



Environment & Sustainability Committee

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Inquiry into Coastal Protection in Wales – Evidence from Royal Haskoning

HASKONING UK LTD.
WATER

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Introduction

Royal Haskoning are pleased to provide this paper of written evidence based on our experience in providing advice to various operating and regulatory bodies with respect to the management and engineering around the coast of Wales.

In providing this paper we have structured our evidence in the following manner:

- *Context*– a brief description of Royal Haskoning's involvement and experience of coast protection and coastal management.
- *Coast Protection and Coastal Management* – examining coastal risk, drawing specifically on the findings of the West of Wales SMP but using examples from other areas.
- *Coastal Risk* – providing a discussion and explanation of coastal erosion and the interaction between sections of coastline, highlighting the thinking and use of SMPs and the impact of climate change and highlighting examples for the long term need for change management and the responsibilities in taking this forward..
- *Funding and Prioritisation* - discussion of influences of and barriers to funding.

Context

Royal Haskoning has been involved with the Welsh coastline for some 60 years, providing advice (now as Royal Haskoning and previously as Lewis and Duvivier and then Posford Duvivier) variously, to Urban, Rural and District Authorities and more recently to the Unitary Authorities, the Environment Agency Wales and the Welsh Assembly. We have also undertaken studies on behalf of Highway Authorities, Countryside Council for Wales (CCW) and the National Trust.

Over the last ten or so years we have provided services in relation to Coast Protection and Flood Risk Management works, coastal monitoring, Port and Harbour development, the Dredging Industry and the assessment of impacts on the natural environment. Currently we are in the process of completing the West of Wales Shoreline Management Plan (covering some 1,200km of the Welsh coastline between Milford Haven and The Great Orme), we have been involved in the development, design and construction of the major scheme at Borth on behalf of Cyngor Sir Ceredigion, we have recently been acting as specialist advisors to the Pwllheli Pilot Study and we are at present advising CCW on the potential for habitat recreation in the intertidal and shallow coastal zone.



At a more local scale we have been working with Pembrokeshire County Council and the National Trust in development of a managed realignment approach at Abereiddy. We also continue to provide ad hoc advice on local management and maintenance issues at a number of locations within Pembrokeshire and Ceredigion.

Staff within Royal Haskoning, such as Gregor Guthrie and Mick Newman, currently involved with the above work, have up to 30 years involvement with the development of management of the coast of Wales and the firm and individuals have had involvement with works and studies in the Dee, North Wales, Anglesey, the Llŷn Peninsula, Cardigan Bay, Milford Haven and Pembrokeshire, Carmarthen Bay and the Burry Inlet, Swansea Bay and the Severn Estuary.

In addition to work directly associated with the Welsh Coastline, individuals involved with work within Wales are also involved more generally with providing advice and undertaking research on behalf of Defra and the Environment Agency. We have been involved with the recent update to Project Appraisal Guidance in England, the development of Planning Policy Statement (PPS)25 and its coastal supplement, Coastal Habitat Management Plans (CHaMPs) and the development of the FaCET analysis tool for developing national funding strategies. Key staff also have experience of developing approaches to coastal management throughout the UK and internationally.

We believe that we can contribute, through our experience and the evidence provided to the committee, a wide ranging knowledge in both; the current situation and thinking, but also, related to this, on the important perspective of issues that have driven change in attitudes towards coastal management and coast protection.

Coastal Protection and Coastal Management

We generally welcome the changes made to the National Strategy for Flood and Coastal Erosion Risk Management in Wales (the Strategy), following the consultation on the initial draft. We feel that the revised Strategy document does go a significant way to redressing the balance in considering specific coastal erosion risks as distinct from more typical flood risk issues. We do, however, believe that these distinctions could be brought out even more clearly and that this will be important in considering how the Strategy is taken forward. We therefore welcome the opportunity provided by the Inquiry into Coast Protection to ensure that coastal issues are fully understood and discussed.

In considering coast protection there is now a far greater appreciation that the well-being of many coastal towns and villages depends upon their interaction with the coast. The majority of the major towns and cities within Wales are at the coast and there are numerous smaller towns and villages along the coastal fringe, whose character and cultural heritage are inextricably linked to their association with the sea. These towns and villages are an essential part of the character of Wales as well as being important residential areas and providing vital services and cultural centres to the large rural hinterland. The various harbours are also important and add both direct value to these settlements and, in the case of the major ports, are identified as important commercial and transport hubs for Wales. Other harbours are important sailing centres, forming a necklace of harbours around the coast, supporting investment in the area. Many of these harbours also provide important services to the local fishing effort as well as supporting the watersports industry.



There are important transport routes which run within the coastal area; several of the main roads or local roads linking communities run close to or at the shoreline or run through areas at risk from coastal flooding. The main railway lines along the north coast and along the coast of north Cardigan Bay and the eastern shoreline of Carmarthen Bay run at the shoreline over much of their length, with critical locations at risk.

The outstanding natural beauty of the coast is important in terms of landscape, its ecological value and in understanding of the geological and geomorphological changes that have occurred. This, together with the historic landscape, has an intrinsic value but also underpins the attraction of the coast for tourism and as a place to live and work. In many areas the beaches provide both an important aspect of coast protection but also a significant value in terms of landscape, recreational use and ecological function.

Coastal change and the management of change cannot be considered purely in terms of a traditional attitude to coast protection or risk management. We welcome and fully support, therefore, the overall attitude taken within the Strategy as set out in the statement:

“Underpinning all of the work on flood and coastal erosion risk management is the Welsh Government’s commitment to sustainable development, in terms of well-being, as our core organising principle. The key aspects of well-being include taking action on social justice, poverty and equality and living within environmental limits, and these are all integral to delivering an effective flood and coastal erosion risk management system for all.”

We also welcome and support the overall approach to funding set out in the Strategy, recognising the increasing pressure on the coast and the need for change and, therefore, the need to prioritise and plan expenditure on coast protection. In particular we support the need for alternative funding arrangements to be developed. Through our involvement with the scheme at Borth, we have seen a good example of how different funding streams have been used in developing an approach providing security to the village in a manner that contributes to the wider values within the area. It has, by no means, been a simple process,

Notwithstanding the above support for the Strategy, however, we do have concerns that the Strategy, with its focus on risk management objectives, (reflecting the similar focus on risk management set out in the Flood and Water Management Act 2010 (FWMA)), potentially constrains and may miss the opportunities for a more integrated approach to coastal management. Risk management forms an essential aspect of management but cannot provide the vision for the coast.

