, KIN 3). It is not clear if the SoP would be maintained in all HTL policy units, as there are three possible ways in which HTL could be implements (see 8.3.1 for an explanation of

HTL). It is, therefore, not possible to say if the potential impacts are as great as assumed in the SEA. The FRMS will look in more detail at how the policy options will be implemented, including the SoP.

Where a no active intervention policy is to be applied, the natural evolution of the coast will adapt to accommodate the impacts of climate change (PEN 1-2, NEW 3, WYE 1-4, TID1, GLO 1, MAI 3, SHA 5, SHA 8, SEV 6, PORT 1-4, KIN 2, KIN 4, HOL 1-2).

Where a managed realignment policy is to be implemented either between the 0-100 year time period or between 20-100years, the option will accommodate the effects of climate change as the retreated defences will, in the upper estuary, provide some flood risk management benefit and across the estuary as a whole managed realignment will allow habitats to roll back providing benefit to protected sites (TID 2, GLO 2, MAI 1 SHA 1-2 SHA 4, SHA 8, KIN 1).

### 9.4.7 SEA Objective: Landscape

#### Avoid detrimental effects and enhance landscape character

Assets to be protected include landscape characters identified in both the English and Welsh parts of the study area, as well as the Mendip Hills AONB. Other landscape features such as wetland areas and areas of historical interest have also been considered in terms of landscape.

A Hold the Line policy option has been proposed for approximately half of the policy units. For some of these policy units where flood risk is minimal, for example CAR 1 and CAR 2 and BRIS 3 and 4, there will be little change to the landscape character because limited raising of defences is required. However, for the majority of policy units the local landscape will be impacted on by the raised height of the sea defences; this could also disrupt views from coastal footpaths (e.g. SEV 1 or GLO 5 – 4) and affect visual amenity. This will be a long term visual impact, but at this stage is assessed as having only a local, minor, adverse impact. Further assessment of impacts will be undertaken at the FRMS stage when more detail on the location, nature and type of defences are known. In addition, a landscape and visual impact assessment will be required by a scheme proponent (likely to be the Local Authority or the Environment Agency) at the project level to characterise the existing local landscape and views and allow impacts on landscape and visual amenity to be identified and quantified in more detail. This will allow impacts to be avoided or mitigated. The Action Plan identifies the need for an EIA (which would include potential landscape and visual impact assessment) for all defence construction and maintenance projects. It is not, however, possible to state with certainty that all impacts will be mitigated.

No Active Intervention has been proposed for approximately a third of the policy units. Most of these units have high ground and or hard geology so are not at risk of flooding or erosion and will not be affected by the adoption of this policy option.

The increasing frequency of flooding in policy units at increased flood risk, is likely to alter vegetation (with terrestrial species replaced by more salt tolerant plants) and as a consequence the local landscape; these impacts may be considered positive or negative. A neutral score has been assigned to reflect uncertainties present at this strategic level and the fact that in some cases the change may depend on perception. Within predominantly rural policy units, for example GLO 6 increased frequency of flooding could result in alterations in vegetation condition and structure, which would lead to landscape change. It is not possible to state with certainty that all impacts will be mitigated and further assessment will be required as part of the FRMS.

For those seven policy units where non active intervention is to be implemented for the first 20 years and managed realignment for the 20-100 year time period the retreat of the defences will cause a local landscape change, but its significance will depend on the specific details of retreat for each policy unit. There will be an increased risk of flooding on the seaward side of the new defences so there is likely to by a change to the vegetation structure and landscape in areas.

Careful consideration will be given to diversion routes for footpaths including the Severn Valley Way to ensure that diversion does not lead to loss of visual amenity of the route through the landscape. It is not, however, possible to state with certainty that all impacts will be mitigated. Further assessment will be undertaken as part of the FRMS, which will look in more detail at the alignment of set back defences. The Action Plan also identifies the need for an EIA (which would include potential landscape and visual impact assessment) for all defence construction projects – this includes projects to create a re-aligned defence.

### 9.4.8 SEA Objective: Contribute Towards Sustainable Development

#### Natural coastal process are promoted e.g. through managed retreat of defences.

Where a Hold the Line policy is advocated (approximately half of the policy units) the natural processes of coastal erosion and deposition will be constrained. It is not possible to mitigate these impacts as it would not enable the flood and erosion management aims of the SMP2 to be met.

A Managed Realignment policy is proposed for eight policy units in the 20-100 year period. These are TID 2, GLO 2, MAI 1, SHA 2, 4, 7 and KIN 1. At these locations any retreat of the defence line will allow natural erosion and deposition processes to continue to in an unrestrained manner for the lifetime of the SMP2. The impacts of this policy option are therefore positive in that they are enabling a more sustainable system to operate.

Where a No Active Intervention policy is proposed (approximately a third of all policy units) and for the first 20 years of the eight policy units where managed realignment is advocated in the 20-100 year period, natural coastal processes will be allowed to operate and will not be constrained by the strategy. This is a positive impact allowing sustainable natural systems to operate.

#### Minimise whole life costs of defences

Where a Hold the Line policy has been proposed defences are likely to require maintaining or raising at some point over the lifetime of the SMP2 and will therefore perform poorly against this objective. A No Active Intervention policy (approximately a third of policy units) has little or no requirement in terms of future capital input and therefore will make a positive contribution towards this objective.

For the eight policy units (TID 2, GLO 2, MAI 1, SHA 2, 4, 7 and KIN 1) that propose a No Active Intervention policy, followed by a Managed Realignment Policy there will be an adverse impact, in that new defence structures are likely to be required to be built and maintained.

It is not possible to state with certainty what the whole life costs of new defences will be (although assumptions are made in the economics assessment for the SMP2 – see Appendix H). Too much uncertainty remains regarding how policies will be implemented, what actions will be undertaken and what and their associated costs will be and at this stae the assessment can nto concludethat the whole life costs of the SMP2 have been minimised. The FRMS will undertake more detailed assessment, as it will provide more detail on how policies will be implemented, but it is unlikely to eliminate all the uncertainty. This will need to be considered in more detail at the project level.

### 9.4.9 Summary

The significance of the individual effects for each objective has been aggregated in order to give an overall assessment of how well each option performed against the objectives (see Table 9-2). The aggregated impacts are colour coded according to the significance scale shown in the key.

**Table 9-2 Aggregated Impact Significance for the Preferred SMP2 Policies**

| Policy Unit & Preferred Strategy Option | Population and Human Health | Material Assets | Biodiversity Flora and Fauna | Historic Environment | Water Envir't | Air and Climate | L'scape | Sus Dev't |
|---|---|---|---|---|---|---|---|---|
| PEN-1NAI | - | - | | - | - | - | - | |
| PEN 2-NAI | | | | | - | - | - | |
| CAR 1-HTL | - | | | - | - | - | - | |
| CAR 2-HTL | | | | | - | | - | |
| CAR 3-HTL | | | | - | - | | - | |
| WEN 1-HTL | | | | | - | | | |
| WEN 2-HTL | | | | | | | | |
| NEW 1-HTL | | | - | | | | - | |
| NEW 2-HTL | | | - | | | | | |
| NEW 3-NAI | - | | - | - | - | - | - | |
| NEW 4-HTL | | | - | | | | | |
| NEW 5-HTL | | | | | | | | |
| CALD 1-HTL | | | | | | | | |
| CALD 2-NAI | - | - | | - | - | | | |
| CALD 3- HTL | | | | | - | | | |
| WYE 1- NAI | - | - | - | - | - | - | - | |
| WYE 2 -NAI | - | - | - | - | - | - | - | |
| WYE 3 - NAI | - | - | - | - | - | - | - | |
| WYE 4 -NAI | - | - | - | - | - | - | - | |
| TID 1 -NAI | | | | - | | - | - | |
| TID 2 - NAI/MR | | | | - | - | - | - | |
| LYD 1 -HTL | - | - | - | | - | | | |
| GLO 1 -NAI | - | - | | - | - | - | - | |
| GLO 2 - NAI/MR | | | | - | - | - | - | |
| GLO 3 -NAI | | - | - | - | - | - | - | |
| GLO 4 -HTL | | | - | | - | | | |
| GLO 5 -HTL | | | | | - | | | |
| GLO 6 -NAI | | | | - | - | - | - | |
| GLO 7 HTL | | | | | - | | | |
| GLO 8 -HTL | | | | | - | | | |
| MAI 1 - NAI/MR | | | - | - | - | - | - | |
| MAI 2 -HTL | | | | | - | | | |
| MAI 3 -NAI | | | | - | - | - | - | |
| MAI 4 - HTL | | | - | | - | | | |
| MAI 5 -HTL | | | - | | - | | | |
| MAI 6 -HTL | | | | - | | | | |
| SHA 1 - NAI/MR | | | | | - | - | - | |
| SHA 2 - NAI/MR | | | | | - | - | - | |
| SHA 3 - HTL | | | | | - | | | |
| SHA 4 - NAI/MR | | | - | | - | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SHA 5 -NAI | - | - | | | - | - | - | - | |
| SHA 6 -HTL | | | | | | | | | |
| SHA 7 - NAI/MR | | | | | - | | - | - | |
| SHA 8 - NAI | - | - | | | - | - | - | - | |
| SEV 1 - HTL | | | | | | - | | | |
| SEV 2 - HTL | | | | | | - | | | |
| SEV 3 - HTL | | | | | | - | | | |
| SEV 4 - HTL | | | | | | | | | |
| SEV 5 - HTL | | | | | | - | | | |
| SEV 6 - NAI | - | - | | | - | - | - | - | |
| BRIS 1 -HTL | | | | | | | | | |
| BRIS 2 -HTL | | | | | | | | | |
| BRIS 3 -HTL | | | | | | | | | |
| BRIS 4 -HTL | | | | | - | - | | | |
| BRIS 5 - HTL | - | - | | | - | - | | | |
| BRIS 6 - HTL | | | | | | - | | | |
| PORT 1 – NAI | | - | | | - | - | - | - | |
| PORT 2 – NAI | - | - | | | - | - | - | - | |
| PORT 3 – NAI | - | - | | | - | - | - | - | |
| PORT 4 – NAI | | | | | - | - | - | - | |
| KIN 1 - NAI/MR | | | | | | | - | - | |
| KIN 2 - NAI | - | - | | | - | - | - | - | |
| KIN 3 - HTL | | | | | | - | | | |
| KIN 4 - NAI | - | | | | - | - | - | - | |
| HOL 1 - NAI | - | - | - | | - | - | - | - | |
| HOL 2 - NAI | - | - | - | | - | - | - | - | |

