

### **3 BASIS FOR DEVELOPMENT OF THE PLAN**

#### **3.1 Historical and Current Perspective**

##### **3.1.1 Physical Structure**

A detailed discussion of the Geology and Coastal processes is presented in Appendix C.

##### *Geology*

To the north, between the Tyne and Crimdon (to the north of Hartlepool) there is the series of Magnesian Limestone Cliffs varying in height and overlain to various degrees and in varying depths by Late Devensian glacial till (overlying much of the hard geology of the SMP coastline). To the south of the Hartlepool headland starts the Triassic sandstones and mudstones extending down to and submerging under the estuarial deposits of the Tees. Emerging from the Tees valley, underlying Redcar, building and changing through the cliffs around Whitby, Ravenscar, Scarborough through to Filey Brig and continuing generally beneath the glacial deposits of the Vale of Pickering are the various shales, limestones, sandstones and ironstones of the Lower, Middle and Upper Jurassic Period. Finally at the southern extent of the SMP area is the massive hard Chalk Headland and shore platforms of Flamborough Head. This changing geology, cut by the major rivers of the Tyne, the Wear, the Tees and the Esk and incised by smaller denes and valleys, and embayed through the differential erosion between harder and more erosive sections of rock and till, dominates the landscape and the geomorphological evolution of the whole frontage. Indeed, although there are other important factors, the development, both physically and in terms of use, values and interest of the NECAG SMP2 coastline is strongly linked and influenced by its underlying geology.

##### *Human and Other Factors*

Notwithstanding this, other factors have also influenced the physical development of the shoreline. Man's influence in some areas is now quite strong, with construction of defences and typically at a larger scale by structures such as breakwaters. Similarly, over at least the last 200 to 300 years, man's exploitation of the economic geology, in terms of quarrying, mining or deposition of waste has had a significant influence. This impact, although locally quite substantial, tends still to be limited in extent by the natural geology determining the overall shape of the coast.

Erosion of the shoreline is influenced by many factors, most obviously, and particularly over the softer coast, by the geomorphology and exposure to wave and tidal action. Other factors include general weathering, chemical and bio-chemical deterioration and ground water. While much if not most of the coastline is subject to this long term erosion or is under some pressure from erosion to the hard geological structure, in general terms the erosion is slow in comparison to other areas of the English coastline.

### *Coastal Change*

Along some of the more resilient sections of coast the best estimates of erosion are less than 0.1m (less than 10m at current rates over the next of 100 year period being considered as a the basis for the SMP2). Typically this is true of many the major geomorphological structures such as Flamborough Head, the general area of the North York Moor, the Hartlepool Headland, the southern headlands of the Durham coast (particularly just to the south of Seaham) and the overall headland associated with Souter Point. In detail, however, there is considerably greater variation. It is estimated that areas of the Souter and Trow headland may have an historical erosion rate of 0.2 to 0.3m/yr, local headlands south of Sunderland down to Seaham may be eroding at similar rates with even greater rates (up to possibly 0.8m/yr) where the Magnesian Limestone is lower or weaker or where there is greater exposure of the softer till<sup>1</sup>. Similarly between the headlands south of Seaham, erosion of the cliffs, once fully emerged from the deposits of colliery wastes, may recommence with an erosion rate of 0.3m to 0.5m/yr along frontages. In other sections of the coast, such as areas of Whitby and Scarborough; partly as a result of coastal erosion but also due to underlying instability of the coastal slope, there are significant landslips making larger areas of the hinterland more vulnerable. Such highly variable episodic rates also apply south of Scarborough. In terms of coastal processes, this variation in erosion has to be set within the context of the geomorphological control imposed by the harder rock headlands, influencing the shape and exposure of sections of the coast and influencing sediment movement along the shore. The natural evolution of the coast as a whole tends, therefore, to be relatively slow and, in terms of coastal processes, substantially constrained by the hard geology.

### *Confidence and Uncertainty*

At the broader scale there is, from the data collated as part of the SMP process, a good level of confidence in overall physical evolution of the SMP frontage. However, given the relatively slow rate of natural evolution, further obscured in several areas by the large scale of change brought about by past activities (such as the deposition of colliery waste during much of the 20<sup>th</sup> Century to the Durham coastline or the earlier mining and quarrying activity, particularly to the foreshore, of jet and ironstone in the Whitby area) obscuring the slower natural changes, there is still uncertainty in extrapolating accurately specific rates of erosion at a local level. Equally, despite efforts to better understand the behaviour of the softer till coast line, there is still considerable uncertainty associated with the specific degree of slippage or instabilities that may arise. Indeed in some areas, such as the lengths between Sunderland and Seaham the very location of harder headlands has changed over time.

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<sup>1</sup> Further details are provided in Appendix C.

In terms of a general perspective of the SMP area, therefore, frontages under distinct pressure tend to be of a local nature; but over the broader area there is the requirement for the longer term perspective of 100 years given by the SMP from which to consider significant larger, longer scale change. Further uncertainty exists, both in terms of definition of and in terms of physical response to climate change.

### *Conclusions*

At the broader scale of the SMP coastline and notwithstanding these areas of uncertainty (which relate more to the timescale of evolution than the underlying process of erosion), the conclusions which may be drawn are that there is little overall change anticipated to the basic geomorphology of the coastline (i.e the underlying shape of the coast will be dictated by the hard geology and slowly eroding control features), but that within this, there will be a continued process of erosion over much of the coast, placing pressure on more local areas. The fundamental aim of the SMP is to consider how management of the coast, specifically its defence policy, may be best taken forward to reduce risk from flooding and coastal erosion against this background.

### 3.1.2 Coastal Processes and Process Linkage

Over much of the coast, specific studies (strategy studies), considering aspects of coastal processes have been undertaken; largely since the development of the initial SMP1. This has provided a good overall definition of wave climate, tidal flows and water levels, and sediment movement.