In this, we would make reference to one of the core findings of the House of Commons Environment Committee report on Coastal Zone Protection and Planning (1992) that:

“Coastal zone protection and planning cannot be reviewed in isolation; they are inextricably linked to the administration and management of the many activities and uses of the coastal zone.....”

The report went on to highlight the need for a broad and integrated view of coastal issues.

Our evidence, presented in this paper, attempts to draw out some of these issues more comprehensively, highlighting the key distinctions between the coastal behaviour, coastal risk and coastal erosion and the risks associated with other sources of flooding and flood risk management. We have taken the topic of coast protection to include some aspects of coastal



flooding in addition to coastal erosion, taking the broader definition of the Coast Protection Act 1949 as “encroachment by the sea”, considering within this wave overtopping and inundation flood risk, where land would normally be covered by tidal waters if it were not defended. In this way we attempt to cover the principle aspects of coast protection that are different from other forms of flooding. We recognise that not every situation is the same and that some aspects of coastal risk may also apply to other forms of flooding. However, in general terms the key distinctions are made:

- Loss is permanent rather than being recoverable.
- Coastal change tends to be progressive and, while there may be the need for emergency response to individual events, this tends to be in the context of longer term changes resulting in increasing vulnerability. As such, the response to erosion or tidal inundation can be very different to flooding; it may not be a case of temporary accommodation, repair to infrastructure or clearing up, it is likely to require preplanning of fundamental change to land use.
- In many areas coast protection is as much about the management of the form of the coast rather than management of probability based extreme events. This is reflected in the different approach taken to Shoreline Management Plans (SMP) and Catchment Flood Management Plans (CFMP). This is discussed later.
- Coast Protection is far more about management of energy (making space for energy) rather than purely water (making space for water).
- Even where we are discussing flooding issues and in particular in areas of tidal inundation, it is considering how this may impact on the hydrodynamic and sediment system over a wide scale that is as significant as the direct impact of flooding.
- As a result of working within a system changing over time, there are situations where there is an element of inevitability. As such, while property may not actually be lost for some time in the future, the decisions made now; the actions taken now, result in putting in motion a condition where future change becomes inevitable.
- The corollary of this is that it is possible to influence and change the coastal system. In some areas, we can create conditions where management of core values becomes more sustainable. This runs counter to the general perception that, in all areas, with climate change, erosion will become worse and that pressure and cost of management will inevitably increase. This may be true in a large number of areas, particularly where there is already significant pressure on the existing defence. It is however possible to modify the way in which energy is directed against the shoreline such that beaches build or that the physical environment is created where accretion of, for example salt marsh, is possible. This all gives a very different perspective to realignment, defined by SMPs as adjusting the form of the coast to achieve a more sustainable system; this is in contrast to the typical flood based definition, implying a necessary retreat from an existing defence line. This comes back to the concept that we are very largely managing energy, rather than water, at the coast.
- Finally, we know that the very character and fundamental function of many coastal communities are so closely aligned with, and dependant on, the behaviour of the shoreline. We also know that coastal communities and transport systems linking communities underpin the social structure of much larger areas of Wales. Therefore, coast protection and coastal management has to consider impacts, interactions and interdependencies over large areas reflecting both physical processes and socio-economic systems functioning at a broad scale and over a long time scale.

If the National Strategy wishes to establish,



“the overarching framework for the development of a holistic flood and coastal erosion risk management system fit for Wales”,

In terms of coastal risk management, we believe it has to be embedded within a holistic and integrated approach to planning and spatial vision for Wales.

Coastal Risk

We welcome the discussion within the Strategy highlighting that the impact of erosion can be as significant as that of flooding. However, we do feel that this is somewhat diluted by the way in which some of the other statements might be interpreted.

Whilst we fully recognise that loss due to erosion directly affects less property and land than flooding, we are surprised at the numbers quoted for erosion loss over the last 100 years. We are aware of some six properties being lost at Amroth during the 1930s. There was a major sea wall failure at Aberystwyth around the same time that resulted in loss of the promenade and loss of use of property behind. There has been a continuous loss of land and, we understand, property at Hells Mouth due to land instability caused by erosion, and similar losses along the North Llyn shoreline and at New Quay.

It may be of interest to the committee that at New Quay, the existing church at Llanina Point is possibly the sixth church in this general location since the 7th century, as the Point has eroded back. This does suggest that in the past there has been a greater acceptance and capacity for change but possibly fewer records of loss than identified by the Strategy.

With respect to the future, the West of Wales SMP (WoW) has provided the following assessment of loss over the next 100 years under a No Active Intervention scenario.

No Active Intervention Box 1. Communities - potential economic damage to property:

Without defence there would be significant loss to all the major towns on the coast. Overall it has been assessed that:

Some 1600 properties would be lost due to erosion, with a discounted present value in the order of £30million (£200 million current value). This does not take account of services and loss of amenity. The main areas at risk from erosion are:

- | | |
|---|--|
| - Little Haven and Broadhaven (50 properties) | - Aberporth and the villages of South Ceredigion (20 properties) |
| - Fishguard and Newport (20 properties) | |
| - New Quay and Aberaeron (130 properties) | - Aberystwyth (180 properties) |
| - Borth (320 properties) | - Aberdyfi and Tywyn (95 properties) |
| - Barmouth (40 properties) | - Porthmadog area (110 properties) |
| - Criccieth (100 properties) | - Pwllheli and Abersoch (12 properties) |
| - Aberdaron (30 properties) | - North Llyn (45 properties) |
| - Western Menai Strait (110 properties) | - Eastern Menai Strait (85 properties) |
| - Western Anglesey (40 properties) | - North and East Anglesey (61 properties) |
| - Conwy and Llandudno (100 properties) | |



There are at present some 14,000 properties at risk from flooding within the SMP area. Despite the economic value of damages being discounted back to a present value, the economic losses would increase over the three time periods of the SMP (over the next 20 years, between years 20 and 50 and between year 50 and 100). This reflects both the gradual failure of defences and the impact of sea level rise making flooding more frequent. Over the 100 years, the economic loss would be in the order of £1,350 million. Over the short term, medium term and long term, the economic damages, purely in terms of direct flood damage to properties and businesses, would be of the order of £220 million, £330 million and £800 million, respectively. This does not take account of potential risk due to inland flooding and the risk from wave overtopping. The most severely affected populations centres, due to direct tidal flooding, would be:

