C5.4 Coastal erosion

In order to determine the shoreline erosion risk along the North Solent SMP frontage for 20, 50 and 100 years time, the following two baseline scenarios were mapped in Annex C5.1:

Under the 'No Active Intervention' (NAI) policy scenario, there is no expenditure on maintaining or improving existing coastal and flood defences; therefore defences will fail at a time dependent upon their residual life and the condition of the fronting beaches and inter-tidal areas. Erosion is then predicted and mapped based on the average erosion rate. It should be noted that the 2108 and 2115 flood map is indicative of the flood risk if all defences failed.

Under the 'With Present Management' (WPM) policy scenario, all existing defence practices are continued, therefore defences are maintained to provide a similar level of protection over the next 100 years to that provided at present resulting in no erosion predicted. In some cases this will require considerable improvement to existing defences to maintain their integrity and effectiveness; presently redundant structures do not form part of this analysis. It should be noted that the 2108 and 2115 flood map is indicative of the residual flood risk under a "no defences" scenario. Erosion is predicted for any undefended sections of shoreline.

The method for deriving the erosion predictions is explained below.

C5.4.1 Erosion method

In order to predict the shoreline erosion risk for the North Solent SMP frontage, an average annual recession rate was calculated for behavioural units, assuming that no defences were present. Behavioural units are defined by geomorphology, wave climate, orientation and beach management activities.

A number of data sources were analysed to calculate an average annual recession rate for the North Solent SMP shoreline, assuming that no defences were present. Figure C5.1 presents the hierarchy of data analysed in order to obtain an annual recession rate of the shoreline.

For coastal frontages covered by aerial photography, Historical Photography Interpretation (HPI) was deemed the most reliable indicator of shoreline erosion. HPI could only be used for behavioural units where defences were not present in the earliest photography, which, considering the high proportion of the shoreline that has historically been defended, restricted the use of this approach.

The location of the Mean High Water (MHW) contour was also taken as a reliable indicator of shoreline movement and recession. Beach management and sediment recycling logs were collated from the Strategic Regional Coastal

Monitoring Programme and taken into account to identify locations and dates of operations. Annual recession rates were then calculated prior these management activities to ensure that they did not include beach management operations.

Depending on data availability, the HPI and/or MHW analysis were used to obtain an average annual recession rate. Annual recession rates from Coastal Defence Strategy Studies and the National Coastal Erosion Risk Mapping programme were documented and compared with the SMP findings.