Despite some variation from north to south, the typical pattern of wave climate offshore records a dominant wave approach from the north and north east, with significant but reduced frequency of exposure from directions south of east. The general pattern of drift anticipated based on this overall wave climate acting over the nearshore area is from north to south. There is a relatively strong pattern of drift in this nearshore area along the Tyneside and Durham coastlines, potentially reducing along the more east/west shoulder of frontage created by the North York Moor land mass. There is less certainty associated with movement in the nearshore zone between Whitby and Scarborough but with stronger evidence that the influence of, initially, Filey Brigg and then the stronger influence of Flamborough Head interrupt the consistent flow of nearshore sediment further south out of the SMP area. At Flamborough it has been determined that there is some movement of offshore material to the south but that some return of material is possible around Flamborough Head.

At this broad scale, both in analysis of sediment movement from the previous SMPs and in consideration of the overall shape of the coast in relation to bathymetric contours, there are four main areas of prominence:

- The Souter Headland (Lizard Point to Souter Point) forming a shoulder of land south of the Tyne valley. Some offshore drift to the south is indicated through this area.
- The Hartlepool Headland forcing a reorientation of the offshore contours coming in from the north but more significantly defining the northern control to the sediment sink of the Tees Valley. Again there is an indicated offshore continuation of drift from the north past the headland.
- The shoulder of land comprising Old Nab (*Staithe*s) to Saltwick Nab (*Whitby*), with the compression of offshore contours against the hard land mass, forming the southern limit of the Tees Valley sediment sink. Due to the nearshore depths of the sea bed and the uncertainty as to the composition of the sea bed in this area, the nature and extent of sediment linkage from north or west to east and south is uncertain. There are, however, records of sand patches potentially identified as having accumulated in large tidal eddies, suggesting movement in the nearshore area<sup>2</sup>.
- Flamborough Head, forming the southern end of the SMP frontage and allowing the development of Filey Bay. This provides a significant control over sediment drift, although still allowing some movement as recorded earlier.

Closer to the shore and, at this local scale, more specifically related to the shoreline drift, a different pattern of both processes and control emerges. At the shoreline the offshore wave climate is modified by the nearshore bathymetry tending to draw the wave to approach more normal to the existing shoreline orientation. In addition, the more prominent local features of the coast, both natural and man-made, provide shelter, tending to modify the wave direction and result in changes to the actual wave climate able to work on sediment.

This local impact is very evident. Working from north to south along the coast it may be seen that the background control provided by the Souter headland and the slight depression of the coast created by the Tyne Valley, coupled with the shelter provided by the major harbour structures at the mouth of the river to the dominant north-easterly offshore wave climate, have created an environment where the general sediment drift has tended to be to the north. This has resulted in an accumulation of sediment against the South Pier, adjusting the coast to create a relatively stable foreshore and bay. This more local interaction between the forces acting on the shore, the local control points and the subsequent redistribution of sediment may be demonstrated over much of the coastline.

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<sup>2</sup> This information was identified during consultation on the draft SMP. While supporting the general conclusions of a continuity of sediment in the nearshore area, further examination of this information is recommended as part of the overall monitoring plan.

To the south of the Souter Headland the coast has settled into the Whitburn valley. The area is controlled by the outcropping Parson's Rock and the heavily reinforced delta of the River Wear. South of Sunderland the coast is far less naturally constrained but even so has been shown to be strongly influenced by the natural harder headlands of Saltern Rocks, Pincushion and the Featherbed Rocks, and further south the more dominant Chourdon Point and Shippersea headlands. (Seaham Harbour, while locally significant, imposes less overall control because of its closer association with natural headlands.)

Over the southern Durham coastline, although still disguised to a large extent by the heavy but transitory mantle and southerly drift of colliery waste, many of the bays are shown to be fundamentally in equilibrium with the net wave direction. This length culminates in an area of sediment accumulation where the Hartlepool Headland has, at this more local level, held material to form the dunes of Hart Warren within the valley of the Crimdon Beck.

The Hartlepool Headland has further influenced and controls movement sediment with the Tees Bay. Within this control, and controlled to its south-eastern end by Hunt Cliff and beyond this the shoulder of land over the North York Moors, the Tees acts as a sediment sink. Sediment drift tends to circulate in a northerly direction behind the shelter of the Hartlepool Headland, the headland's influence being reinforced by the extension of the Heugh Breakwater. The influence of the Long Scar pulls forward the coastline, tending to retain material in Hartlepool Bay and anchoring the north end of the Seaton Sands; the main control to the Seaton Sands being provided by the North Gare Breakwater. To the east of the Tees, the South Gare and the Coatham Rocks contain the relatively stable Coatham Sands and, while it has been shown that sediment tends to move across the Redcar Frontage, the Coatham Rocks act in conjunction with Huntcliff to contain the developing bay between Redcar and Saltburn.

In terms of direct shoreline linkage, the bays of Skinningrove, Runswick and Whitby are strongly contained, although in each case, there are very certainly important interactions of sediment within each bay, and possibly between bays and the offshore zone. From Whitby through to Filey Brigg, while there is more potential for southerly sediment drift over the frontage, as in the case of the south Durham coast, this is restricted by the relatively deeply cut bays (Maw Wyke Hole, Robin Hoods Bay, Hayburn Wyke, Cloughton Wyke, Scalby, North and South Scarborough and Cayton) and limited by the actual supply from the cliff line. As noted earlier the accumulation of sand patches does suggest that in the nearshore area, as opposed to that at the actual shoreline, sediment drift does occur potentially due to tidal streams.

Finally at Filey, the shape of the bay is dominated by the influence of the Brigg and Flamborough and has been progressively cut between these two headlands to the extent that there is now a good indication that the overall shape is near equilibrium. Although there is some slow erosion of the Brigg,

the main change is in the continuing erosion of the cliff line as a result of the variation in wave exposure and cliff instability. As previously discussed, and applying to most sections of the coast, there will be a longer term trend of erosion, increasing with climate change and sea level rise.