- Newgale and Solva (40 properties)	Lower town Fishguard and Newport Parrog (50 properties)
- Cardigan (100 properties)	
- Aberaeron (350 properties)	- Aberystwyth (950 properties)
- Borth and the Dyfi Estuary (500 properties)	- Aberdyfi to the Dysynni (350 properties)
- Fairbourne (400 properties)	- Barmouth (250 properties)
- Harlech Area (450 properties)	- Porthmadog (1650 properties)
- Pwllheli (1200 properties)	- The Western Menai Strait (176 properties)
- The Cefni and Malltraeth area (140 properties)	- Rhosneigr and Valley (250 properties)
- Holy Island (350 properties)	- Traeth Coch area (35 properties)
- Beaumaris and Porthaethwy (270 properties)	- Bangor (330 properties)
- Llanfairfechan (78 properties)	- Conwy and the inner Conwy Estuary (1000 properties)
- Llandudno (4800 properties)	

Clearly, this assessment does highlight significantly greater economic damage resulting from flooding, however, it may be argued that because we are identifying permanent loss due to erosion, erosion may have substantially greater social consequence. In relation to coastal erosion, the statement in the Strategy that,

"....Shoreline Management Plans suggest that the numbers are significantly less. The majority of these would be affected in the medium to long term when the effects of sea levels result in increasing erosion."

tends to underplay the significance of erosion and certainly underplays the need for present day management and possible investment and as importantly planning for change now.

In considering those locations identified in the table above, it is important to consider the specific circumstances, rather than the implication that this is a future problem that may be put off to the future.

- In many of these areas, in fact in relation to nearly all properties identified, are areas that are currently defended and areas that have had some form of defence over anywhere between 30 to 50 years or for well over 100 years. In this respect, identifying the property as being at risk purely in the future is not strictly true. They are at risk now but that risk is being managed with existing defences.
- In several cases, therefore, the timing of loss is related directly to the residual life of the defence, not as suggested by the Strategy a consequence of sea level rise or the slow process of erosion. In several areas the loss of defence would result in almost immediate loss of property, irrespective of sea level rise or further need for long term erosion; basically properties are sat immediately behind the defence.



- Without continued investment and improvement to the defences, should defences be allowed to fail, while some properties might not be lost for twenty or even 50 years, their loss may then be inevitable. In many areas (but not all) the concept of setting back the defence to a more sustainable position is not a technically viable alternative.
- For many of the communities the sea front and property associated with the sea front form the core of the community. Loss of individual properties cannot in reality be viewed in isolation but should be seen as loss of the integrity of community.
- The amenity and often tourism and economic value of the sea front in several cases provide a core element of the community. In project appraisal terms, in defining erosion damages, this can distort the economic loss. Taking locations such as Broadhaven, Barmouth, Criccieth or Llandudno, the width of promenade, even while being essential to the function of the town, contributing also to the essential landscape of the community also, in terms of traditional attitudes to risk management, acts as a buffer zone before the loss of actual property.

These issues are, from our experience in other areas of the UK, only coming to the fore now, particularly in England in developing the new Defra approach to funding and prioritisation of funding.

For completeness, we also include the equivalent table identifying potential loss for the West of Wales area under the preferred SMP plan approach to management.

Preferred Plan

Box 3. Communities -:

The plan aims to reduce risk from erosion and flooding:

Of the 1600 properties at risk due to erosion under the No Active Intervention (NAI) over 1000 properties would be protected under the policies set out in the plan. Many of the properties still at risk would gain some protection over a longer period of time. The economic loss under the plan would be reduced from approximately £30 million to £8 million. The main areas where potential loss is anticipated over the next 100 years are set out below. NAI losses are shown in *italics* for comparison.

- Little Haven and Broadhaven (11 properties, 50)	- Aberporth and the villages of South Ceredigion (4 properties, 20)
- Fishguard and Newport (1 property, 20)	
- New Quay and Aberaeron (43 properties, 130)	- Aberystwyth (6 properties, 180)
- Borth (290 properties, 320)	- Aberdyfi and Tywyn (0 properties, 95)
- Barmouth (10 properties, 40)	- Porthmadog area (4 properties, 110)
- Criccieth (2 properties, 100)	- Pwllheli and Abersoch (6 properties, 12)
- Aberdaron (5 properties, 30)	- North Llyn (32 properties, 45)
- Western Menai Strait (11 properties, 110)	- Eastern Menai Strait (21 properties, 85)
- Western Anglesey (15 properties, 40)	- North and East Anglesey (30 properties, 61)
- Conwy and Llandudno (20 properties, 100)	



Note: Losses are estimated based on projected erosion over the next 100 years.

There are at present some 14,000 properties at risk from flooding within the SMP area. These properties would continue to be at risk; however the SMP would aim to reduce the impact of flooding. The economic damages would be reduced from £1,350 million under a NAI scenario to £223 million over the period considered under the plan. The risk to property would still increase over the three epochs. Over the short, medium and long term, the economic damages, purely in terms of direct flood damage to properties and businesses, would be of the order of £40 million, (£220 million NAI), £50 million (£330 million NAI) and £140 million (£800 million NAI), respectively. This reflects the increased risk associated with sea level rise, but also the intent within the plan to defend areas where it is sensible to do so without leaving people in a more vulnerable position. The most significant areas where properties may be lost due to increased risk or where there is greatest need for adaption are shown below.

- | | |
|--|---|
| - Newgale (epoch 1) and Solva (epoch 3) | - Lower Town Fishguard and Newport Parrog (both in epoch 3) |
| - Borth and the Dyfi Estuary (epoch 3) | - Fairbourne (epoch 2) |
| - Clarach (epoch 1) | - Dysynni Estuary (epoch 2) |
| - Artro Estuary (epoch 2) | - Porth Dinllaen and Morfa Nefyn (epoch 2) |
| - Pwllheli (epoch 2) | - Porth Llechog, Moelfre and Traeth Coch (epoch 3) |
| - Dinas Dinlle and Morfa Dinlle (from epoch 2) | - Bangor (epoch 3) |
| - Beaumaris and Porthaethwy (epoch 3) | - Conwy valley (epoch 2) |
| - Llanfairfechan (epoch 3) | |

There would continue to be significant flood risk to:

- | | | |
|-------------------------------------|-----------------------------------|---------------|
| - Cardigan | - Aberaeron | - Aberystwyth |
| - Aberdyfi | - Harlech and Talsarnau | - Porthmadog |
| - Caernarfon and Y Felinheli | - Valley and areas of Holy island | - Llandudno |
| - Conwy and the inner Conwy Estuary | | |

This highlights the need identified by WoW for adaption and the recognition that not all communities or defences will be sustainable.