Key

| | | | |
|---|---|---|---|
| | Major positive contribution to objective | | Minor positive contribution to objective |
| | Major negative contribution to objective | | Minor negative contribution to objective |
| - | No impact, or change to existing situation | | |

# 10. Implementation and Monitoring Plan

The SEA directive sets out that "member states shall monitor the significant environmental effects of the implementation of plans and programmes to identify at an early stage unforeseen, adverse effects and be able to undertake appropriate remedial action "(Article 10.1). In addition the Environmental Report should provide a "description of the measures envisaged concerning monitoring" (Annex I).

With these requirements in mind this section of the report documents how, once adopted the environmental effects of implementing the strategy will be monitored against predictions made by the SEA. The key objectives of monitoring are to:

- ensure the mitigation measures are fully implemented and are effective;
- monitor all the significant environmental effects identified during the assessment and documented in the Environmental Report. This includes all significant positive, adverse, foreseen and unforeseen environmental effects;
- identify any unforeseen environmental effects and
- avoid duplication of monitoring by utilising existing monitoring programmes

Monitoring proposals have in part been derived from the environmental objectives, indictors and targets identified during the Scoping stage of the SEA although it should be noted that the monitoring proposed may not specially be testing compliance with all the suggested targets identified in Section 6.

An Action Plan is being developed as an integral part of the SMP2 to:

- present the process for the implementation of the recommendations and policies of the SMP2;
- promote use of the SMP recommendations in spatial planning;
- identify procedures for the management of the SMP until its next review;
- define the operations, activities and monitoring requirements to resolve existing uncertainties hindering policy implementation;
- provide a framework to ensure the SMP2 is used by the relevant planning authorities and made available to the stakeholders;
- establish a framework to monitor progress and inform future SMP review.

The lead LA for co-ordinating the AP is Monmouthshire County Council (MCC). They intend to monitor the delivery of the action plan through meetings held with LA (consisting of elected member of the PMG, strategic planner and flood defence engineer) bordering the Severn Estuary SMP2 shoreline, plus representatives from the EA, to discuss the approach to implementation of the Severn Estuary SMP2. Specific monitoring measures proposed are summarised below:

## 10.1 Human Environment: Access and Recreation

There is limited information about the level of current activities going on and user attitudes to change and future demand. This combined lack of information makes it difficult to plan proactively for change. An “Assets at Risk” register for the access and recreation sites around the Severn Estuary coast would help to provide the framework for improved coastal data and information management in Wales, as well as acting as the portal for improving advice to coastal decision makers. This would, however, need to be supplemented with user experience and demand information so that decisions can be made not only based on what is at risk, but what is most important to protect (from a user perspective). This requirement will be addressed within the SMP2 Action Plan.

There will be a need to monitor and review proposals for the All Wales Coastal Path as they are developed and assess the implications for proposed footpath alignments in the context of the preferred SMP2 polices. A similar exercise will need to be undertaken in England when the Marine and Coastal Access Bill is passed. It is recommended that this role l be undertaken by local authorities.

## 10.2 Biodiversity, Flora and Fauna

There is considerable variation in the nature, age and level of detail of data on designated areas of nature conservation. This means that in areas where data collation is only relatively recent it is difficult to establish long term trends supported by scientific evidence. In addition, many of the influences on nature conservation are linked to changes to the physical environment. Any uncertainty in the impact of climate change on the physical environment therefore has implications for understanding impacts on nature conservation (CCW, 2008)

### 10.2.1 European Sites

Some of the policies within the SMP2 will inevitably affect European sites across the estuary and in particular the Severn Estuary SAC, SPA and Ramsar site. The Appropriate Assessment to be undertaken for the SMP will provide additional information on intertidal habitat losses predicted to arise as a result of the implementation of the SMP, and measures to mitigate or compensate these impacts. It is likely that an IROPI Statement of Case will be needed. (see Appendix I Part B).

Managed Realignment is proposed in a number of Policy Units and has been selected where there is the potential to create and compensate for habitats lost as a result of coastal squeeze at other stretches of shoreline of the Severn Estuary. A detailed Habitat Delivery plan is being developed as part of the Severn Estuary Flood Risk Management Strategy to compensate for habitat lost as result of coastal squeeze and the construction of new defences as well as a vehicle to help achieve Environment Agency BAP targets.

Within England it has now been agreed by the Coastal Forum, that the Environment Agency Regional Habitat Creation programmes (RHCP’s) can be used to deliver compensatory habitats for SMPs and FRMSs. Local Authorities who are responsible for the development on some SMP’s, will liaise with RHCP coordinators to ensure that their habitat requirements (i.e. from coast protection works) are included in the RHCP’s. Natural England (NE) will also consult with the RHCP to establish and agree what type of habitat must be created and its geographical position in relation to the losses. Consultation with NE must also occur once the site has been decided upon to establish the validity of the selected site. This agreement with NE is extremely important in determining Environment Agency approval for delivery of the habitat creation, without it the habitat creation may not be supported. NE will also need to work with the Environment Agency to agree and put in place a monitoring package to monitor habitat evolution and determine whether and when any sites created as compensatory habitat have achieved the required ecological functioning to be considered as compensating for the losses

elsewhere. The changing nature and extent of intertidal habitat and the ratio of mudflat to saltmarsh will require ongoing monitoring, potentially linked to the monitoring of SSSIs (see below). The SMP2 Action Plan identifies the need for monitoring of overall habitat losses and gains as well as of individual habitat creation projects.

### 10.2.2 SSSIs

The SMP has the potential to affect the condition of SSSIs through changes in habitat and coastal management. The continued monitoring of SSSI units is essential as this will enable an early determination of where favourable condition may be threatened by inappropriate coastal management (SMP policy). It is considered that the existing monitoring programme undertaken by Natural England and CCW would be sufficient for this purpose, but there is a need to feed any findings into ongoing reviews of the SMP Action Plan and the subsequent evolution of SMP policy.

### 10.2.3 BAP Habitats

Implementation of the SMP will result in the shift in transitional habitat composition (particularly the loss or gain of intertidal habitat and the relative ratios of mudflat to saltmarsh). There is a need to ensure that monitoring of BAP habitat in the plan area is provided in a manner which will highlight shifts in BAP habitat extent, and inform the BAP recording process. This mechanism is required to ensure that wider mechanisms exist for BAP habitat creation which addresses emerging requirements based on the effects of the SMP. This task is likely to be taken on by one or several of the following: Environment Agency, Local Authority, CCW, NE.