To the southern end of Filey Bay, Thornwick, North Landing, and Selwick Bay are local features with little effective process association with other frontages.

### 3.1.3 Sediment Supply

There is some form of sediment supply from the nearshore area to shoreline generally over the whole length of the frontage. This is more evident in some areas than others. The likely transfer between the nearshore and the shore at Sunderland, north of Hartlepool, the Tees Bay, Whitby and Scarborough are examples of this. In other areas such as over much of the rocky coastline between Whitby and Scarborough, such transfer is far less obvious, although the presence of sand patches in the nearshore area does indicate some movement. At Filey, while there is clearly significant movement between the shore and the nearshore area, this nearshore area is relatively independent of the broader offshore processes, making this in effect a delicately balanced closed system.

In such areas sediment supply from the cliffs has been identified as being important, and in several areas this cliff supply is seen as providing necessary supply to sustain the local bay beaches. However, there is nowhere that really provides an SMP scale supply from erosion of the land, feeding the whole or substantial sections of the coast. Indeed, over much of the coastline, both due to the relatively slow erosion of the main rock cliffs and the composition of the cliffs, the coastline as a whole is not seen as providing a substantial supply of beach materials to the shoreline.

### 3.1.4 The Purpose of the SMP in Relation to the Physical Structure and Processes

The aim of the SMP is to ensure that proper account is taken of the impact or interaction between areas, such that management in one area does not have a detrimental impact elsewhere. Typically this implies the need to consider the reliance of defences or erosion rate and cliff stability on secure beach levels. From this; and from the broader picture of the sediment supply (potentially from the nearshore and offshore areas and from erosion of the land), there is the need to consider the potential sediment pathways, the possible interruption of those pathways and the potential for erosion or retention of sediment. At the same time the SMP has to provide flood and erosion risk policy guidance to a level of information that may feed practically into local planning and management of specific defence lengths. In developing this, therefore, the SMP has to maintain a perspective at a broad level while still addressing local interactions. In terms of the physical processes, the NECAG SMP coastline exhibits a relatively limited, but still

potentially important, linkage across much of the length, within the nearshore area. At the shoreline this general linkage is far more constrained. Therefore, at the same time as taking the high level picture of interaction over the whole coast, many of the more immediately practical issues relate, in some areas, such as the Tees, to quite large but still discrete frontages, and in other areas to very short frontages and local bays.

### 3.1.5 Natural and Cultural Heritage

Appendix D (Thematic Review) provides a detailed definition of the natural heritage, landscape, historic environment and land use. The following paragraphs draw this together in a general appreciation of the values of the area.

#### *Geology*

The SMP shoreline is highly diverse in terms of its natural and cultural heritage; those aspects of the coastline that give an essential and important quality and backdrop to the current use and appreciation of the area. With respect to geology, this has already been discussed (Section 3.1.1) in terms of the physical structure. However, the NECAG frontage exhibits an array of both hard and soft geological exposures significant for research, in understanding the very long term perspective of change, for education, in awakening and developing an appreciation of this change, and for sheer enjoyment of the varied landscape, habitats, flora and fauna. In addition to this general varied collection of interest, reflecting the diversity over the whole coast, are the more specific sites, focussing on such aspects as palaeontology, with some of the best exposures of fossils such as around Robin Hoods Bay. These specific qualities are recognised in the extensive range of designations at international, national, regional and local levels.

The geology also underpins a significant element of the cultural heritage. Many of the heritage designations associated with the coast reflect man's exploitation of the natural resources, giving a broad range of understanding to the human development of the area. Such activities cover the surface mining of jet and ironstone in the Whitby area, the more recent mining of coal associated with the Durham coast or the still active extraction of Potash at Boulby. These activities map the historic human settlement of the area as well as providing an important cultural context associated with the development of settlements such as Hartlepool, Seaham, Sunderland and South Tyneside.

#### *Heritage*

As significant as this economic based archaeology, is the longer term history of settlements, more often providing a continuous process of association between humans and the coast. This association is demonstrated in the find of a Neolithic axe head on the foreshore of the Hartlepool Headland, to the more obvious heritage of the Souter Lighthouse or the 20<sup>th</sup> Century military coastal defence at Trow Point. This maritime heritage is celebrated in the

museum area in Hartlepool but is still alive in such villages and towns as Staithes, Whitby, Filey and even Scarborough. The importance of this living heritage is recognised in the aim of the North York Moors National Park Authority to sustain the vitality and community of the coastal villages.

In addition to the important cultural and educational context, the varied assemblage of heritage interest supports a significant tourism industry, supporting in turn the sustainability of the cultural values.

#### *Natural Environment*

A substantial proportion of the coast is covered by internationally important designated areas of natural heritage. There are 4 SACs; including much of the Durham coastline, Beast Cliff south of Whitby and Flamborough Head. There are a further 3 SPAs, with the Northumbria Coast SPA, covering intermittently the discrete section of rocky shore from the Tyne to the Tees, the Teesmouth and Cleveland Coast SPA and Flamborough Head and Bempton Cliffs SPA. In addition certain areas are designated as Ramsar sites. As significantly, these sites are part of a matrix of national, regional and local sites (Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Sites of Importance for Nature Conservation (SINC) and Regionally Important Geological Sites (RIGS) forming a near continuous definition of value over the whole SMP frontage; supported by more general designations of Heritage Coast, the National Park and wildlife corridors.

Despite the obvious legal imperatives set out in relation to national and international sites, from the perspective of what the SMP attempts to deliver, it is this interactive mosaic of interest and value which the SMP not only aims to protect but also enhance. This overarching principle is enshrined in the targets for bio-diversity and in the emerging application of the principles of the Water Framework Directive.