WoW also identifies other aspects of the coast at risk. This includes both risk in terms of erosion and inundation. The two tables show respectively the No Active Intervention scenario and the situation for the West of Wales area under the preferred SMP plan approach to management.

No Active Intervention

Box 2 Transport and Critical Infrastructure:

Without defence or managed adaption there would be significant loss and disruption to transport routes. The main areas at risks are identified below.

- the coastal road around St Brides Bay and St David's (including Little Haven, Broad Haven Newgale and Solva).
- the coastal road and access to Fishguard Harbour and through Lower Town.
- road access to New Quay and between Aberaeron and Aberystwyth.
- the road and rail network within the Dyfi Estuary, including the rail link to Aberystwyth.
- the railway line between Dyfi Junction and Pwllheli: at the Dyfi, across the Dysynni, at Friog and across the Mawddach Estuary, at Harlech, and across both the Dwyrdd and Glaslyn Estuaries, along the Criccieth frontage and at Abererch.
- the airfield at Morfa Dinlle.
- the coastal roads at Menai Straits.



- the road system to and through Beaumaris.
- the road and rail links along the north Wales coast and across Anglesey to Holyhead.
- the road and rail links along the Conwy valley and through to Llandudno.

There are some 34 harbours, landing stages or mooring areas identified within the area, providing over 2500 moorings. By their nature such facilities are inevitably at risk from flooding or potentially impacted by erosion and coastal change. The main harbours are identified below:

- | | | |
|---------------------------------------|------------------------------|-------------|
| - Solva, Porthclais and Porthgain | - Fishguard | - Newport |
| - Teifi and Cardigan | - New Quay | - Aberaeron |
| - Aberystwyth | - Aberdyfi | - Barmouth |
| - Shell Island | - Porthmadog | - Pwllheli |
| - Morfa Nefyn | - Caernarfon and Y Felinheli | - Holyhead |
| - Bangor and the Eastern Menai Strait | | - Amlwch |
| - Conwy | - Deganwy | |

There are approximately 64 waste water and sewage treatment works within the SMP2 study area. Power distribution and electricity sub stations tend to be clustered around the main urban coastal centres. There are 27 waste treatment and recycling sites occurring within the coastal SMP2.

Preferred Plan

Box 4 Transport:

The key areas where decisions need to be taken with respect to the future of the transport network are highlighted below.

- the coastal road around St Brides Bay and St David's.	There are several areas where defence of the road would no longer be sensible or would constrain appropriate management of the adjacent shoreline. The whole transport network within the area will need to be reviewed over epochs 1 and 2
- the coastal road and access to Fishguard Harbour and through Lower Town.	Consideration need to be given to realignment of the road.
- the road and rail network within the Dyfi Estuary, including the rail link to Aberystwyth.	The potential for realigning the railway and road needs to be considered during epoch 1, in preparation for increased pressure on defences in the long term
- the railway line between Dyfi Junction and Pwllheli:	There are several sections of the line that may not in the future be sustainable, particularly where the railway runs across the flood plain or behind or across soft natural defences. The need for realignment is highlighted in several of these areas potentially affecting the entirety of the route. (epoch 1)
- the road system to and through Beaumaris	The potential need for long term change is highlighted
- the road and rail links along the north Wales coast and across Anglesey to Holyhead.	This route would be maintained but there are areas where there would be joint benefit in management of other assets.
- the road and rail links along the Conwy valley and through to Llandudno.	Realignment of the route along the Conwy Valley would be necessary to sustain the service provided.



We have provided a map as Figure 1 showing the key areas of concern with relation to the Cambrian railway, to provide better context of the larger scale and interconnected issues relating to Coast Protection and coastal management. This is discussed more broadly in the section of our evidence below.

Context of Coastal Change

The above reference to the broader scale geographic implications of coast protection is highlighted in considering the potential risk to the Cambrian Railway and the need for long term planning in decision making with respect to individual sections of the coast. In this section of our evidence we highlight how this equally applies, but at a slightly more local scale, to other areas of the coast. This is presented with reference to two areas of New Quay and Aberystwyth but hopefully provides a discussion of broader issues that are applicable to understanding and in considering issues of coast a protection more generally.

The Strategy refers to erosion as happening not at a constant rate (which is true) but then suggests that it is purely event driven (which it is not). It is also suggested that the first visible signs of erosion is the loss of sand or shingle exposing the underlying rock. This tends to suggest a very simplistic message, ignoring the very visual influence of geomorphology at a larger scale than that of a beach.

There is also the implication within the Strategy that there is a real distinction between hard and soft approaches to management at a strategic level, such that within section 4 of the Strategy (Implementation) reference is made to working with natural processes alongside reference to beach nourishment, with the strong implication that beach nourishment at a Wales strategic level is necessarily a desired form of engineering.

The principles of “working with nature” are, we feel, very important but this term tends to be with reference to understanding and incorporating the needs of the natural ecological system as an integral part of coastal management.

This is quite distinct from the “engineering with nature” which is a term used for example in describing the recent scheme for large scale import of sediment to the coast of the Netherlands (an approach which could have application to certain sections of the Welsh coastline) or at a more modest scale in using and influencing the behaviour of the coast to create more sustainable outcomes.

Approaches such as beach nourishment could be very valuable in certain locations of the Welsh coast but, as with any other form of engineering, may not be technically viable in others and could equally have major negative impacts on the way in which the coast behaves, the use of the coast or the ecological value and diversity of the shoreline. We believe it is important that a clear distinction is made in the Strategy (and in taking it forward) between strategic intent and the technical tools or techniques for delivering the strategy.