## 10.3 Historic Environment (Cultural Heritage)

Given the importance of the historic environment within the Severn Estuary the implementation of the SMP2 will inevitably affect some features of the estuary. Data on heritage features within the Severn Estuary is extensive but often fragmented. There is a need to compile a dataset of prioritised features of the historic environment and assess the relative importance of assets around the Severn. For prioritised heritage features, specific details regarding the preferred management of the site are required in order to fully and effectively assess appropriate policy. The formulation of a prioritised list of heritage features with preferred management practices will inform the development of policy and assist where there is a conflict of interest: e.g. Management practices that protect developed features of the shoreline from flooding may affect the quality of the heritage feature at the site. Once the SMP2 is completed, it is important for future study to consider an appropriate programme of survey, recording and investigation to record heritage features (known and unknown) where proposed policy results in their loss.

Within the SMP Action Plan therefore, Cadw; English Heritage; Local Authorities; Glamorgan-Gwent Archaeological Trust will be instrumental in establishing what the specific nature of losses may be, and where losses are known, a figure for investigation established so that this funding can be sought from Government. The intent of addressing this matter within the SMP Action Plan will be to ensure that funds are made available to investigate threatened sites and to better understand the importance of historic environment features around the estuary.

## 10.4 Morphology

Monitoring of foreshore levels, and erosion rates (where relevant) will be undertaken to contribute to the recording and assessment of shoreline evolution, to provide quantified rates of shoreline evolution and changes in intertidal habitats such as saltmarsh. The SMP2 Action Plan identifies the need for monitoring of overall habitat losses and gains as well as of individual habitat creation projects.

## 10.5 The Water Environment

Data on groundwater, flood risk and water quality is already routinely collated by the Environment Agency and this information will feed into the ongoing monitoring for the SMP2

# 11. Conclusions

The Severn Estuary SMP2 is a non-statutory plan which aims to set high level policy approaches for the future management of flood and erosion risk along the estuary's coastline. SMPs allow the development of strategy plans to be prioritised.

The SMP2 outlines broad policy options to be adopted across each of the policy units within the study area, and many if not all of the policy options are likely to result in the identification of some potentially adverse effects. This does not necessarily mean that the policy is unacceptable, but that measures to avoid or mitigate these impacts will need to be identified in the SMP2 Action Plan or at the FRMS or implementation (project) stage.

A summary the aggregated impacts resulting from the adoption of the proposed SMP2 policy options and measures identified to manage or mitigate impacts is provided below:

**Population and Human Health**

The SMP2 will result in significant benefit to populations, human health, material assets and critical infrastructure by ensuring a strategic approach is taken to protect centres of population, businesses and critical infrastructure form increased flood and erosion risk, in the face of a changing climate. In some less densely populated policy units a Managed Realignment or No Active Intervention policy may result in the increased frequency of flooding to agricultural land which could affect nature and productivity of agricultural activities. As part of the delivery of the Action Plan discussions with IDBs and NFU/FUW are proposed to identify measures to avoid, offset or mitigate impacts.

Overall the SMP2 is considered to have a minor positive contribution to protecting recreational resources. The key strategic effect would be the protection of the existing footpath networks, public open space, cycle routes and other leisure amenities from increased flood and erosion risk.

**Biodiversity Flora and Fauna**

The assessment of likely significant effect undertaken for the SMP2 (see Appendix I Part B) concluded that the only European sites potentially affected by the implementation of the SMP2 are the Severn SPA, SAC and Ramsar sites and the Somerset Levels and Moors SPA and Ramsar sites. This has been assessed as a major adverse impact. A calculation of the predicted habitat loss has been undertaken as an integral part of the Appropriate Assessment (see Appendix I Part B). The Environment Agency are developing a Habitat Delivery Plan which will identify sites across the estuary which can potentially be secured to provide compensation for habitat loss. It is not possible to state with certainty that a sufficient quantity of compensatory habitat or the required type / types will be provided with the Severn Estuary. This uncertainty is due to the need to secure the agreement of land owners and funding to implement projects as well as general uncertainty around how well the sites will perform in developing the necessary replacement habitat. Further investigation and assessment will be undertaken for the IROPI Statement of Case, as part of the FRMS and for individual projects.

All of the SSSIs that comprise the Gwent Levels will be protected by a Hold the Line policy in this location. No adverse impacts on any other non-geological SSSI are predicted and in many cases a Hold the Line policy will ensure sites continue

to be protected from adverse effects of flooding and/or erosion. Overall the impact of the SMP2 on sites of national nature conservation importance has been assessed as a major beneficial impact.

There are eleven coastal SSSIs and designated for geological features and one RIGS within the study area. Of these, nine of the SSSIs and the RIGS all located within policy units where No Active Intervention is the preferred policy. This policy will ensure that the cliff faces continue to be exposed to natural coastal processes, which will help to maintain the features for which these SSSIs and the RIGS have been designated. Rhymney River Section SSSI is located within policy unit CAR3 where a Hold the Line Policy is proposed. Further consideration of how the policy will be delivered will be undertaken at the FRMS and project level to ensure adverse impacts on the site are avoided or minimised. Overall the SMP2 will have a major positive impact on geological SSSIs, although this conclusion should be treated with caution, as uncertainty about how policy options will be implemented remain at the SMP2 level. The FRMS will help to clarify some of these issues; others will need to be addressed at project level.

**Historic Environment (Cultural Heritage)**

Overall all the SMP2 will have a major beneficial impact on the historic environment, largely protecting features and historic landscapes behind existing defences where a Hold the Line policy is being proposed.

There is the potential for adverse effects on individual features within some policy units either where structures are on the existing defence line (e.g. a SAM within policy unit WEN 1) are in front of the defence line (e.g. the pier and esplanade in PEN2) or are potentially affected by increased flooding as a result of a No Active Intervention or Managed Realignment policy option. Further discussions with relevant heritage organisations including County Archaeologists (in England), Cadw, English Heritage and the Gwent and Glamorgan Archaeological Trust will be undertaken as part of the development of the SMP2 Action Plan to determine priorities for measures to avoid or mitigate potential impacts on the heritage environment.

**Water Environment**

The SMP2 will have a major positive effect on water resources and water quality, protecting key features such as sewage treatment works, existing abstractions and source protection zones from future flood and erosion risk.

**Air and Climate**

Where a no active intervention policy or managed realignment is to be applied, the natural evolution of the coast will adapt to accommodate the impacts of climate change, delivering a minor beneficial impact. A Hold the Line policy is likely to require ongoing maintenance or increasing height of defences to take the effects of climate change into account so has been assessed as having minor adverse impact in that the approach will not provide sustainable ongoing adaptation to climate change

**Landscape**

Overall the SMP2 has been considered to have a neutral impact on the landscape of the Severn estuary. Uncertainty remains over specific impacts and mitigation measures needed that will need to be addressed either by the FRMS or at project level. The SMP2 Action Plan identifies the need to undertaken EIAs for all maintenance or construction works to implement policies.

Implementation of a Hold the Line policy may result in the need for new defences or the height of existing defences to be increased. Although these will result in local adverse effects, measures to ensure the structures are visually integrated into the local landscape will ensure this is only a local minor adverse impact. The adoption of this policy option will however ensure that the landscape behind the defence line is protected from change (major positive impact).

Where an option will result in a significant increase in the frequency of flooding of an area, a change in vegetation structure is likely to occur and this has been assessed as potentially resulting in a major adverse change to the landscape.

**Sustainable Development**

Overall the SM2 will have a neutral impact when considered in the light of the sustainability objectives identified. No Active Intervention and Managed Realignment policies are suggested for approximately half the policy units and will allow natural processes to continue to operate, a minor beneficial impact. However a Hold the Line policy will constrain natural process, resulting in a minor adverse impact.

Hold the line and managed realignment policies will require ongoing input of resources (minor adverse effect), whereas the implementation of a Non Active Intervention policy will have minimal resource requirement (minor beneficial effect).

Uncertainty remains over specific impacts and mitigation measures needed that will need to be addressed either by the FRMS or at project level. The SMP2 Action Plan identifies the need to undertaken EIAs for all maintenance or construction works to implement policies.

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# GLOSSARY OF TERMS

**— A —**

**Advance the line**
The construction of a new flood management scheme in front of existing flood defences

***Agri-environment schemes***
Schemes under EC Regulation 1257/99 which offer grants for measures to conserve and enhance the countryside.

***Tir Cynnal Agri-environment Scheme***
The National Assembly for Wales are responsible for Tir Cynnal, a new 'entry level' agri-environment scheme that acts as a precursor to Tir Gofal (see below). It is a mechanism for farmers to receive incentive payments for converting at least 5% of their total land areas to semi-natural wildlife habitat, for example through river corridor works.