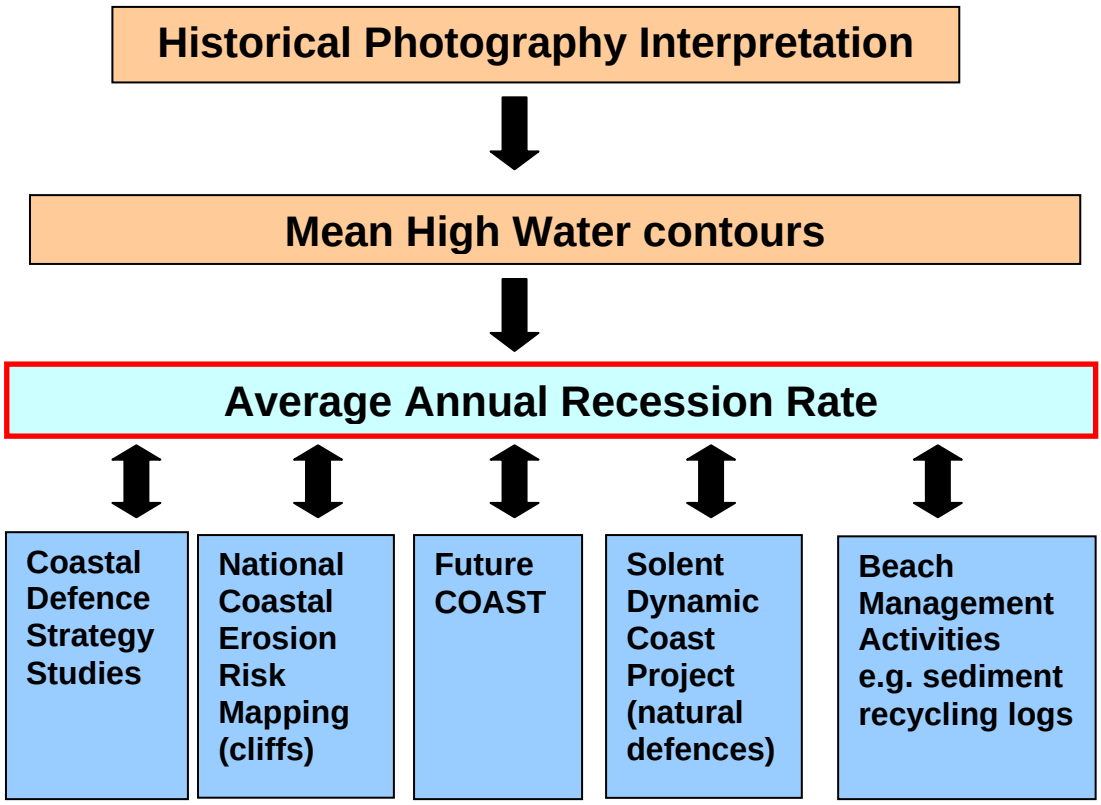

Figure C5.1: Hierarchy of data analysed to obtain an annual recession rate

Historical Photography Interpretation

Historical aerial photography was utilized from the Solent Dynamic Coast Project and the West Solent Coastal Defence Strategy Study. Where identifiable, the back of the beach and/or the cliff edge were digitized. Geo-rectification and digitizing error were accounted for in the determination of recession rates. The average annual recession rates were calculated between the earliest aerial photography and the most recent orthorectified images. This omitted any seasonal variations in erosion rates. Limitations for obtaining an annual recession rate from the HPI approach include:

- 80% of the North Solent coastline is currently defended and the majority of these defences were in place before the earliest available historical aerial photography (e.g. in the 1940s)

- historical aerial photography was only used if the geo-rectification error was no greater than +/-5m and the digitizing error was less that 1m
- non-continuous coverage of geo-rectified historical aerial photography

Geomorphological features such as spits that are prograding or highly dynamic, were not included in this assessment, as their potential evolution is highly variable.

Mean High Water Contour Migration

Historical mean high water (MHW) lines were obtained from Hampshire County Council's Archaeological Department; these included 1843–1893 (1st edition), 1891–1912 (2nd edition), 1904–1939 (3rd edition) and 1919–1943 (4th edition). In addition, more recent MHW lines were obtained from the South East Strategic Regional Coastal Monitoring Programme baseline topographic surveys for years 2000–2004 and years 2007–2008. The historical MHW lines cover the Hampshire area and the more recent Regional Monitoring MHW lines cover the whole North Solent.

The average annual recession rate between the earliest historical MHW line and the most recent Regional Monitoring data were calculated. In addition, the annual recession rate between the two Regional Monitoring surveys was calculated to provide an accurate measure of recent change. Sediment recycling events were noted to ensure annual recession rates did not include beach management operations.

Coastal Defence Strategy Studies, National Coastal Erosion Risk Mapping and FutureCOAST

Detailed recession rates were collated from the various Coastal Defence Strategy studies within the North Solent SMP area.

FutureCOAST estimated erosion rates for cliffs only. Within the North Solent SMP area only 4% of the shoreline comprises of cliffs; therefore FutureCOAST's estimated recession rates only applied at the following sites:

Location	Recession potential (per annum)
Selsey Bill	1-2m assuming total removal of structures
Titchfield Haven	0.5-1m
Hillhead (Calshot)	0.5-1m
Lepe	0.5-1m assuming total removal of structures

Table C5.12 FutureCOAST estimates of future cliff recession

During the period of calculating recession rates, Local Authorities were requested to input and verify the erosion rates proposed in the National Coastal Erosion Risk Mapping (NCERM) programme. NCERM considered erodible frontages as lengths of coastline that, if eroded, would not result in flooding. Where erosion would lead to flooding the shoreline was classified as

a non-erodible frontage. Where Local Authorities had not validated the NCERM database, recession rates presented in the Coastal Defence Strategy Studies and FutureCOAST were used in the SMP analysis.