Finally as an introduction to this section, the Strategy makes reference to SMPs, thus:

“In terms of coastal erosion, our Shoreline Management Plans are based on an understanding of coastal processes, planning issues, current and future land use, defence needs and environmental considerations. Each Shoreline Management Plan defines specific lengths of coast which each have a proposed shoreline management policy.”



The focus on the SMP policy in this is incorrect, in that the SMPs attempt to define a preferred management plan for the shoreline, not specific policies. Individual policies for specific sections of the coast are to deliver the plan and cannot be taken out of context of the broader scale intent of management which is the main output of the SMP.

These points are developed in relation to New Quay and Aberystwyth to help understand the context within which we see the Strategy being taken forward.

New Quay (Figure 2).

From the figure the very distinct shape of the coast may be appreciated. This bay shape is formed by the erosion of the soft central section of the bay, eroding the toe of the coastal slope and preventing the coastal slope from developing a naturally stable slope. The shape is controlled by the hard rock of New Quay Head, enhanced by the influence of the Stone Pier, providing shelter from the dominant wave energy, and by the harder outcrop of glacially deposited material at Llanina Point.

From this it may be seen that the way in which we intend to manage coast protection to the town and at Llanina Point has a major influence on the way in which the central section of the coast then develops. The overall management intent for the area is to continue to manage the whole frontage. The economic value underpinning this is focussed on sustaining the essential core use of the town, the road running through the town down to the harbour, the harbour itself and the overall importance of the town in relation to the rural hinterland, Ceredigion and indeed Wales; New Quay being one of the iconic towns supporting tourism to Wales. The specific policy from the SMP for the town is Hold the Line. The number of properties actually affected by erosion provides relatively limited direct economic benefit. Indeed, over the first 20 years should defences be allowed to fail there would be no direct loss of properties within the town.

Clearly if defences were allowed to deteriorate and fail, the harbour and any investment opportunity would be severely constrained. There would be little benefit in re-establishing defences further back, as one would have lost access through the town. New Quay as a community would be lost..

At Llanina Point the policy is also to Hold the Line. This policy is set in the context of the overall management approach to the bay. The intent is not specifically to defend the Point from any or all erosion but to maintain the influence of the point as a control feature of the shoreline. This is set out in explaining the specific policy associated with this section of the coast.

Between these two Hold the Line policy sections, there is no strong economic argument for defence of the coastal slope, and quite strong environmental and sustainability issues with attempting to defend this frontage. However, holding the two adjacent frontages effectively means that the policy of Managed Realignment is imposed on the central section of the bay. This does also provide the opportunity for adaptation of the use of the coastal slope and adaptation of the important caravan park located at the crest of the slope.

It may be seen from this that there is a need for a co-ordinated approach to coast protection over the whole frontage. The traditional risk values in relation solely to loss of properties provides only one aspect in terms of the management of broader scale risk and values. There is the need to



consider the longer term impact of coast protection, or the lack of coast protection, in looking at sustainable communities and the ability to adapt.

It is the combination of nominally hard engineering, coupled to the ideas of influencing and working with and understanding natural processes that provides this sustainable approach to coastal management.

In terms of funding, various schemes have been mooted in the past for improvement to the harbour. This might open opportunities for alternative funding arrangements but equally has to be set in the context of how the coast functions, the impact on the landscape and the potential impact on the ecology. This then ties in to the need to have a clear overall vision for the area, identifying the essential values that characterise this section of the coast.

Aberystwyth. (Figure 3)

We have selected Aberystwyth as being representative of several other towns, cities or indeed villages. Typically, such places as Swansea, Llanelli, Saundersfoot, Lower Town Fishguard, Aberaeron, Barmouth, Pwllheli Beaumaris or Llandudno, all of have significant areas of flood and erosion risk, either in combination or as discrete issues affecting different areas of the community. In the case of Aberystwyth, the town has an important sea front and promenade, extending from the harbour through to Marine and Victoria Terrace. Much of the new development of the town has taken place within the Rheidol valley extending up along the defended valley floor through to the town centre. The potential flood risk area from tidal influence is shown in Figure 3. The defence is manageable, in that it is not under significant pressure apart from increasing water levels as sea level rises (i.e there is no significant flow pressures causing erosion). Defences may be raised to improve or maintain the standard of defence in the future. The main consideration for the future is the height to which the defence will need to be raised to provide an adequate standard of protection, coupled to the increasing vulnerability in the longer term under conditions when the defence standard might be exceeded.

This risk is seen as being manageable, at least under standard predictions of sea level rise, and, with the development that has taken place within the valley, is certainly economically justified. There are potential issues should sea level rise be greater than the typical 1m values recommended by Defra for strategic planning over the next 100 years. Given the possibility of more rapid sea level rise or looking beyond the 100 years, there have to be questions as to the sustainability of defence to the area. This becomes a long term planning issue for the future economic development of Aberystwyth.

The other key area of risk to the town is along its sea front, particularly along Victoria and Marine terraces. This area is as critical to the sustainability of core values to the overall town as a centre of tourism within West of Wales. The main retail centre, the services and catering sections of the town rely on the sea front attracting visitors and defining one of the principle characteristic values of Aberystwyth. Significant effort has gone into regeneration of this sea front asset, reflecting its important value.

In terms of defence, the frontage is protected against both wave overtopping and erosion by sea walls. As mentioned earlier in our evidence, failure of the sea wall to the north of the sea front did result in local damage both to the promenade and property. However, over much of the length, actual loss of property may not occur for 20 to 50 years following failure of the sea walls. The economic case for defence, however, is strong enough based on normal risk analysis to justify



the Hold the Line policy, with the intent of management being to sustain the overall value and function of the sea front.

With sea level rise, the pressure for erosion, risk of overtopping and direct water level flooding increases. In addition to the increased economic risk, is the risk of loss of the beach. In the longer term defences could be raised but at the expense of creating a barrier between land and sea that would itself detract from the function of the promenade. Beach nourishment might go some way to addressing deterioration in levels and improving the amenity of the frontage but this would require regular re-nourishment and might not be considered sustainable in the future. There are, therefore, very difficult challenges in terms of coast protection and sustaining the important sea front asset of the town. This is discussed within the SMP and the conclusion drawn is that there may be a need to radically rethink the sea front, potentially building forward and encouraging opportunity for creating new development seaward of the existing defences. This requires a new way of thinking beyond that purely of risk management. Risk management becomes an essential part (and possibly the driver for change) but does not become the driver for what is actually done.