***Tir Cymru***
The Tir Cymru agri-environment scheme includes the Tir Gofal and Tir Cynnal programmes. Tir Gofal is WAG's flagship agri-environment scheme that was introduced in 1999 to replace the Environmentally Sensitive Area (ESA) and Tir Cymen schemes. It is a whole farm scheme, available on farmed land throughout Wales. It rewards farmers for caring for the environmental, historical and cultural features on their land and is designed to support the farming community in protecting and enhancing the environmental and cultural landscapes of Wales. It provides the opportunity to encourage landowners in the CFMP area to pursue more sustainable land use management. The Tir Cynnal scheme was introduced by WAG in 2005. It is a whole farm, entry-level scheme which aims to give Welsh farmers more opportunities to protect areas and features of environmental importance on their land, in return for payment. This scheme requires greater levels of environmental protection than the SPS Cross Compliance requirements, but is not as demanding as Tir Gofal. Participants in this scheme must identify the risks to soil, water and air on their farm arising from current farming practices, and ensure that 5 per cent of the total area is set aside for wildlife habitats.

***Tir Gofal Agri-environment Scheme***
Tir Gofal, for which the National Assembly for Wales are also responsible for, is a whole farm initiative which aims to encourage agricultural practices that will protect and enhance the landscapes of Wales, and their cultural features and associated wildlife, through the provision of incentive payments.

***Agricultural Land Classification***
A grading system for agricultural land based on the analysis of long-term physical limitations for agricultural use. Climate, site and soil characteristics and the interactions between them can affect the classification.

***Average Annual Damages (AAD)***
Depending on its size (or severity), each flood will cause a different amount of flood damage. The average annual damage is the average damage in pounds per year that would occur in a designated area from flooding over a very long period of time. In many years there may be no flood damage, in some years there will be minor damage (caused by small, relatively frequent floods) and, in a few years, there will be major flood damage (caused by large, rare flood events).

***Annual Exceedence Probability (AEP)***
This is the statistical chance of a flood of a given size happening in any one year. For example, a flood with a 1% AEP will happen, on average, every 100 years.

This can also be expressed as a 1/100 chance of happening in any one year or a 100 year return period. A flood with an AEP of 10% will happen, on average, once every 10 years and has a 1/10 chance of happening in any one year or a 10 year return period.

***Aquifer***
An aquifer is an underground layer of water-bearing permeable rock, or unconsolidated materials (gravel, sand silt or clay) from which groundwater can be extracted.

***Area of Outstanding Natural Beauty (AONB)***
AONBs were formally designated under the National Parks and Access to the Countryside Act of 1949 to protect areas of the countryside of high scenic quality that cannot be selected for National Park status owing to their lack of opportunities for outdoor recreation (an essential objective of National Parks). The Countryside Council for Wales is responsible for advising the National Assembly for Wales regarding the designation of AONBs. Further information on AONBs can be found at: http://www.aonb.org.uk

***Attenuation***
In relation to flooding, the impact of the floodplain on the shape of a flood hydrograph (reducing flood peak and increase flood duration) due to a combination of storage and resistance. Flood attenuation provided by 'natural storage' has increasingly been considered as a useful complement to conventional flood defences in certain situations, e.g. flood attenuation areas that can be used to cope with overflow when river levels rise. By allowing floodwaters on to these open spaces, downstream properties can be better protected.

**— B —**

***Biodiversity Action Plan (BAP)***
An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity. BAPs are statutory documents. For further information, consult the BAP website: http://www.ukbap.org.uk

***Birds Directive***
European Community Directive (79/409/EEC) on the conservation of wild birds. Implemented in the UK as the Conservation (Natural Habitats, etc.) Regulations (1994). For further information, consult the Office of Public Sector Information website: http://www.opsi.gov.uk or Her Majesty's Stationary Office (HMSO) website: http://www.hmso.gov.uk/si/si1994/Uksi_19942716_en_1.htm

***Boulder Clay***
Residue deposited by glaciers as they retreated at the end of the ice ages. It consists of a mixture of rock fragments, clay, sand and gravels. Boulder clay is variously known as till or ground moraine.

**— C —**

***Cadw***
Cadw is the Welsh Assembly Government's historic environment division. Its aim is to promote the conservation and appreciation of Wales's historic environment. Cadw is the prime source of information on designated assets. Information on non-designated assets is held in the Glamorgan-Gwent Archaeological Trust's Historic Environment Record (HER) (www.ggat.org.uk) and the National Monuments Record (NMR). Further details may be available either on the Royal Commission on the Ancient and Historical Monuments of Wales website: http://www.rcahmw.org.uk/ or via Cadw's website: www.cadw.wales.gov.uk

***Calcareous***
Of, or containing, carbonate of lime or sandstone.

***Catchment***
The area drained by a particular river or watercourse. A surface water catchment is the area defined by the highest boundary between two catchments whilst a groundwater catchment is the area that contributes to the groundwater component of the river flow.

***Catchment Abstraction Management Strategy (CAMS)***
Environment Agency strategy document outlining the availability and pressures on water resources in a catchment.

***Catchment Flood Management Plan (CFMP)***
A CFMP is a large scale, long-term (50 to 100 years) strategic planning framework for the integrated management of flood risks to people and the developed and natural environment in a sustainable manner.

***Catchment Sensitive Farming***
Government initiative aimed at reducing diffuse water pollution from agriculture in England and Wales. The programme seeks to help meet Water Framework Directive water quality targets. The project aims to improve the environment and reduce farming's impact on local streams, rivers and lakes.

***Coastal Habitat Management Plan (CHaMP)***
Strategic plans that quantify habitat change (loss and gain) over a 30-100 year timescale and recommend measures to prevent future losses. Measures include modifying flood and coastal defence options to avoid damage, or identifying the necessary habitat restoration or recreation works to compensate for unavoidable losses. CHaMP actions are delivered through Shoreline Management Plans (SMPs) and other flood and coastal defence strategies and schemes.
Living with the Sea - CHaMPS - What are they?

**Coastal Squeeze**
Areas of saltmarsh or mudflat that become trapped between the seawall and the rising sea levels.

***Common Agricultural Policy (CAP)***
The CAP is a system of EU agricultural subsidies and programmes. The subsidies guarantee a minimum price to producers by direct payment of a subsidy for crops planted. Reforms of the system are currently underway, including a new Single Payment Scheme for direct farm payments that is being introduced in the UK.

***Communication Plan***
A plan that sets out the CFMP consultation programme, and specific arrangements for consulting both internal teams and external organisations.

***Conservation Areas***
These are areas, usually in towns and villages, where the character of buildings and other public spaces is of "special architectural or historical interest". Such areas are defined by the Local Planning Authorities and are afforded different development controls to open countryside and built up areas not under this definition.

***Conveyance***
Conveyance is a measure of how well a channel or structure, such as a bridge or culvert, allows water to pass through. It depends on the physical characteristics of the channel or structure, including its size, shape and surface roughness.

***Countryside and Rights of Way Act (CRoW)***
The Countryside and Rights of Way (CRoW) Act 2000 came into force on 30 January 2001. The Act applies in England and Wales and has five parts:
1. Access to the Countryside.
2. Public Rights of Way and Road Traffic.
3. Nature Conservation and Wildlife Protection.
4. Areas of Outstanding Natural Beauty.
5. Miscellaneous and Supplementary.
Of these, Part 3 is the most relevant in terms of catchment flood management as it gives biodiversity a statutory basis, revises SSSI notification procedures, greatly increases protection for SSSIs and strengthens the advisory role of EN / CCW, increases the scope of some wildlife offences and increases penalties. For further information, refer to the Office of Public Sector Information website: http://opsi.gov.uk or Her Majesty's Stationery Office (HMSO) website: www.hmso.gov.uk/acts/acts2000/20000037.htm

***Countryside Character Areas***
Non-statutory sub-divisions of England, as defined under the Countryside Agency's Countryside Character Initiative. There are 159 Character Areas in England, each with a broadly cohesive countryside character and specific ecological and landscape issues.

***Countryside Council for Wales / Cyngor Cefn Gwlad Cymru***
The Countryside Council for Wales is the Government's statutory adviser on sustaining natural beauty, wildlife and the opportunity for outdoor enjoyment in Wales and its inshore waters.
***Home Page - Countryside Council for Wales***

***County Wildlife Site (CWS) / Site of Nature Conservation Importance (SNCI)***
CWSs and SNCIs are designated at a local level through inclusion within local or unitary development plans due to their regional or local conservation interest. These sites are usually adopted by local authorities for planning purposes but have no statutory protection. Further information on these designations can be found at the following website: http://www.naturenet.net/status/sinc.html

***Critical Ordinary Watercourses (COWs)***
Stretches of non-main watercourses that have been defined as critical in terms of flood risk management through consultation between the Environment Agency, Local Authorities and Internal Drainage Boards (IDBs).