Comparison of recession rates proposed by these various studies and projects improved the degree of confidence and validation of the average annual recession rates that were calculated.

Data analysis

Shoreline recession rates were determined by availability of data. Positions of back of beach and/or cliff edge were identified from HPI and/or MHW changes. Recession rates were then measured between datasets, and average annual recession rates were calculated on defined profile lines for behavioural units. The annual average recession rates for the No Active Intervention and With Present Management scenarios were then projected landwards from a shore parallel baseline (i.e. back of beach, cliff edge), on the same bearing as the profile lines. Erosion zones were produced for the SMP epochs 0-20, 20-50 and 50-100 years. The recession rates that were applied on each profile line are presented in Annex C5.2.

The average annual recession rates were only applied to the shoreline baseline when the existing defences reached the end of their residual life or natural defences (e.g. saltmarshes, barrier beaches, small cuspate features) have been eroded and no longer provide protection to the mainland from wave attack. Where no defences occur or existing defences had already reached the end of their residual life, the recession rates were applied from Year 1.

Residual life information for the existing defences was collated through the SMP process from operating authorities (see C2 Defence Assessment). Rates of inter-tidal loss were taken from the Solent Dynamic Coast Project and CDS, where available, and expert judgment. Barrier rollover rates were estimated from the historical aerial photography and Bradbury's (1998) overwashing model (SCOPAC Barriers and Spits work).

The harbours were treated differently to the open coast due to lack of data for undefended sections of eroding shoreline. The eroding Hayling Billy frontage was used as a proxy for erosion in the harbours. An average erosion rate of 0.2m per annum was applied to south-westerly facing frontages and a rate of 0.1m per annum to south-easterly facing frontages in all three harbours.

Under the "No Active Intervention" scenario, once a defence initially fails, depending on such variables as geology, morphology of the coastline, etc. the shoreline may initially erode at a higher rate, due to short-term realignment of the shoreline, as it attempts to reach equilibrium; e.g. a promontory that is no longer defended, or afforded protection from defences updrift. Under the NAI scenario, an additional 5m of erosion was applied to cover the faster initial cut back rate, following defence failure. This coarse estimate was based on initial cut back at Milford when the seawall collapsed in August of this year.

By projecting past erosion rates, increases in future sea level rise and changes in wave attack have not been accounted for in the NAI and WPM scenarios.

Dynamic coastal areas such as barrier beaches and spits, in particular, were termed “complex coastal processes” in the erosion mapping. These features do not erode in the same way as a cliff, instead they overtop, overwash and then eventually breach causing landward flooding.

C5.4.2 Coastal erosion tables per council ward

The following table presents the total number of properties, per Council, potentially at risk from erosion within the 0-20, 20-50 and 50-100 year epoch under a No Active Intervention and With Present Management scenario.

Local Authority	Number of properties in erosion risk zones per epoch (not cumulative)					
	No Active Intervention scenario	With Present Management scenario	No Active Intervention scenario	With Present Management scenario	No Active Intervention scenario	With Present Management scenario
	Epoch 1 (0-20 years)		Epoch 2 (20-50 years)		Epoch 3 (50-100 years)	
Chichester District	74	0	342	1	762	0
Havant Borough	26	4	279	3	473	0
Portsmouth City	4	0	97	0	347	0
Gosport Borough	15	0	66	0	136	0
Fareham Borough	3	1	54	38	38	5
Winchester City	0	0	0	0	0	0
Eastleigh Borough	5	1	2	1	18	1
Southampton City	0	0	6	0	93	4
Test Valley Borough	0	0	0	0	0	0
New Forest District	0	0	2	0	28	8
SMP Total	**127**	**6**	**848**	**43**	**1895**	**18**

Table C5.13 Total number of properties at risk from erosion, per epoch, for Local Authorities within the Shoreline Management Plan extents

The following tables show the number of properties at risk from erosion, per Council ward within the 0-20, 20-50 and 50-100 year epoch under a No Active Intervention and With Present Management scenario.

