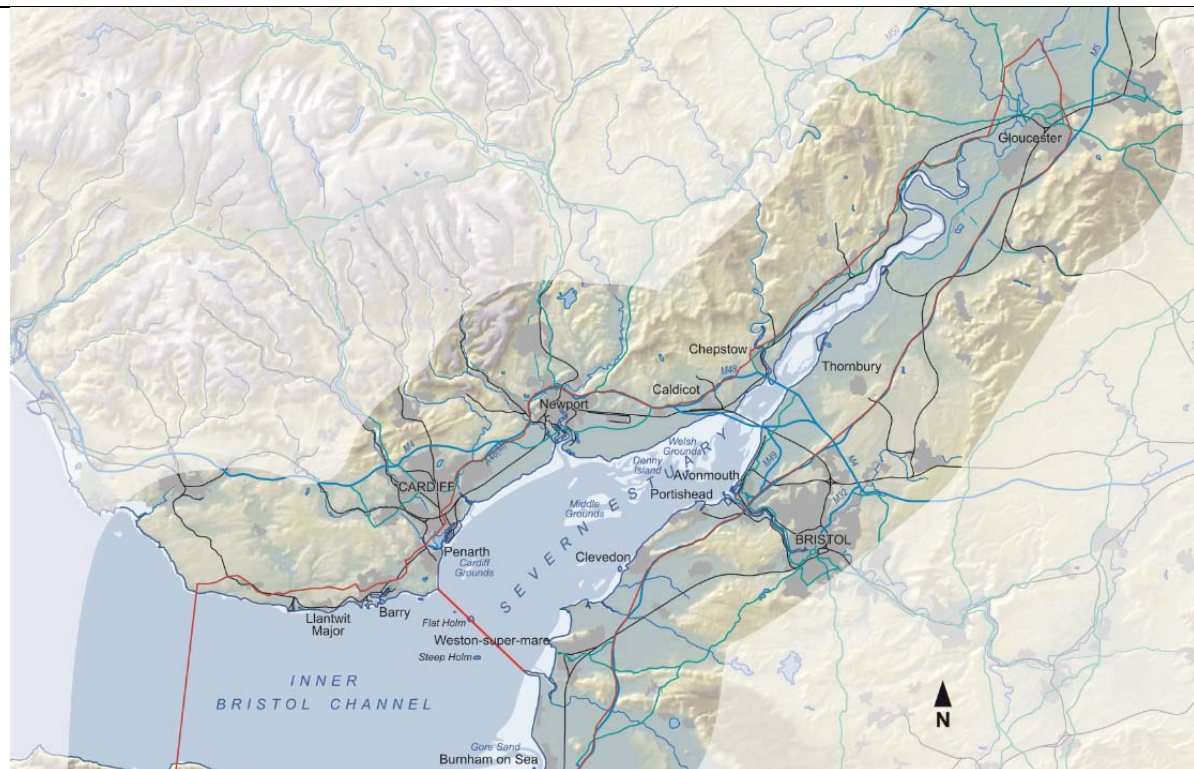


Case Study 1b: Severn Estuary/Bristol Channel



General background

The Severn Estuary is located on the west coast of the British Isles and separates South West England from South Wales. It is Britain's second largest estuary and has one of the largest catchments, extending into the English Midlands and into Mid-Wales. With an area of 557 km² including an intertidal area of 100 km² (22,000ha), the estuary boasts the second largest tidal range in the world. The tidal regime of the estuary causes strong tidal streams, mobile sediments and high turbidity as well as the famous Severn Bore. The Severn is a large coastal plain estuary, and is extremely diverse, supporting areas of open, low lying coast, salt marshes, tidal flats and offshore islands.

The Severn Estuary is internationally known for nature conservation, being part of the Natura 2000 network of conservation sites. The estuary habitat is internationally important for migratory fish, supporting such species as salmon and the internationally rare shad. In winter the estuary regularly supports nationally important numbers of various species of waterfowl as well as some of international importance including the dunlin, Bewick's swan and the European white-fronted goose. The Severn also boasts the only known extensive subtidal reefs of the honeycomb worm, *Sabellaria alveolata*, in Britain.

Over one million people living adjacent to the estuary, mainly in extensive lowlying areas around the cities of Cardiff, Newport, Bristol and Gloucester. For centuries the region has been a focus for

human activities, a location for settlement, a source of raw materials and a gateway for trading and exploration. Today, significant industrial development, ports and port-related activities are supported by excellent land and sea communications, including links to Britain's major motorway network and the ports provide a gateway to the Atlantic. Estuary industries include port installations, chemical processing plants and power stations. Deep-water channels, cooling water, cheap waste disposal and offshore aggregates (for construction) are the estuary's natural 'resources' for such activities. Today, the maritime interests of the estuary include significant recreational activity related to seaside resorts and fashionable waterfronts. The potential for offshore renewable energy generation, including tidal energy, periodically also receives considerable interest.