**— D —**

***Department for Communities and Local Government (DCLG)***
The successor to the Office of the Deputy Prime Minister (ODPM) It is responsible for promoting community cohesion and equality, housing, urban generation, planning and local government.
http://www.communities.gov.uk

***Department for Energy and Climate Change (DECC)*** Created in October 2008, to bring together: energy policy (previously with BIS - the Department for Business, Innovation & Skills), and climate change mitigation policy (previously with Defra - the Department for Environment, Food and Rural Affairs). For further information: Home - Department of Energy and Climate Change

***Department for Business, Enterprise and Regulatory Reform (BERR)*** Government department created on 28 June 2007 on the disbanding of the Department of Trade and Industry (DTI), and was itself disbanded on 6 June 2009 on the creation of the Department for Business, Innovation and Skills.

***Defra***
Department for Environment, Food and Rural Affairs. The department of central Government responsible for flood management policy in England.
Defra, UK - About Defra

***Defra/Welsh Assembly Government PAG3 document***
Defra's/WAG PAG (project appraisal guidance) documents set out the criteria which determine whether or not a scheme is eligible for grant aid. PAG 3 relates to economic appraisal (based on cost of the scheme verses the damages that the scheme will avoid). The other PAG documents are;
PAG1. Overview
PAG2. Strategic planning and appraisal
PAG4. Approaches to risk
PAG5. Environmental Appraisal
Defra, UK - Flood Management - Project Appraisal Guidance

***DG5 Register***
Register held by water companies of the frequency of actual flooding of properties from the public sewerage system by foul water, surface water or combined sewage.

***DTLR***
Department for Transport, Local Government and the Regions; the department responsible for developing and implementing planning policies. Replaced by the Office of the Deputy Prime Minister. – now superseded by Dept for Local Communities

***Drift***
In geology, drift is transported rock debris overlying the solid bedrock. The transport mechanisms can include rivers and glaciers. Glacial drift is a general term for the coarsely graded and extremely heterogeneous sediments of glacial origin. In the UK the term drift is commonly used to describe any deposits of quaternary age.

**— E —**

**English Heritage**
English Heritage is the Government's statutory adviser on the historic environment in England. Officially known as the Historic Buildings and Monuments Commission for England, English Heritage is an Executive Non-departmental Public Body sponsored by the Department for Culture, Media and Sport (DCMS). Its powers and responsibilities are set out in the National Heritage Act (1983) and it reports to Parliament through the Secretary of State for Culture, Media and Sport. About Us: English Heritage

***Environment Agency***
Non-departmental public body responsible for the delivery of UK Government policy relating to the environment and flood risk management in England and Wales.

***Environmental Impact Assessment (EIA)***
The process by which the likely impacts of a project or development upon the environment are identified and assessed to determine their significance. EIA are statutory for many developments likely to have an adverse environmental impact, and for any plan affecting a European designated site for conservation.

***Environmentally Sensitive Areas (ESA)***
Introduced by the Ministry of Agriculture, Fisheries and Food (MAFF; predecessor to DEFRA) in 1987 and are designated under the provisions of sections 18 and 19 of the 1986 Agriculture Act and Environmentally Sensitive Area (Stage II) Designation (Amendment)(No2) Order 2001. They are governed by DEFRA and offer incentives (on a 10 year agreement with a 5 year break clause) to encourage farmers to adopt agricultural practices, which would safeguard and improve parts of the country of particularly high landscape, wildlife or historic value. DEFRA introduced the Environmental Stewardship Scheme in March 2005 which supersedes (with enhancements) the Environmentally Sensitive Areas and Countryside Stewardship Schemes. Further details can be found on the DEFRA website:
http://www.defra.gov.uk/erdp/schemes/esas/default.htm

***Environmental Stewardship Scheme (ESS)***
ESS is a new agri-environmental scheme, launched in March 2005, which provides funding to farmers and other land managers in England who deliver effective environmental management on their land. The scheme is intended to build on the recognised success of the ESA and Countryside Stewardship schemes.

***Evaporation***
The process where a liquid (water) changes into a gas (water vapour).

**— F —**

***Fisheries Action Plan***
A document setting out a vision for rivers, canals and stillwater fisheries within a catchment and an actions plan to address the main issues affecting them. Potential funding is also identified where possible. We are developing FAPs in partnership with representatives of the local fisheries community. The production of FAPs was proposed in the Salmon and Freshwater Fisheries Review 2000 and has since been supported by the Government. More information and existing FAPs are available on our website: http://www.environment-agency.gov.uk

***Flood cell***
A discrete area of flood-risk that is bounded by raised land features or structures, which prevent the passage of flood waters.

***Flood Damages***
Flood damages are worked out from the estimated flood depth and extent data obtained from hydraulic modelling. By combining the information on the type and value of properties shown to be within the modelled flood outline, it is possible to calculate the overall damage the flooding would cause. Flood damage figures can be given for a range of specified magnitudes of flood event, for example, the 1% annual probability flood event.

***Flood Defence***
A structure (or system of structures) for the alleviation of flooding from rivers or the sea. Flood defences only reduce the likelihood of flooding and not the consequences of flooding when they are overtopped. Flood risk is a combination of likelihood of the event occurring and the consequences when it does.

***Flood Event***
An occurrence of flooding.

***Flood Map***
Shows flooding from rivers and sea, with a 1 % and 0.5 % chance respectively of happening in any one year. The extreme flood outline (EFO) is also shown for both river and tidal flooding with a 0.1 % annual chance. The flood map also displays flood defences and the areas that benefit from them. It can be found on our website at www.environment-agency.gov.uk/flood . These maps are sometimes referred to as Section 105 maps, or Indicative Flood Maps.

***Floodplain***
Any area of land over which water flows or would flow if there were no flood defences. It can also be a place where water is stored during a flood event.

***Flood Risk***
Flood risk is the product of the likelihood (or frequency) of flood events and their consequences (such as property loss or damage, physical harm or distress and social and economic disruption).

***Flood Risk Management***
Changing the frequency or consequences of flooding to an appropriate level (appropriate to land use), and monitoring to make sure that flood risks remain at this level. This should take account of other needs to manage water levels, and opportunities and constraints. It is not just about applying flood defence measures.

***Flood Risk Management Strategy***
A long-term approach to developing and setting out the policy, objectives and options for flood defence taking into account a broad range of local, national and international issues.

***Fluvial***
Relating to a watercourse (river or stream)

***Fluvial Geomorphology***
Processes and forms associated with the erosion, transport and deposition of river sediment.

***Forestry Commission Wales***
Forestry Commission Wales acts as the Welsh Assembly Government's department of Forestry and directly as stewards of the 38% of welsh woodlands owned by the National Assembly. Their mission and corporate plan is to help deliver Better Woodlands for a Better Wales. Forestry Commission Wales

***Freshwater Fisheries Directive Designation***
An EC Directive (78/659/EEC) aiming to protect and improve water quality and forming part of the Environment Agency's water quality monitoring programme. The Directive sets standards to safeguard freshwater fisheries, mainly relating to the quality of the water, and requires that certain designated stretches of water meet these standards in order to enable fish to live or breed.Environment Agency - Freshwater Fish Directive

**— G —**

***General Quality Assessment***
The Environment Agency assesses river quality annually using a survey called the General Quality Assessment (GQA) scheme. This measures four aspects of river quality – biology, chemistry, nutrients and aesthetic quality.

***Geographical Information System (GIS)***
A GIS is a computer-based system for capturing, storing, checking, integrating, manipulating, analysing and displaying data that are spatially referenced.

***Geomorphology***
Geomorphology is concerned with the structure, origin and development of the topographical features of the earth's crust. Fluvial Geomorphology is concerned with the physical processes that create sediment erosion and deposition and which define the shape of a river and its floodplain.

***Glacial Till***
Till is an unsorted glacial sediment. Glacial till is that part of glacial drift which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel and boulders.

***Groundwater***
Water occurring below ground in natural formations (typically rocks, gravels and sands). The subsurface water in the zone of saturation, including water below the water table and water occupying cavities, pores and openings in underlying soils and rocks.

**— H —**

***Habitats Directive***
European Community Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna. Implemented in the UK through the Conservation (Natural Habitats, etc.) Regulations (1994) and known as the 'Habitats Directive'. It establishes a system to protect certain fauna, flora and habitats deemed to be of European conservation importance. For further information refer to the Office of Public Sector Information website: http://www.opsi.gov.uk/si/si1994/Uksi_19942716_en_1.htm

***Historic Character Areas***
The historic landscape characterisation process (see below) divides each landscape area on the Register into a number of smaller, more discrete, geographical areas of broadly consistent historic character.

***Historic Environment***
Encompassing all elements of designated or un-designated archaeological sites, historic buildings and historic landscapes. It also includes sites of palaeoenvironmental interest that provide information about the nature of past landscapes, climate and environments.