The function of the SMP is, in an area such as this and in many other areas of the coast at different scales and in different detail, to raise such issues and open discussion of how coast protection and flood risk management may be adapted to add to future sustainability of communities. This goes beyond the traditional role of flood and coastal erosion risk management in regulating and controlling development. We believe this example demonstrates that need in taking forward the Strategy to allow risk management at the coast to provide an important new role within spatial planning of the coastal zone. This has important implications with respect to responsibilities defined by the Flood and Water Management Act 2010.

Over the last few years, certainly with respect to councils responsible for coast protection in the WoW area, there has been progress in discussing these issues at the local level with communities at risk. The works at Borth have been developed in partnership with the community. The Pwllheli Pilot has been involving local people in developing an approach to management of the coast as well as raising awareness of the risks being faced.

There are, however, barriers to this. While significant effort is going into raising awareness of risk, the mechanism for developing actions to address such risks in a positive way, looking at how change management can form a catalyst for rethinking how communities develop into the future, is not always being followed through. Without established mechanisms for taking this forward the awareness of and discussion of how future risk could be managed tends to fade into the background. There is almost an acceptance among communities that they are at risk but then a rapid return to "business as usual" with the expectation that others will address or initiate actions.

At a very local level, this can be seen in the planning applications that are emerging. Despite an apparent awareness of the risk, individual applications are made which quite clearly offer no longer term thought for a need to adapt. This often places the Planning Authorities and the Environment Agency either in a position of conflict with individuals and communities, or, in accepting applications with necessary conditions, acting to kill long term strategic thinking by a process of "death by a thousand cuts".



We do see, almost perversely, that a result of providing a stronger responsibility structure and hierarchy through the Flood and Water Management Act 2010, with respect to risk management, is possibly weakening the links directly between risk management, planning and communities. With the problems predicted for the future, there is a growing need to be thinking one step ahead, rather than waiting for issues to become critical, when it becomes easier to draw people together to deal with a common concern, when options for addressing such problems may be far more limited.

Not least of the barriers to the development and implementation of longer term aspirations for sustainable management of the coast is funding, and this is discussed below.

Funding and Prioritisation.

What becomes very clear from the SMPs and from research undertaken, both with respect to Wales and more broadly with respect to other areas of the UK, is that to maintain coast protection defences, in the same way as in the past, is going to require significant increase in costs. Notwithstanding the present economic situation, highlighted within the Strategy, it is the longer term climate change and sea level rise that will impose significant additional costs just to stand still in terms of the standard of defence provided at present.

How and where national funding is spent will need to be prioritised and planned. In terms of the overall pot and the role Government in funding coast protection, we feel this lies outside our remit of providing evidence and we focus on the discussion of the influence of how funding is delivered and the potential barriers to alternative funding.

It is, however, noted that the level of national funding has been an issue long discussed. The Royal Commission on Coastal Erosion, in 1906, discussed this very matter; alongside attempting to define erosion lines and rates of erosion. In addition, it is worth noting that one of the core principles behind the Coast Protection Act 1949 was that funding arrangements should reflect the value of the coast to the nation. This is also alongside the responsibility of government to support the wellbeing of people living on the coast, the value of coast protection to the local community and the direct benefits that individuals gain from coast protection. The concept of partnership funding is, therefore, far from new.

Furthermore, prior to the Coast Protection Act, funding in many areas did tend to come primarily from individuals, local funding or even public subscription. We see evidence that, as increasingly more development occurred on the coast, so this local, piecemeal approach to coast protection did result, in some areas, construction of inappropriate defences creating problems that we have now inherited. It is equally true, however, that some of the nationally funded works undertaken, particularly on the east coast of England, following from and in immediate response to the storm of 1953, gave rise to an expectation of defence that we are now having to address through different approaches, including adaptation of land use rather than reinforcing existing defences.

The tensions we now see emerging from the present move towards localism and joint funding are:

- the need for good strategic guidance to ensure local defence does not create broad scale problems
- and the need to ensure that national funding is not purely driven by the local ability to pay or match fund.



We have seen that, as schemes have been developed over the last few decades, there does seem to have been greater emphasis on broadening of objectives, which might not in the past have been strictly considered a function of coast protection. In many ways this has led to far better schemes, providing a far more integrated approach, incorporating broader vision within the need for coast protection.

Schemes such as those constructed at Blackpool or Weston-super-Mare are excellent examples of this. It is interesting, however, that these schemes have been triggered by the need to improve defences and, only on the back of this, have the ideas for regeneration and amenity improvement really been developed. The opportunity was taken, at Weston-super-Mare, to step back from the initial concepts for defence and to consider the broader scale, longer term regeneration of the sea front.

In some ways, and this was a point made in recent Defra research on adaptation, this highlights that it has only been where there is strong traditional justification for coast protection, that opportunity has emerged for improving the quality of the scheme to deliver wider benefits. Where the economic justification, from a risk perspective, is weaker, there is a tendency for schemes to be developed within very limited budgets with little opportunity to address or attract funding to address broader issues associated with the coast.

This issue has been addressed in part by the new English approach to prioritisation of grant in aid, with the move from 100% funding to an approach which attempts to spread funding over a broader range of schemes. However, we still see issues arising from this:

- The present policy approach based on number of properties lost, with a bias on properties lost within the first epoch (first 20 years), this does not fully recognise some of the peculiarities of coastal communities identified earlier in our evidence (e.g. a promenade may act as a buffer zone extending the nominal life of property but in reality not capturing the inevitability of loss to a community).
- With the focus starting from the need to address a coastal risk problem, it is more difficult to attach joint funding, as such funding tends to come from those most at risk rather than from those who benefit in other way from sustaining or improving the interaction between the community and its sea front.
- Starting from a scheme designed to address coastal risk issues, the approval process tends to take over, such that approval is given to a specific, closely defined approach. This can immediately constrain thinking about the opportunity in developing and designing an approach with a more opportunity (land use led) built in from the inception stage.
- The alignment of funding sources remains a key issue; with pressures to spend funds within tight deadlines, the legal difficulties associated with commitment of funding from different partners and also the arrangements, particularly where funds are obtained from individual property owners in relation to construction risk and contingency.

We provide a brief discussion of some of these issues in relation to our experience from the Borth Scheme as we do see this as a very positive example of bring together funding opportunities, while highlighting some of the challenges.