#### *Conclusion*

For all aspects of heritage; while with respect to specific designation it may be possible to rank the significance of different elements, in considering SMP policy at a local and strategic level there has to be a recognition of the need to conserve very specific aspects of heritage in the context of how it contributes to the overall value of a local area. This is both with respect to specific heritage themes as well as in the cross-cutting benefit to the region. In developing policy and policy scenarios, therefore, there needs to be an awareness of the potential total interrelationship between the different elements. As in consideration of the linkage created by the physical processes, the development of the SMP has to be carried out at a specific level but maintaining this broader awareness of legal imperatives and international significance.

### 3.1.6 Human (Socio-Economic) Environment and Activity

Significant sections of the coast are heavily developed, providing important areas to live and work but also providing substantial economic wealth to the whole region and the nation. The main settlements on the SMP frontage are:

- South Tyneside; the main centre being set back from the coast but reliant upon the coast for an important recreational and amenity area. This area increasingly links through to the regeneration of the River Tyne corridor.
- Sunderland; where the northern section of the city's coastline is again seen as a major asset to the whole town, both as an amenity zone and an area for tourism. Equally important to the City is the Port of Sunderland and the regeneration plans being developed for the area of the port and harbour. To the south of Sunderland the area of Hendon is seen as an area for greater opportunity associated with the use of the shore, providing an essential recreational and amenity area to this southern part of the city.
- Easington; has seen important regeneration of the sea front and town centre supporting efforts to revitalise the whole area. Associated with this is the development of the Port, the construction of the coastal link road and the development to the northern section of the town frontage. The northern promenade is seen as an important aspect of the town.
- Hartlepool; the town's frontage is divided into two main areas, that of the headland with its substantial residential areas and the more commercial town centre to the south of the Headland. The Headland is also important for its heritage value to the town. The Victoria Dock area is planned for redevelopment linking from the headland through to the centre of the town, the marina and the recently developed tourism centre. To the south of Hartlepool is the town of Seaton Carew, an important settlement in its own right but built around its sea front and extensive sandy beaches.
- Teesmouth; this area is the industrial core of the region, important as a port but also for its various industrial plants. This area is of vital importance to employment in the area.
- Redcar, Marske and Saltburn; the largest of these settlements is Redcar but all have important sea fronts, supporting the tourism of the area but also providing a recreational amenity to the local populations. In particular at Redcar the sea front has considerable commercial value associated with these activities.
- Whitby; is an important traditional sea-side town as well as having a thriving central, working harbour area. Whitby is an important holiday destination supporting tourism within the wider area of the National Park.
- Scarborough; the sea front at Scarborough was developed during the Victorian period and supports superb architectural features from that time as well as important heritage features from earlier settlements. The two main beach areas function in very different ways, complementing each other. Between the two beaches the Harbour is important as a working harbour but also as a centre of activity for the town.

- Filey; the main town is on the cliff above the sea front promenade but even so the sea front acts as an important focus for the town, supporting a valuable tourist industry.

Between these main centres are the smaller villages such as Skinningrove, Staithes and Robin Hoods Bay, all adding to an essential vitality of the coastal environment. These villages and the larger towns both provide the important commercial and economic justification for management of the coast but also contribute, as reflected in the objectives of the North York Moors National Park Authority, to the overall value and appreciation of the area.

#### *Conclusion*

An important role of the SMP is to examine how these various communities can be sustained in the context of an eroding coast. Equally important, however, is to reflect what it is about each centre that is important, so that in maintaining defence to an area, or in considering the need for change in defence policy, the values of the coastal frontages are equally maintained.

## **3.2 Sustainable Policy**

### 3.2.1 Natural Processes

The geological exposures of the coast, certainly over the northern section of the frontage, are clear evidence of how sea levels in the area have changed. Over the last 2,000 years, this change has been quite minimal (averaging less than a millimetre per year). However, we are now entering a period of accelerating sea level rise that will impose greater pressure on the coast to erode and could in some areas; particularly where the shoreline is dependent on natural protection provided by beach material, result in significant change. There is also the potential for changes in sediment supply. This problem has been exacerbated at some locations in the last century due to human intervention reducing the contemporary sediment supply from cliff erosion by the construction of coastal defences and harbour arms. Although attention is focussed upon the shoreline position, this process also has the potential to produce a deepening of the seabed at any particular point. This is a feature that has been potentially identified within a number of areas on the coast where there is evidence of the low water contour moving closer to the shoreline. We have to plan for this change. In general terms we have to expect greater energy against the coast and against defences coupled with a potential reduction of sediment along sections of the shoreline. If we choose to continue to defend our shorelines in the same locations that we do at present, then the size of the defences may need to increase. We need, therefore, to be looking to create width where this is possible, either through setting back defences or through modifying the approach we take. Equally we need to be recognising the importance of the geological control that exists to the coast, working with this to sustain the shape of the coast and thus to retain and maximise the use we make of the sediments which are available.

As discussed earlier, over much of the coast, there is quite limited overall movement of sediment at the shoreline. This is not primarily seen as a coast where action in one area has major impact elsewhere. More locally the transfer of sediment along the shore can be significant. In considering the sustainability of managing areas of the coast we have to understand the significance of these impacts such that we are able to maximise the use of material without creating problems elsewhere. A sustainable shoreline sediment system is one that is allowed to behave as naturally as possible, without significant further intervention.