***Historic Landscapes Register***
The Historic Landscapes Register provides a national overview of the historic content of the Welsh landscape. It is a non-statutory, advisory Register which aims to provide information and raise awareness on important historic landscape areas in Wales, in order to aid their protection and conservation and to give the historic environment equal weight alongside more traditional issues of nature conservation, wildlife protection and scenic amenity. Part 1 of the Register identifies 'landscapes of outstanding historic interest' and Part 2 identifies 'landscapes of special historic interest'.

***Historic Parks and Gardens***
Starting in 1992, Cadw has undertaken a comprehensive survey of historic parks and gardens in Wales. Parks and gardens thought to be of national importance have been included on the Cadw/ICOMOS Register of Parks and Gardens of Special Historic Interest in Wales. The Register was compiled in order to aid the informed conservation of historic parks and gardens by owners, local planning

authorities, developers, statutory bodies and all concerned with them. It is non-statutory.

***Hold the line***
Maintaining the existing flood defences and control structures in their present positions. This may mean repairing or replacing defences in the same place as they currently exist. It does not necessarily mean increasing the standard of protection to counteract sea level rise and climate change.

**— I —**

***Impermeable***
Used to describe materials, natural or synthetic, which have the ability to resist the passage of fluid through them.

***Inception Report***
Provides a detailed description of the work carried out during the CFMP inception stage. This includes a summary of catchment data collection and early understanding of the main issues we should consider for effective flood risk management during later phases of the CFMP process.

***Indicative Standard of Protection***
The range of level of protection to be considered for flood defences, based upon the use of the land being protected. They do not represent any entitlement to protection or minimum level to be achieved.

***Internal Drainage Boards***
IDBs are long established bodies operating predominantly under the Land Drainage Act 1991 and have permissive powers to undertake work to secure drainage and water level management of their districts and undertake flood risk management works on ordinary water courses within their districts (i.e. watercourses other than 'main river'). Much of their work involves the maintenance of rivers, drainage channels and pumping stations, facilitating drainage of new developments and advising on planning applications. They also have statutory duties with regard to the environment and recreation when exercising their permissive powers.

***Inundation***
To cover with water - especially flood waters

**— L —**

***Land Management***
A scheme, plan or other project deliberately using particular practices to affect the character, quality or value of an area. Land Management is subject to UK legislation and may require authorisation from a competent authority where it results in a change in Land Use, may require planning permission.

***Land Use***
The use to which an area of land is put (e.g. residential, agriculture, forestry, etc.). The term Land Use is used in many contexts and is controlled by the town and country planning system.

***Landscape Character Areas (LCAs)***
Landscape Character Areas are developed by the Countryside Agency under the Countryside Character Initiative, and have a strong social, historical and cultural element. The Countryside Character Initiative is a programme of information and advice on the character of the English countryside. It includes systematic

descriptions of the features and characteristics that make the landscape and guidance documents on how to undertake Landscape Character Assessment.

***Local Biodiversity Action Plan (LBAP)***
A local agenda (produced by a Local Authority) with plans and targets to protect and enhance biodiversity and achieve sustainable development. The Environment Agency is committed to BAPs and works with UK Government (Rio Earth Summit, 1992) to realise LBAP objectives.

***Local Development Documents***
These are statutory plans providing information used to decide planning applications for land use development in England. The system currently consists of Local Development Plans (produced by District Councils and Unitary Authorities) and Structure Plans (produced by County Councils and Metropolitan Councils). The Planning and Compulsory Purchase Act 2004 replaces these documents with Regional Spatial Strategies (e.g. for south east England) and Local Development Frameworks.

***Local Development Plans***
These are statutory plans providing information used to decide planning applications for land use development in Wales.

***Local Nature Reserve (LNR)***
Designated under the National Parks and Access to the Countryside Act 1949 by local authorities (which must have some legal control over the site), in consultation with Countryside Council for Wales, for their locally important wildlife or geological features. They are generally meant for education and recreation as well as conservation. For further information, refer to the Countryside Council for Wales website: http://www.ccw.gov.uk

For further information refer to the Natural England website: Natural England - Home Page

**— M —**

***Main River***
Main rivers are usually larger streams and rivers, but also include smaller watercourses of strategic drainage importance. A main river is defined as a watercourse shown as such on a main river map, and can include any structure or appliance for controlling or regulating the flow of water in, into or out of the main river. Our powers to carry out flood defence works apply to main rivers only. Main rivers are designated by the Welsh Assembly Government and Defra.

***Managed realignment***
The policy of Managed Realignment involves the placement of a new Managed Realignment flood defence landward of the existing flood defences or realignment to higher ground. This policy would be achieved through the partial or complete removal of the existing flood defences or through regulated tidal exchange. This policy would be gradually implemented and regularly monitored in order to study any potential effects on the overall estuary shape.

***Mean High Water Springs (MHWS)***
The average of the spring tides, which happen every two weeks.

***Ministry of Agriculture, Fisheries and Food (MAFF)***
Predecessor Government Department to Defra

***Morphology***
The study of form or shape e.g. the shape of river channels and how this changes overtime by processes of erosion and sedimentation.

**— N —**

***National Assembly for Wales (NAW)***
The National Assembly for Wales is the representative body with legislative powers in devolved areas. It has sixty elected members and meets in the Senedd. http://www.wales.gov.uk/organipo/index.htm .
The role of the National Assembly for Wales is to scrutinise and monitor the Welsh Assembly Government

***National Farmers Union (NFU)***
The National Farmers' Union represents the farmers and growers of England and Wales. Its central objective is to promote successful and socially responsible agriculture and horticulture, while ensuring the long term viability of rural communities. http://www.nfuonline.com/x286.xml. NFU Cymru represents the farmers of Wales. NFU Cymru - National Farmers Union of Wales - Welsh Farming and Agriculture

***National Nature Reserve (NNR)***
National Nature Reserves are designated under the National Parks and Access to the Countryside Act 1949 or the Wildlife and Countryside Act 1981 (as amended) primarily or nature conservation, but can also include sites with special geological or physical features. They were established to protect the most important areas of wildlife habitat and geological formations in Britain, and as places for scientific research. They are usually owned or leased by Countryside Council for Wales, or managed in accordance with a Nature Reserve Agreement with the landowner or occupier.

***National Park***
A National Park Authority's duties and powers are derived from a number of Acts of Parliament and statements of Government Policy, most recently the Environment Act (1995). The statutory purposes of National Parks, which the National Park Authority has the duty to pursue, are to:
• to conserve and improve the natural beauty, wildlife and cultural heritage of the area;
• to promote opportunities for the public to understand and enjoy the area's special qualities.
In pursuing these purposes National Park Authorities also have a duty to seek to foster the economic and social well being of the communities within the National Park, but without incurring significant expenditure in doing so. Further information can be found on the National Park Authorities' website: http://www.anpa.gov.uk/

***National Salmon Strategy***
We have taken over implementation of the National Salmon Strategy, which was launched by the National Rivers Authority in February 1996. It sets out objectives for the management of salmon fisheries in England and Wales to preserve fish stocks for the future whilst protecting sustainable exploitation and recognising the economic value of fisheries. Implementation takes the form of Salmon Action Plans which are local documents produced at a catchment scale.

***Natura 2000 Network***
European network of protected sites which represent areas of the highest value for natural habitats and species of plants and animals which are rare, endangered or vulnerable in the European Community. The Natura 2000 network includes Special Areas of Conservation (SAC) or Sites of Community Importance (SCI) where they support rare, endangered or vulnerable natural habitats and

species of plants or animals (other than birds). Where areas support significant numbers of wild birds and their habitats, they may become Special Protection Areas (SPA). SACs and SCIs are designated under the Habitats Directive and SPAs are classified under the Birds Directive.

***Natural Area Profiles***
Natural Areas are developed by Natural England, each area having a characteristic association of wildlife and natural features. There are 120 Natural Areas in England and each has a unique identity resulting from the interaction of wildlife, landforms, geology, land use and human impact.

***Natural England***
Natural England works for people, places and nature, to enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas; promoting access, recreation and public well-being, and contributing to the way natural resources in England are managed so that they can be enjoyed now and in the future.

***No active intervention***
There would be no further active intervention by the Environment Agency. Without intervention the defences would eventually fail and areas currently protected from flooding would no longer be protected. This would happen gradually over a long period of time. However, land owners may be entitled to pay for the continued maintenance of the flood defences or undertake maintenance themselves following the preparation of an Exit Strategy.

***Non-main River***
See Ordinary watercourses

***Non-Statutory Plans***
Since about 1990, there have been a number of initiatives in regard to non-statutory plans dealing, in particular with coastal issues. Many of these contain policies and proposals that have land-use planning implications. Non-statutory plans include: CFMPs, SMPs, CHaMPs, Estuary management plans, River Basin management Plans, Local Environment Agency Plans and Water Level Management Plans.