CLIMATE CHANGE

Sea level rise

A recent comprehensive review of tide gauge data for the Bristol Channel and Severn Estuary by Phillips & Crisp (2010) concluded that there had been a detectable rise in mean sea levels and indicated a rise in the order of 30cm by 2050, and a rising trend of 2.4mm/yr-1. These trends are in line with other research results (Antunes and Taborda (2009) and UKCP09 projections. Based on the latter it is estimated that by 2080 sea levels will be 30-40cm higher than they are at present based on a medium greenhouse gas emissions scenario.

Storm surges

On the Bristol Channel storms and storm surges have occurred throughout history, and have been the cause of substantial damage and flooding from the sea both in the past and more recently.

Within the Bristol Channel and Severn Estuary the trend is for an increase in the 50-yr skew surge return level of around 0.8 mm yr, not including relative mean sea level change. This is, however, considered to be insignificant when compared to projected sea level rise (UKCP09/DEFRA Mtg May 10). In addition, the work by Phillips & Crisp (2010) indicates that the height of extreme high water in the Bristol Channel/Severn estuary has shown a decrease over 15yrs, though there are differences across the estuary.

The analysis of the causes of significant storms and storm surges on the Bristol Channel has shown that there are two specific synoptic meteorological cases (Rodgers, 2011: <http://www.severnestuary.net/sep/imcore/CCSsms.html>). Firstly, surges which are associated with residual sea surface elevations of up to approx 0.75m at Avonmouth. These are caused by strong winds from the westerly quadrant, and can be particularly damaging to the coast of Somerset due to the exposure of the coast to this direction. Secondly, large damaging surge events caused by the passing of a deep depression or trough close to the region with associated SE winds. This was the case in the 1981 event and more recently in 2008. The incidence of the SE winds is important, as the prevailing winds are from the SW. In addition, it has been noted that winds from the E and NE direction causes significant damage to the coastline of south Wales, especially Penarth. This wind direction is associated with the maximum (NE) fetch for the area even though it is not from the prevailing wind direction.

IMPACTS OF CLIMATE CHANGE

One of the most significant threats to the estuary over the next hundred years comes from climate change. With significant urban development and critical infrastructure associated with the low-lying coasts of the Severn Estuary, a key consideration is protecting these assets and the associated communities from flooding and erosion impacts of severe storms. Whilst much of the estuary already benefits from significant stretches of coastal defence, particularly around the Wentlooge

and Caldicot levels on the Welsh coast and around the Somerset Levels on the English coast, hard structures cannot easily be relocated to cater for changes in sea level. Whilst potential changes in storminess, sea level and wave climate could lead to major economic and social losses if defences are breached or overtopped, the major consideration for estuary management is the potential for 'coastal squeeze' along these developed and defended shorelines. This could result in a significant loss of intertidal habitat and associated internationally important conservation and heritage features, particularly given the site's *Natura 2000* status and extremely valuable archaeological and historical heritage.

MANAGEMENT

For an overview of the policy framework relevant to the management of the Severn Estuary see Ballinger and Stojanovic (2010) as well as the IMCORE Climate Change description of the management of the Estuary at: <http://www.coastaladaptation.eu/index.php/en/9-experiences/severn-estuary>

There are two estuary-wide plans of note:

The Severn Estuary Shoreline Management Plan - The Severn Estuary has recently undergone a comprehensive Shoreline Management Plan Review (SMP2) <http://www.severnestuary.net/secg/smpr.html>

Severn Estuary Shoreline Management Plans (SMPs) are non-statutory documents. These advise on how the shoreline should change in the long term (up to 100 years). They are developed all round the coast of England and Wales and are important in guiding how coastal flooding and erosion is managed by local and national government and other regulators and managers, including the Environment Agency (EA).

Severn Estuary Flood Risk Management Strategy - <http://www.severnestuary.net/frms/>

The Environment Agency is also finalising a plan for the Severn Estuary to manage tidal flood risk in the region. The strategy aims to define a 100 year plan of investment for flood defences by the Environment Agency and local authorities, to prioritise other flood risk management measures such as providing advice to utility companies to protect critical infrastructure, development control advice and flood warning investment and to decide where new inter-tidal wildlife habitats should be created to compensate for losses of habitat caused by rising sea levels.

REFERENCES

Antunes, C., & Taborda, R. (2009). Sea level at Cascais tide gauge: data, analysis and results. *Journal of Coastal Research*, 218-222.

Ballinger, R., & Stojanovic, T. (2010). Policy development and the estuary environment: a Severn Estuary case study. *Marine pollution bulletin*, 61(1), 132-145.

Phillips, M. R., & Crisp, S. (2010). Sea level trends and NAO influences: the Bristol Channel/Severn Estuary. *Global and Planetary Change*, 73(3), 211-218.