### 3.2.2 Economic Sustainability

One of the difficulties facing us, as a nation, is the cost of continuing to protect shorelines to the extent that we do at present. Many of the defences that exist today have been the result of reactive management with often limited understanding (or perhaps knowledge) of the long-term consequences, including financial commitment. Studies over the past few years have established that the cost of maintaining all existing defences is already likely to be significantly more than present expenditure levels. In simple terms this means that either more money needs to be invested in coastal defence, defence expenditure has to be prioritised, or funding has to come from other sources based on the benefit they bring. Whilst the first option would clearly be the preference of those living on or owning land along the coast, this has to be put into context of how the general UK taxpayer wishes to see their money used. Given that the cost to provide defences that are both effective and stable currently averages between £2million and £5million per kilometre, the number of privately owned properties that can be protected for this investment has to be weighed up against how else that money can be used, for example education, health and other social benefits. Furthermore, because of the climate changes being predicted, which will accelerate the natural changes already taking place, these recent studies have also established that the equivalent cost of providing a defence will increase during the next century, possibly in some areas to between 2 and 4 times the present cost. Consequently those areas where the UK taxpayer is prepared to continue to fund defence may well become even more selective and the threshold at which an area is economically defensible could well shift. Whilst it is not known how attitudes might change, it is not unreasonable to assume that future policy-makers will be more inclined to resist investing considerable sums in protecting property in high risk areas, such as the coast, if there are substantially cheaper options, such as constructing new properties further inland. It is extremely important that the long-term policies in the SMP recognise these future issues and reflect likely future constraints. Failure to do so within this Plan would not ensure future protection; rather it would give a false impression of a future shoreline management scenario which could not be justified and would fail to be implemented once funding was sought. The implications of these national financial constraints are that protection is most likely to be focussed upon larger conurbations and towns,

where the highest level of benefit is achieved for the investment made, i.e. more properties can be protected per million pound of investment. The consequence is that more rural communities are more likely to be affected by changing financial constraints, but from a national funding perspective, i.e. best use of the taxpayer's money, this makes economic sense.

However, sustainability cannot only be judged on the effort necessary to defend areas. There has also to be consideration of what values, what heritage may be passed on to future generations. This is not just in the bricks and mortar that is being defended but is the character and vitality of the coastal communities. There has, therefore, to be a sensible balance achieved between those areas where the increasing pressure from the changing shoreline will make defence unacceptable in reality and those where defences can be maintained but at increased cost. The SMP has to consider this in terms of:

- What is the value that is being defended, whether this is in terms of a viable community or merely from the economic perspective of a hard asset.
- Whether defences themselves are causing a further deterioration in conditions which makes their maintenance increasingly difficult.
- How management practice will itself evolve. For example in moving down one course of action will this lead to further defence, and further resource being put into defence.

In this latter case the SMP attempts to identify where there is a need to possibly take earlier action to support existing natural structures or to take advantage of existing width, so as to provide a more sustainable defence system in the future.

In many respects sustainability and the balance which we are attempting to achieve may be considered in terms of how the consequence of our action now will be considered in the future. Either in terms of these consequences or in deciding to defend or not defend, a simple test of sustainability is the degree of regret that might be felt in the future of the decision which is being made now. Will we wish that we had taken a different course of action?

### 3.2.3 Natural Environment

The forces of nature have created a variety of landforms and habitats along the NECAG coastline. The special quality of the natural habitats and geological/ geomorphological features on this coast is recognised in a number of national and international designations, protected under statutory international and national legislation, as well as regional and local planning policies. There is a legal requirement to consider the implications of any 'plan' or 'project' that may impact on a Special Protection Area (SPA) or Special Area of Conservation (SAC), through the European Union Habitats Directive (Council Directive 92/43/EEC) and Birds Directive (Council Directive

79/409/EEC). The Defra High Level Target for Flood and Coastal Defence (Target 9 – Biodiversity) also requires all local councils and other operating authorities to:

- avoid damage to environmental interest
- ensure no net loss to habitats covered by Biodiversity Action Plans
- seek opportunities for environmental enhancement

A key requirement for the SMP is therefore to promote the maintenance of biodiversity or enhancement, through identifying biodiversity opportunities. Coastal management can have a significant impact on habitats and landforms, both directly and indirectly. In places, coastal defences may be detrimental to nature conservation interests, e.g. producing coastal squeeze, but in other locations defences may protect the interest of a site, e.g. freshwater sites. Coastal habitats may also form the coastal defence, e.g. the sand dune complex to the north and south of Teesmouth. Therefore, coastal management decisions need to be made through consideration of both nature conservation and risk management. Although the conservation of ecological features in a changing environment remains key, in terms of environmental sustainability, future management of the coast needs to allow habitats and features to respond and adjust to change, such as accelerated sea level rise. It is recognised that true coastal habitats cannot always be protected in situ because a large element of their ecological interest derives from their dynamic nature and this is important to ensure the continued functionality of any habitat. Similarly in terms of many of the geological designations many of these rely on fresh exposure of the cliffs. This poses a particular challenge for nature conservation and shifts the emphasis from site 'preservation' to 'conservation'. Therefore, accommodating future change requires flexibility in the assessment of nature conservation issues, possibly looking beyond the designation boundaries to consider wider scale, or longer term, benefits. The SMP also needs to consider opportunities for enhancing biodiversity throughout the SMP area, not just at designated sites.

The natural environment of the SMP coastline, quite apart from its intrinsic value, is acknowledged to be of exceptional importance in tourism and to the very way of life of people living in the area. In looking to sustain this environment, therefore, the SMP has to consider how the natural and built environment co-exist on this dynamic coastline.

### 3.2.4 Social Justice

A number of stakeholders have raised the issue of 'Social Justice' in relation to an aspiration for coastal protection during the consultation phase on the draft Shoreline Management Plan 2 (SMP2).

Social Justice refers to conceptions of justice applied to an entire society. It is based on the idea of a just society, which gives individuals and groups fair treatment and a just share of the benefits of society. The term 'Social Justice'

itself tends to be used by those who believe that present day society is unjust in some aspect.

In the context of Shoreline Management Planning, social justice has been used by some to justify intervention in terms of proactively managing the coast and, more particularly, an expectation that the public purse should fund defence against erosion, inundation and/or loss of property arising there from.

In terms of the SMP2 it is interpreted that social justice refers to the provision for compensation for property lost to the sea. Firstly that compensation should be paid for total loss of property due to failure to defend against coastal erosion on a hitherto defended coast. This infers a change in the preferred policy over the epochs of the SMP2. Secondly if the policy is to not defend properties at all, then the owners of properties that will be lost, should receive compensation.

In response to these interpretations it must be remembered that the premise upon which coast protection is provided is under permissive powers. Coast Protection Authorities operate under permissive powers to act; there is no statutory right to be protected.