The initial identification of developing issues in relation to the frontage were in 1994, following inspection and monitoring of the groynes and beach levels over the previous 10 years. It was



seen that the groynes (typically constructed in the 1970s) were showing signs of increasing deterioration and need for repairs. An initial assessment was made as to the long term commitment likely to be needed to sustain the defence into the future. It was felt that much more major investment would be required over the next 10 to 15 years and that there was opportunity for adopting a different approach to defence.

This commitment to monitoring and continual re-assessment of the situation by the Cyngor Sir Ceredigion was vital in allowing time within which to respond to the developing situation.

Two actions were subsequently taken. The first was to examine, from a perspective of coast protection risk management, potential options for future defence. This involved development of a strategic framework for management based on modelling and appraisal of the problem.

The second action was in involving the community in a visioning exercise, developing alongside the risk management approach an awareness and understanding of the issues coupled to an exploration of how the community felt Borth could or should develop in the future.

In combining these two aspects, a coast protection strategy was developed. An essential feature of this strategy was that while setting out clear guidance on the technical, environmental and economic parameters, the approach needed to retain a strong element of adaptability so as not at this stage to constrain ideas and the future thinking about opportunities.

The final phase 1 of the scheme has developed through a series of interactions, developing the approach through outline and detailed design, allowing local input in arriving at the solution.

The attitude towards funding and building in EU and national funding, alongside additional funding from the council has been a major benefit in delivering the scheme. Associated with this has been the council's ability to demonstrate that the scheme is part of their overall forward planning for the wider area, addressing issues that contribute to EU fund objectives, alongside development of a local vision for Borth. The scheme design recognises the longer term sustainability issues of defence to the village as identified through the SMP and is designed to provide flexibility in how management may be undertaken towards the latter part of the this century. It therefore provides present day security, while allowing for future adaptation.

The overall approach has necessarily worked within established procedures for appraisal of coast protection but has been constrained by this process. This has benefited from a case by case approach to scheme approval rather than a strictly formulaic approach, particularly in terms of funding allocations.

There have been significant challenges that have had to be overcome, not least in terms of timing associated with different funding streams. This has led to extremely tight deadlines, with increased design and construction risks.

Further phases of work to deliver the full strategic approach to the frontage are currently being progressed and will rely upon continuity of funding arrangements. Whilst it seems likely that these future phases will need to be re-examined in detail, not least in light of lessons learnt from phase 1, the overall strategic approach provides a strong framework from which this can be undertaken.



In terms of coast protection management and delivery and implementation of the Wales Strategy, we feel that the important issues highlighted by the Borth scheme are:

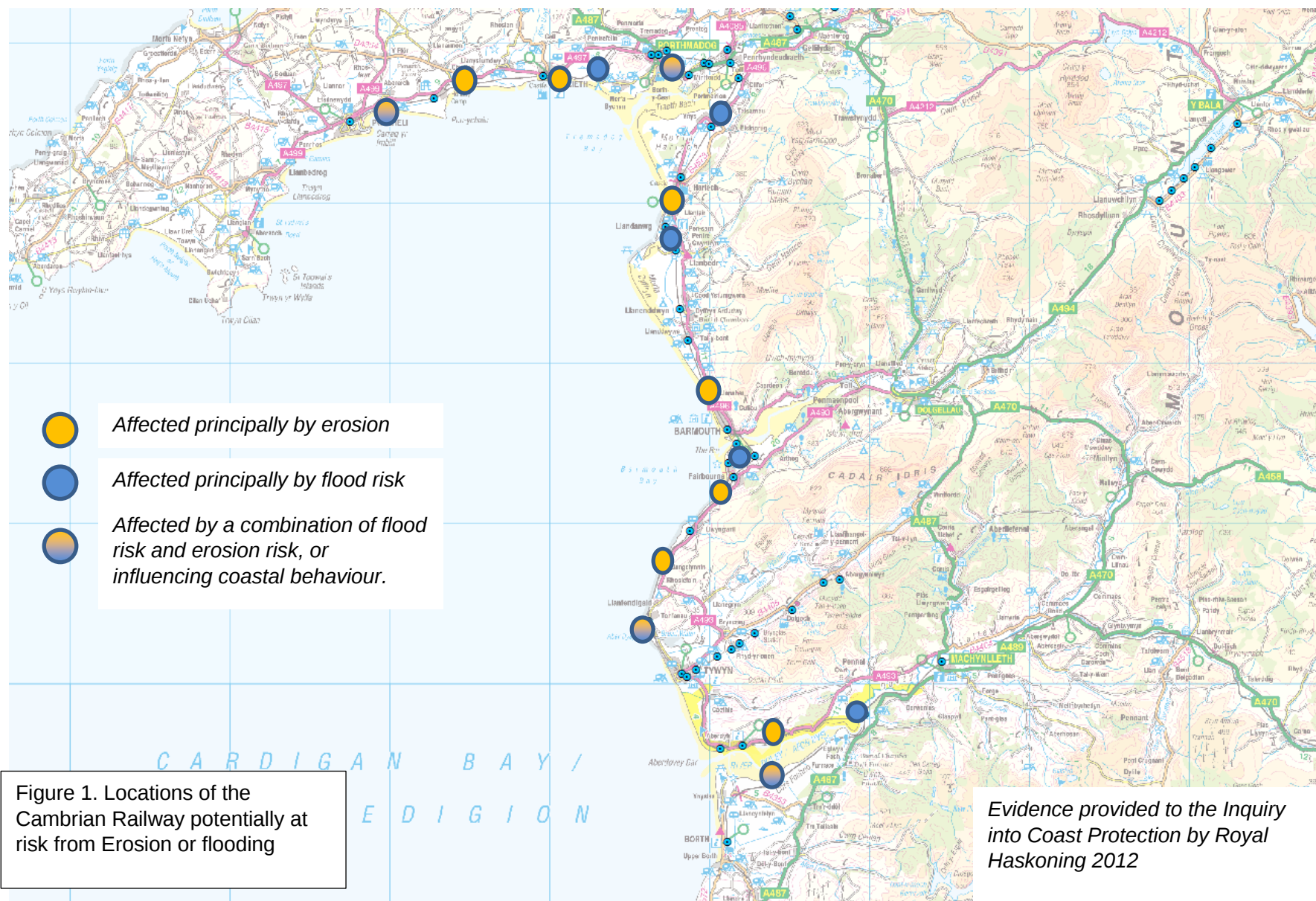
- The need for monitoring of the coast and the way in which defences perform and are managed. The value of such monitoring needs to focus on the specific issues of individual areas as much as providing national information in compliance with the Flood and Water Management Act 2010.
- That information needs to be used locally and nationally to allow planning of future management activities and the results of monitoring needs to be disseminated to communities such that they gain an understanding of issues.
- That flood and coast protection risk management cannot be viewed separately from other issues at the coast and that there needs to be a long term commitment and involvement from both operating authorities and communities in developing risk management within future planning to meet the broader issues of the communities.
- While there needs to be planning and prioritisation of funding for coast protection, this needs to maintain the flexibility to adapt to actual needs and timing in development of schemes on a case by case basis.
- Planning more adaptive and sustainable approaches to coast protection needs time and should be driven by the specific needs of individual areas not by fixed processes and procedures.
- The timing of funding streams is a major issue that requires careful consideration. This will become more critical as greater emphasis is placed on private or local funding arrangements.