**— O —**

***Offline / Online storage***
Offline storage: the deliberate creation of a separate flood area (or areas) adjacent to a river, linked to the river through a sluice, weir or other control mechanism. Depending on the frequency of flooding all or part of the flood storage area may be maintained for farming (grazing or arable) or for wildlife or environmental benefits. On-line: river and storage areas are directly connected by removing embankments thereby creating a permanently wet area that fills further during flood events. On-line areas flood more frequently and in a loss controlled manner than off-line storage, this means they are less efficient and consequently a larger area is required for the same return period.

***Office of the Deputy Prime Minister (ODPM)***
The former department of central Government responsible for policy on planning and other related issues. Formerly DTLR. Has been replaced by the Department for Communities and Local Government (DCLG).

***The Office of Water Services (OFWAT)***
The economic regulator of water and sewerage services in England and Wales.

***Ordinary Watercourses***
All watercourses not designated as 'main rivers'. Operating authorities, such as Local Authorities have powers and duties to maintain ordinary watercourses within their boundaries. Riparian owners (land owners) are responsible for maintaining ordinary watercourses.

***Ordnance Datum Newlyn (ODN)***
A traditional vertical coordinate system, consisting of a tide gauge datum with its origin (0,0) located at Newlyn (Cornwall) and a Terrestrial Reference Frame observed by spirit levelling between 200 fundamental benchmarks across Britain. Each benchmark has a vertical height only (not ellipsoid height or accurate horizontal position). This coordinate system is important because it is used to describe vertical positions of features on British maps (for example, spot heights and contours) in terms of height above average sea level.

***Outfall***
The outlet of a river, drain or a sewer where it discharges into the sea, a lake etc.

**— P —**

***Permeable***
Able to be penetrated by water

***Planning and Compulsory Purchase Act (2004)***
Legislation promoted by the Office of the Deputy Prime Minister, which substantially reformed the town planning and compulsory purchase framework in Great Britain. It amended and recalled significant parts of the existing planning and compulsory purchase legislation and introduced reforms such as the abolition of Local Plans and Structure Plans, and their replacement with Local Development Frameworks.

***Planning Policy Statement 25: Development and Flood Risk (PPS25) – England Only***
One of a series of Planning Policy Statements notes (PPSs) issued by DTLR to advise local planning authorities and developers. While PPSs are not statutory, planning authorities have to consider them when they prepare plans and determine planning applications. PPs25, issued in July 2001, raises the profile of flood risk, which should be considered at all stages of the planning and development process and across the whole catchment. It emphasises the need to act on a precautionary basis and to take account of climate change. It provides advice on future urban development in areas at risk of flooding. It assesses proposals according to the amount of risk and promotes the concept of Sustainable Drainage Systems (SuDS) in new developments or redevelopments. For further information please refer to the Office of the Deputy Prime Minister's planning website: http://www.planning.odpm.gov.uk/pps25/

***Planning Policy Wales***
Planning Policy Wales sets out the land use planning policies of the Welsh Assembly Government. It is supplemented by a series of Technical Advice Notes (TANs). Together they comprise national planning policy which should be taken into account by local planning authorities in Wales in the preparation of unitary development plans (UDPs) and Local Development Plans (LDPs).

***Policy Appraisal***
Process of evaluating chosen policies against catchment objectives and scenarios of catchment change.

***Probability of Occurrence***
The probability of a flood event being met or exceeded in any one year (usually expressed as a return period – e.g. 1% AEP).

**— Q —**

**— R —**

***Ramsar site***
The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat (1971) requires the UK Government to promote using wetlands wisely and to protect wetlands of international importance. This includes the designation of certain areas as Ramsar sites, where their importance for nature conservation (especially with respect to waterfowl) and environmental sustainability meet certain criteria. Ramsar sites receive SSSI designation under The Countryside and Rights of Way (CRoW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended).Further information can be located on the RAMSAR convention on wetlands website: http://www.ramsar.org/

***Receptor***
Asset, people or environmental, cultural or landscape resource that is at risk of flooding.

***Reens*** Drainage ditch on the Gwent Levels

***Regional Planning Guidance (RPG) – England Only***
Planning Guidance issued by the Government Office for the region. RPGs are to be replaced by statutory Regional Spatial Strategies (RSS).

***Regional Spatial Strategy (RSS) – England Only***
Regional Spatial Strategies (RSS) provide a spatial framework to inform the preparation of local development documents, local transport plans and regional and sub-regional strategies and programmes that have a bearing on land use activities.

***Registered Historic Parks and Gardens***
English Heritage maintains a Register of Parks and Gardens of special historic interest in England. Cadw maintains a Register of parks and Gardens of special historic interest in Wales. The respective registers seek to ensure that the features and qualities that make these landscapes of national importance are safeguarded but does not give extra protection.

***Register of Landscapes of Historic Interest in Wales***
In 1998 and 2001, as a first step towards raising the profile of historic landscapes in Wales, Cadw, CCW and ICOMOS (UK) (International Council on Monuments and Sites) published the two-volume Register of Landscapes of Historic Interest in Wales. This advisory and non-statutory document highlights what are considered to be the best examples of different types of historic landscape in Wales.

***Return Period***
The average interval in years between events of similar or greater size (e.g. a flow with a return period of 1 in 100 years will be equalled or exceeded on average once in every 100 years). This does not mean that they will happen regularly however. To be more accurate, the 100 year flood should be expressed as an event that has a 1 % chance of being met or exceeded in any one year.

***Riparian***
Land or habitat connected with, or immediately adjacent to, the banks of a river or stream.

***Risk Assessment***
Consideration of the risks inherent in a project, leading to the development of actions to control, mitigate or accept risks.

***River Basin Management***
Maintaining a balance between human activities and demands and ecological and hydrological status within river basin catchments. River Basin Management requires an understanding of all the elements of catchment management and the legislation that drives them such as the EU Water Framework and Habitats Directives.

***River Basin Management Plan***
Part of the Water Framework Directive and will be implemented in 2009. They will describe the unique characteristics of each river basin, and the pressures it faces from pollution and over-use. We will develop a programme of measures, which sets out the WFD directives for each river basin.

***Riverine***
Relating to a watercourse (river or stream) and its floodplain.

***Run-off***
That part of rainfall which finds its way into streams, rivers etc and flows eventually to the sea

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***Salmon Action Plan (SAP)***
Local plan for the management of salmon, prepared by the Environment Agency.

***Saltmarsh***
An intertidal habitat comprising salt tolerant vegetation. Frequency and duration of tidal inundation determines which plants and animal species are present. Salt marshes are bisected by meandering creek systems, which allow tidal waters to drain in and out. The creeks slow down tidal energy and the marsh plants slow down wave energy.

***Scheduled Monuments, (SM)***
To protect archaeological sites for future generations, the most valuable sites may be “scheduled”. Scheduling means nationally important sites and monuments are protected by law by being placed on a list, or ‘schedule’. Cadw identifies sites in Wales, which should be placed on the schedule by the Welsh Assembly Government. The current legislation, the Ancient Monuments and Archaeological Areas Act 1979, supports a formal system of scheduled monument consent for any work affecting a designated monument. Further information can be found on the Cadw (http://www.cadw.wales.gov.uk ) and English Heritage (www.english-hertiage.org.uk) websites.

***Scoping Report***
Report that will gather information on catchment characteristics and flood risk. It will test how sensitive the CFMP area is to future changes in climate and land use and develop draft catchment objectives.

***Sea level rise***
The rise and fall of sea levels throughout time in response to global climate and local tectonic changes.

***Sedimentation***
The process of depositing sediment.

***Shoreline Management Plan (SMP)***
Non-statutory plans to provide sustainable coastal defence policies (to prevent erosion by the sea and flooding of low-lying coastal land), and to set objectives for managing the shoreline in the future. These are prepared by us or maritime local authorities, individually or as part of coastal defence groups.

***Single Payment Scheme (SPS)***
An agri-environment scheme that came into force in January 2005 and replaced most of the individual Common Agricultural Policy (CAP) subsidy payments previously made to farmers. Farmers claiming the SPS must be actively farming and/or maintaining the land in Good Agricultural and Environmental Condition.

***Site of Community Importance (SCI)***
Site of Community Importance adopted by the European Commission under Article 4(2) of the EC Habitats and Species Directive (92/43/EEC). Defined as a site which, in the biogeographical region or regions to which it belongs, contributes significantly to the maintenance or restoration at a favourable conservation status of a natural habitat type or of a species and may also contribute significantly to the coherence of Natura 2000, and/or contributes significantly to the maintenance of biological diversity within the biogeographic region or regions concerned.). These sites have been adopted by the European Commission but not yet formally designated by the government of each country.