The SMP2 when developing policies takes into account technical, environmental, social and economic factors in line with the Government's strategy for managing floods and coastal erosion. The SMP2 is realistic, uses existing legislation and accounts for likely future Coastal Defence funding. The SMP2 has developed policies based on current legislation.

Management of the coast has to be addressed in relation to the different aims, duties and responsibilities of society and individuals and this is reflected in the existing funding and regulations. There is a requirement on the operating authorities to regulate development on the coast and shoreline to ensure that the actions of individuals or groups of individuals do not cause damage to others or to those features of the coast valued in some way by society. The SMP2 provides an essential role in advising on this, through being able to examine the coast and interactions at a suitably broad scale. In exercising permissive powers, operating authorities are able to undertake works to reduce the risk from flooding and erosion where such action is seen as being to the overall benefit of the nation and society. This is most frequently judged in terms of economic benefits but can also be driven by other factors such as cultural, heritage or environmental issues; but always in relation to the overall community, not specifically in relation to individuals. The SMP2 is an essential tool in considering the overall risk and, judged against the various objectives identified, identifies policy which balances the achievement of these objectives in a sustainable manner. Addressing the risks at an individual level, where there is not seen to be specific national or overall community benefit, remains the responsibility of the individuals, acting always within the regulatory framework discussed above. Even at this level,

the SMP2 provides an important function, setting out the anticipated risk and providing guidance on the coastal processes influencing this. Furthermore, the SMP2 identifies where there are potential constraints in relation to the possible impacts any individual action may have on other sections of the coast.

Within the current legal framework, the SMP2 provides a valuable overview of the various issues which might arise from specific action or inaction in terms of coastal defence and flood and erosion risk management.

The SMP2 has raised the importance of Social Justice and its application to the delivery of long term sustainable solutions for coastal management. Stakeholders' concerns have been brought to Defra's attention. Defra has recognised within the Making Space for Water project SD2: Adaptation toolkit, that Social Justice and Flood and Coastal Erosion Risk Management (FCERM) are now inextricably linked.

### **3.3 Thematic Review (A review of the different themes is given in Appendix D)**

It is evident from section 3.1 above and Appendix D that there is a high degree of diversity over the SMP2 coastline, in terms of the physical processes, natural and cultural heritage and socio economic drivers; and in considering sustainability (section 3.2) that there is significant interaction within each theme and between the different themes or individual sectors of interest. Furthermore, depending on the scale at which the coast is considered there are different interactions. Nominally, for example, it may be appropriate to say that over the whole SMP2 coastline there is a north to south sediment drift. At a high level this might be valid but ignores, at a slightly more detailed level, the fact that the Tees Bay acts primarily as a sediment sink or, at an even more detailed level, that there is a reversal to this sediment drift trend in areas such as Scarborough South Beach or along the northern flank of Flamborough Head. Similarly in terms of transport or coastal footpaths, or indeed the contribution that Scarborough or Sunderland have on the economic welfare to the region, there are many interactions at differing levels of detail.

The aim of the SMP is to provide an assessment of flood and erosion risk at the national level and, associated with this, an indication of the overall level of commitment to defence in these areas. Equally the SMP aims to provide a general assessment of appropriate policy for risk management at a level that will assist direct management of defences in a manner which will support other management objectives for the areas. Clearly to address both levels there needs to be a layered approach to the SMP analysis. To achieve this, despite maintaining a clear awareness of the broader levels of interactions between areas, it is necessary, to allow focus on all issues, to consider sections of the coast in detail and within which individual policy units can then be derived. In taking such an approach consideration has also to be given to the higher level issues, such that the interaction between these is not lost.

The public consultation undertaken at the start of the SMP allowed issues to be identified for individual features within the area. This was used to develop an overall characterisation of the coast, which in turn assisted in agreeing specific objectives for management. Consideration of this overall characterisation allows the coast to be divided into sections, through which more detailed consideration could be given to the development of policy. This process is discussed in Section 3.4.