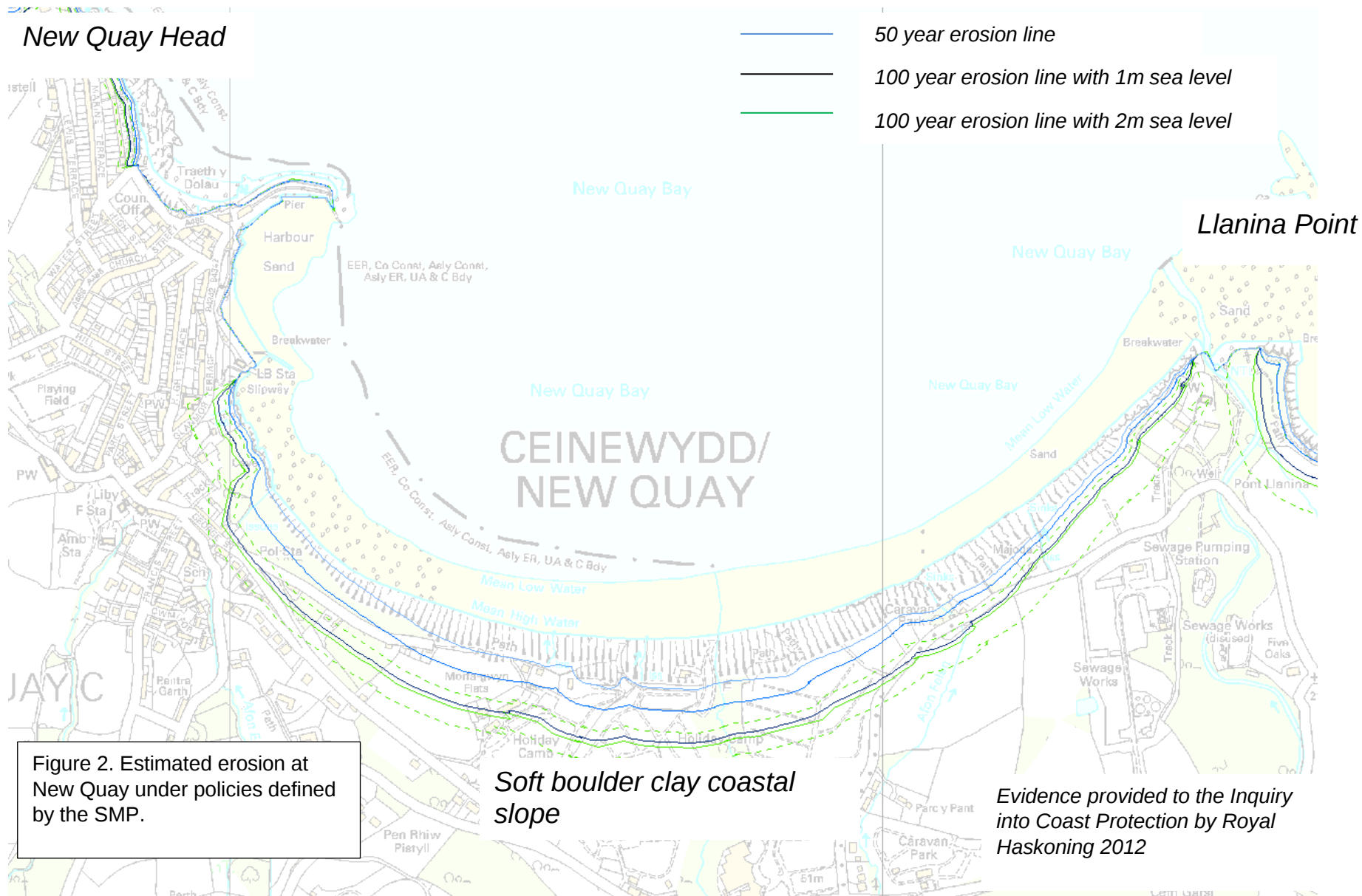
As a final note on future funding and prioritisation of funding, it is recognised from our experience even now, that the level of support is not adequate to meet the needs of all works necessary to maintain and improve defences around the UK and in Wales. There will be a need for change. As part of making decisions, we envisage, as stated in the WoW SMP and other SMPs that there may well be the need to move existing communities due to increased vulnerability or due to lack of funding. Whilst creating a more sustainable approach in the long term to coastal management, the cost and thought associated with managing such major relocation will not be insignificant. At present there appears to be little recognition of this and no clear responsibilities in terms of initiating or implementing such change. At present the approach appears to fall between authorities such that should the decision be made to withdraw maintenance of defences, there is little guidance or preparation for what happens then.

The focus within the Strategy is on preparing for emergency response to flooding. This quite correctly does need a high priority. However, at the coast where it is possible to predict the need for longer term permanent loss, the Strategy does not address this issue.

Conclusion

This note has been prepared by Royal Haskoning in response to an invitation to do so by the Environment and Sustainability Committee. We are conscious that the subject of coast protection is wide ranging and we have attempted to provide evidence and comment based on our experience in this field relevant to the Committee's terms of reference. Should there be further aspects of the subject where the Committee feel that we could provide further more specific evidence we would be pleased to do so.







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