***Site of National Conservation Interest (SNCI)***
SNCIs are designated at a local level through inclusion within local or unitary development plans for their regional or local conservation interest. They are usually adopted by Local Authorities for planning but have no statutory protection.

***Site of Special Scientific Interest (SSSI)***
Sites notified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way (CRoW) Act 2000) for their flora, fauna, geological or physiographical features. Notification of a SSSI includes a list of activities that may be harmful to the special interest of the site. Section 28 of the Wildlife and Countryside Act 1981 (provisions relating to SSSIs) has been replaced by a new Section 28 in Schedule 9 of the CRoW Act. The new Section 28 provides significantly improved protection for SSSIs. All SACs, SCIs, SPAs and Ramsar sites are designated as SSSIs. For further information, refer to CCW's website: http://www.ccw.gov.uk/

***Special Area for Conservation (SAC), Candidate Special Area for Conservation (cSAC)***
An internationally important site for habitats and/or species, designated as required under the European Community 'Habitats Directive' (92/43/EEC). SACs are protected for their internationally important habitat and non-bird species. A cSAC is a candidate site, but is afforded the same status as if it were confirmed. SACs and cSACs also receive SSSI designation under The Countryside and Rights of Way (CRoW) Act (2000) and The Wildlife and Countryside Act (1981) (as amended). For further details refer to the Joint Nature Conservation Committee website: http://www.jncc.gov.uk/ProtectedSites/SACselection/UK_SAC_map.htm

***Special Protection Area (SPA), Proposed Special Protection Area (pSPA)***
A site of international importance for birds, designated as required by the EC Birds Directive. A pSPA is a proposed site, but has the same status as a confirmed site. SPAs are designated for their international importance as

breeding, feeding and roosting habitat for bird species. The Government has to consider the conservation of SPAs in all its planning decisions. SPAs receive SSSI designation under The Countryside and Rights of Way (CRoW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended). For further details refer to the European Commission: website: http://europa.eu.int/comm/environment/nature/spa/intro_en.pdf and The Joint Nature Conservation Committee website at: http://www.jncc.gov.uk/ukspa/sites/spalistA-C.htm

***Standard of Protection (SoP)***
The standard of flood defence afforded to a location or community, expressed as the chance of a flood event causing flooding to an area or overtopping of defences. A SoP of 0.1% (1 in 100 chance of occurrence in any given year) means that the location will not flood until this or greater events occur.

***Strategic Environmental Assessment (SEA)***
Applying EIA to earlier, more strategic, decision-making policies, plans and programmes. SEA has been a legal requirement since 2004 for plans and programmes which are required by legislation and may lead to developments that would require EIA. It is not formally required for CFMP but the principles of SEA will be incorporated into the development of the Draft CFMP. For further details, please consult the Welsh Assembly Government website: www.wales.gov.uk/index.htm and the Office of Public Sector Information website: http://www.opsi.gov.uk/si/si2004/20041633.htm

***Structure Plan***
A statutory plan comprising part of the Development Plan, prepared by County Councils or a combination of unitary authorities, containing strategic policies that cover key planning issues over the area and provide a framework for local planning, including Unitary Development Plans (UDPs). To be replaced under the new planning system with Local Development Frameworks (which comprise all sub-regional plans).

***Surface Water Flooding***
This type of flooding occurs when the volume of water falling or flowing onto the ground surface (generally a man-made surface) overwhelms existing drainage systems.

***Sustainability***
A concept, which deals with man's effect on the environment through development. Sustainable development is 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs' (Bruntland, 1987). In the case of flood risk, sustainability is about how much flood risk management options avoid tying future generations into inflexible or expensive options for flood defence. This usually includes considering other defences and likely developments as well as processes within a catchment. It should also take account of, for example, the long-term demands for non-renewable materials.

***Sustainability Appraisal (SA)***
Sustainability Appraisal (SA) is a form of assessment that is broader in scope than SEA. It extends to considering the social and economic, as well as the environmental, effects of a strategy or plan, and evaluates these in relation to the aims of sustainable development. Under the Planning & Compulsory Purchase Act 2004.

***Sustainable Drainage Systems (SuDS)***
A sequence of management practices and control structures designed to minimise the impact of surface water on flood risk and the environment.

Techniques include the use of porous materials and soak-away systems to increase the time taken for water to enter the river network.

***Sustrans***
A sustainable transport charity which works on practical projects to encourage people to walk, cycle and use public transport to reduce motor traffic and its adverse effects.

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***Technical Advice Note 15 (TAN 15): Development and Flood Risk***
One of a series of Technical Advice Notes (TANs) issued by the Welsh Assembly Government to advise local planning authorities and developers. In conjunction with Planning Policy Wales 2002 it provides advice on development and flood risk as this relates to sustainability principles, and provides a framework within which risks from both river and coastal flooding, and from additional run-off from development in any location can be addressed. For further information, please refer to the Welsh Assembly Government's website: Welsh Assembly Government | Technical Advice Note (TAN) 15: Development and Flood Risk (2004).

***Telemetry***
The means by which a data signal is transferred to a remote control centre via the telephone network.

***The Country Land and Business Association***
With almost one hundred years experience, the Country Land and Business Association (CLA) is the premier organisation safeguarding the interests of those responsible for land, property and business throughout rural England and Wales. Country Land & Business Association

***Topography***
Physical features of a geographical area.

***Transport Wales, Welsh Assembly Government***
Transport Policy of the National Assembly for Wales. Responsible for maintenance and improvement of trunk roads and motorways in Wales. Administration of grants to local authorities and other bodies to fund a range of capital transport schemes and transport services.

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***UK Climate Change Impacts Programme (UKCIP)***
UKIP02 developed future emissions scenarios to study climate change. It was updated in 2005, and is due for its next update in 2008. The programme is funded by the Department for Environment, Food and Rural Affairs (Defra) and modelled by the Hadley Centre for Climate Prediction and Research (part of the Met Office), and are a key component of UK national and regional climate impacts assessment.

***Unitary Development Plans***
These are statutory plans providing information used to decide planning applications for land use development. UDPs sit alongside Local Plans (produced by District Councils and Unitary Authorities) and Structure Plans (produced by County Councils and Metropolitan Councils). The Planning and Compulsory Purchase Act 2004 replaces all these documents with Local Development Frameworks, to include Local Development Plans, which are currently being completed by Local Authorities across Wales.

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***Wales Spatial Plan***
The Wales Spatial Plan is a 20 year plan for the sustainable development of Wales. The plan goes further than traditional land use planning by providing a consistent basis for the spatial integration of all policy in Wales, including those Welsh Assembly Government policies that are not directly associated with the land use planning system.

***Watercourses***
Water features include rivers, lakes, ponds, canals and coastal waters.

***Water Framework Directive (WFD)***
European Community Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives for water status based on: ecological and chemical measures; common monitoring and assessment strategies; arrangements for river basin administration and planning; and a programme of measures to meet the objectives. For further details consult the European Commission website: http://europa.eu.int

***Water Level Management Plan (WLMP)***
A document setting out the needs for managing water levels in a defined flood plain area (usually a SSSI). The aim of this document is to achieve a balance between different needs for drainage.

***Water Table***
The natural level of underground water, used as a standard of measurement in the process of conserving water. Where the water table meets the ground surface springs, streams, rivers and lakes occur.

***Welsh Assembly Government (WAG)***
The Welsh Assembly Government is the devolved government for Wales. Led by the First Minister, it is responsible for many issues, including health, education, economic development, culture, the environment and transport. http://new.wales.gov.uk/?lang=en

***Wildlife and Countryside Act 1981 (as amended)***
The principle mechanism for the legislative protection for wildlife in Great Britain. This legislation is the means by which the EC Habitats Directive and EC Birds Directive are implemented in Britain.

***Woodland for Wales***
Woodlands for Wales sets out the National Assembly's strategy for trees and woodlands in Wales. It presents a Vision for forestry and woodland policy over the next 50 years and sets a direction for the way in which trees and woodlands will contribute to a sustainable future for the people of Wales. http://www.forestry.gov.uk/forestry/INFD-5NLKT7

***World Heritage Sites***
World Heritage Sites receive designation from the United Nations Educational, Scientific and Cultural Organisation (UNESCO). These sites must be protected or safeguarded but receive no additional statutory protection from such designation, although there is an assumption that they will already be of such importance to receive protection from their status alone, if not from existing statutory arrangements and laws (such as Heritage, Conservation, Environmental, Planning, etc. at national and local level). Planning authorities regard the status of World Heritage Sites as a material consideration in determining planning applications and applications for permission for development affecting listed

buildings and their setting. For further details refer to the UNESCO website: http://whc.unesco.org/toc/mainf13.htm