### **3.4 Development of Policy**

#### **3.4.1 Derivation of Policy Development Zones**

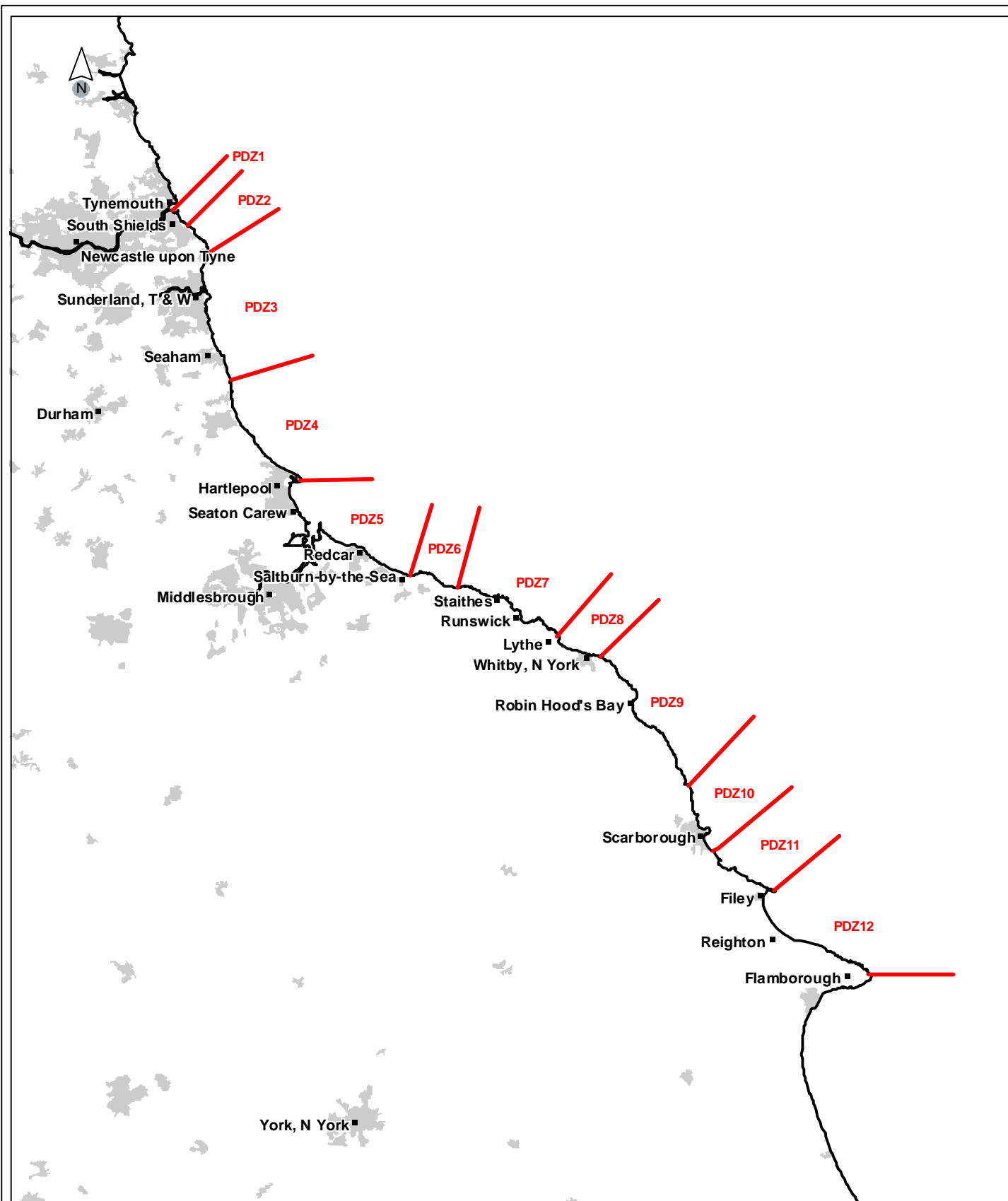
There is quite clearly no single issue which dominates the development of policy on the coast. From whichever perspective the coast is viewed, there are always overlapping issues and interests between sections. Purely from the manageability of developing policy in sufficient detail, however, the coast has to be divided. This has been done in such a manner as to minimise the residual linkages between one section of the coast and the adjacent section, but also to ensure that in developing and discussing policy, all major interactions across all themes are able to be considered. Figure 3.1 maps out in broad terms the high level division of the coast. It is within these sections or zones that individual policy units may be developed. This division is not intended to define hard barriers to thought about the coast as a whole but solely a practical means of examining the coast in detail. So as not to be confused with the final policy units, the sections are called, merely as a matter of labelling and convenience, “Policy Development Zones” (PDZ). Within each of these zones are identified the principal management issues which need to be addressed.

#### **3.4.2 Identification of Policy Units**

Within each PDZ different scenarios are considered; always starting with the policy for “No Active Intervention” (NAI) for all locations within the PDZ. This provides the baseline for considering the need or the sense in actively managing the coast. The second scenario is based on the policy developed from SMP1, taking into account further detail or modification which may have been developed during strategy studies undertaken since SMP1. These are termed “Present Management” (i.e that policy which the SMP2 is reviewing<sup>3</sup>) and provides the starting point for considering future management. This Present Management scenario sets out a series of policies for individual lengths of coast within each PDZ. Within any PDZ these individual policies may be different for specific lengths along the shoreline, such that one length may be to “hold the line” (HTL), in a different length the policy may be for

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<sup>3</sup> It is recognised that the purpose of the SMP is to review this present management, making recommendations where necessary for these policies to be updated. As such the SMP2, on completion and approval, will define present management for the future.



Key:  
 Policy Development Zones

Title:  
 Policy Development Zones

Project:  
 SMP2 River Tyne to Flamborough Head

Client:  
 North East Coastal Authorities Group

Date:  
 March 2006

Scale:  
 1:650,000

Figure:  
 3.1



Source:  
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managed realignment (MR) or advancing (A) the line of defence, or may be to take no active intervention. Furthermore, over different time periods, the policies may change from retreat (R) to holding the realigned defence line (HR).

The two initial scenarios are compared and the way in which they allow the coast to develop and the manner in which they meet or fail to meet objectives defined within the SMP2 is considered. For some sections of coast the scenarios may in effect be the same. In other areas one scenario may address certain issues but fail to address others. In this comparison, therefore, there may be the opportunity to introduce adaptation which will move forward to a more sensible approach to long term management. In such cases new scenarios are then considered, looking how best to deliver the objectives of the SMP.

From this approach either the “Present Management” policies are confirmed or new policies developed for individual sections of the shore. A preferred defence policy is then defined for a specific section of the coast. This section of coast is the policy unit. This defines how that section of coast should be managed over the life time of the SMP.

There is appreciation that there may be a need for transition from present management through to the long term policy. This may be a result of a new policy being recommended or it may be in recognition of the way in which the coast is likely to evolve. To allow adaptation there is scope within the SMP for changes in policy over time. Policy for each unit is therefore defined over time periods; from now to 2025 (short term), from 2025 to 2055 (medium term) and from 2055 to 2105 (long term).

The aim of developing policy for individual units of the coast within the framework of the PDZ is to ensure the broader implications of managing one policy unit with respect to another unit is considered; hence the scenario approach. These implications are discussed in the process of developing policy within Section 4. Inevitably, therefore, there are dependencies between policy units, the intent being to manage groups of policy units to best deliver objectives for management of areas of the coast. This is discussed below.

### 3.4.3 Management Areas

Policy Development Zones, as described above, are merely a convenient mechanism for ensuring that policy is developed over appropriate lengths of the coast to ensure interactions are taken into account. Policy units are then sections of the coast for which a specific defence management policy (No active intervention, Hold the Line, Managed Realignment or Advance) are defined. However, as discussed above there may be dependencies between Policy Units (to justify a policy of retreat in one area may be on the assumption that an adjacent section of coast is held). Having defined these

policies, therefore, it is equally important to group policy units where there is this dependency. Such groups of policy units are defined as “Management Areas”. It is within these management areas that the overall intent of management of the coast can best be described.

The definition of the management area is only at the end of the policy development process. A statement can then be produced providing the understanding of why a specific area of the coast is to be managed in this way and how individual policies work to deliver that intent.

## 3.5 PDZ Analysis

The analysis and discussion for each zone aims to provide an understanding of the issues and nature of the area in such a manner which is logical and rigorous but also in a manner that may referred to and understood by both coastal managers and people who use or live on the coast. This analysis is undertaken in Section 4 and for each zone a standard approach, in line with the SMP guidance, has been taken. This has been set out in three sections:

- Description,
- Physical Characteristics
- Management.

These are explained below.

### **DESCRIPTION**

#### *Physical*

This section merely describes where things are and what they are, in terms of: the underlying physical nature of the coast, the existing defences and, where appropriate, their overall condition, together with the use being made of specific areas. This section aims to set the scene, starting to pull together the overall picture. More detail on the physical processes is provided in Appendix C.

#### *Environment*

In association with the physical description, this draws on the thematic review (Appendix D) and the consultation (Appendix B) in identifying the different issues and interests associated with the specific zone. Again the aim of this is to provide an overall appreciation of the way in which elements of how the coast is valued come together.

#### *Key Principles*

There are common principles addressing basic issues over the whole length of coastline.

#### *Key Objectives*

The final element in this first section is a list of key objectives quite specific to the zone. These objectives and principles attempt to summarise the overall aim derived from the more detailed list of objectives in Appendix E.

### **PHYSICAL CHARACTERISTICS**

#### *Basic Parameters*

These provide direct information on wave climate and water level within each zone, together with a synopsis of rates of erosion for different sections of the coast within the zone.

#### *Existing Processes*

A brief description of how the coast is behaving is provided, aiming to explain exposure conditions and where the coast is attempting to change. From this

may be understood where there may be pressure developing in relation to the use of the coast and an initial appreciation of what may or may not be sustainable in the long term.

#### *Unconstrained Evolution*

Although recognised to be a totally theoretical scenario where there has been or is still major modification of the coast, this section briefly examines what would happen if all man's influence were suddenly removed. The aim of this is to provide a better understanding of how we are influencing the coastal behaviour and therefore the stresses and broader scale impact that are introduced. This assists in assessing first how the coast might wish to change but also in defining the limits of interaction which the SMP should be considering.

### **MANAGEMENT**

#### *Current Management*

Current management is summarised in terms of the policies developed during SMP1 and with respect to subsequent strategy studies.

#### *Scenarios*

The section provides a more detailed description and assessment of the two base line scenarios for the whole zone. This starts with the No Active Intervention Scenario and then considers the current management scenario (With Present Management). In many cases strategies have only looked over a period of 50 years. The SMP2 extends the implication and intent of the current management policy over the full 100 years and comments, where appropriate, on the further implications of this beyond this period of time. The aim of the No Active Intervention, is to identify what is at risk if defences were not maintained. In a similar way With Present Management aims is to examine how the coast may develop, identifying where there are benefits in this management approach and where there may be issues arising in the future. Associated with each scenario is a brief summary of the key risks based on the MDSF and strategy findings. This provides a headline assessment of how each scenario achieves the key objectives set out in section one above.

#### *Discussion and Detailed Development of Policies*

This sub-section uses the two baseline scenarios to consider specific issues in more detail, looking at both the long term implications of the current policies and stepping back from the more local strategy development areas to consider any impacts on the coast as a whole. The discussion also considers any detailed proposals put forward in strategies and comments on these from the broader perspective. Where the current policy is felt not fully to address some of the issues being identified, further scenarios are developed. Typically this has been found to be a variation within one of the baseline scenarios, rather than a scenario with such wide reaching impacts that the influence of management affects area outside the development zone being considered. From this discussion and from the analysis of different

approaches and their consequences, recommendations are made for the SMP policy. This principally starts with where management would take the coast in the long term, working back to how policy should therefore be adapted over the short and medium term periods.

#### *Management Areas*

Policy units are grouped as management units, providing coherent intent as to the management and dependencies over the area.

### **3.6 Management Area Policy Statements**

The policy units and management areas are developed in the analysis described above. A summary or statement is presented for each management area. This is set out in the following manner.

#### **SUMMARY OF POLICY**

The format for this summary is based on the Policy Unit summary suggested by the procedural guidance. However, because of the nature of the coast and in particular in many cases because distinct policy units have an association and cannot really be managed independently; the policy summaries have been developed by management area. A brief overview of the preferred plan recommendations is presented together with an overview of implementation for the short and medium term, followed by the long term intent. Finally the specific policies are identified.

#### **CHANGES FROM PRESENT MANAGEMENT**

The essential changes from current management are highlighted.

#### **IMPLICATIONS**

For each management area a summary is provided of the potential impacts these policies will have in terms of the various specific themes and in term of residual risk and risk reduction.

#### *Built Environment*

Assessments are provided covering the impact on the built environment, together with a summary of the economics, the impact on the heritage and amenity. This is followed by an assessment with respect to issues relating to the Water Framework Directive. In this last aspect, the aim is to identify whether there may be significant impacts that will require further consideration as the emerging WFD guidance comes into force or where at a more local scale the principles set out in the WFD need to be considered.

#### *Environmental Assessment*

The management area statement also includes an assessment of potential impacts on the natural environment. Where the area includes internationally designated sites, a summary based on the Appropriate Assessment (Appendix J) is included. This is followed by a table assessing the impacts on other designated areas.

### **MANAGEMENT AREA ACTION PLAN**

The management area statement concludes with an action plan relevant to the specific area. (These actions are drawn together for the whole of the NECAG SMP2 coastline in Section 7, together with an explanation of the requirement for monitoring.)