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
New Forest District Council	Boldre & Sway	0	2	0
	Brockenhurst & Forest South East	0	0	13
	Dibden and Hythe East	0	0	4
	Fawley, Blackfield & Langley	0	0	7
	Hythe West & Langdown	0	0	4
LA Total		**0**	**2**	**28**

Table C5.14 Total number of properties at risk from erosion, per epoch, for the New Forest District Council Ward under a NAI scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
New Forest District Council	Brockenhurst & Forest South East	0	0	3
	Fawley, Blackfield & Langley	0	0	5
LA Total		**0**	**0**	**8**

Table C5.15 Total number of properties at risk from erosion, per epoch, for the New Forest District Council Ward under a WPM scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Chichester City Council	Southbourne	5	2	0
	Selsey South	35	83	219
	Selsey North	3	55	254
	East Wittering	25	118	178
	West Wittering	1	80	98
	Donnington	0	1	2
	Bosham	5	3	11
LA Total		**74**	**342**	**762**

Table C5.16 Total number of properties at risk from erosion, per epoch, for Chichester District Council Ward under a NAI scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Chichester City Council	Bosham	0	1	0
LA Total		**0**	**1**	**0**

Table C5.17 Total number of properties at risk from erosion, per epoch, for Chichester District Council Ward under a WPM scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Eastleigh Borough Council	Bursledon & Old Netley	4	1	0
	Hamble-le-Rice & Butlocks Heath	1	0	2
	Netley Abbey	0	1	16
LA Total		**5**	**2**	**18**

Table C5.18 Total number of properties at risk from erosion, per epoch, for Eastleigh Borough Council Ward under a NAI scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Eastleigh Borough Council	Bursledon & Old Netley	0	1	0
	Hamble-le-Rice & Butlocks Heath	1	0	1
LA Total		**1**	**1**	**1**

Table C5.19 Total number of properties at risk from erosion, per epoch, for Eastleigh Borough Council Ward under a WPM scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Fareham Borough Council	Fareham East	1	10	7
	Hill Head	0	2	23
	Portchester East	1	0	1
	Sarisbury	0	7	0
	Titchfield	1	33	0
	Warsash	0	2	7
LA Total		**3**	**54**	**38**

Table C5.20 Total number of properties at risk from erosion, per epoch, for Fareham Borough Council Ward under a NAI scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Fareham Borough Council	Portchester East	1	0	0
	Sarisbury	0	7	0
	Titchfield	0	31	5
LA Total		**1**	**38**	**5**

Table C5.21 Total number of properties at risk from erosion, per epoch, for Fareham Borough Council Ward under a WPM scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Gosport Borough Council	Alverstoke	0	2	1
	Anglesey	1	1	3
	Christchurch	2	1	4
	Hardway	0	1	37
	Lee West	0	0	8
	Town	12	61	83
LA Total		**15**	**66**	**136**

Table C5.22 Total number of properties at risk from erosion, per epoch, for Gosport Borough Council Ward under a NAI scenario

There are no properties at risk from erosion for Gosport Borough Council under a With Present Management scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Havant Borough Council	Emsworth	17	17	36
	Hayling East	1	253	432
	Hayling West	4	4	2
	St. Faith's	4	5	3
LA Total		**26**	**279**	**473**

Table C5.23 Total number of properties at risk from erosion, per epoch, for Havant Borough Council Ward under a NAI scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Havant Borough Council	Hayling West	4	3	0
LA Total		**4**	**3**	**0**

Table C5.24 Total number of properties at risk from erosion, per epoch, for Havant Borough Council Ward under a WPM scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Portsmouth City Council	Charles Dickens	0	1	0
	Eastney and Craneswater	2	3	19
	Nelson	1	3	3
	Paulsgrove	1	82	261
	St Jude	0	1	1
	St. Thomas	0	7	63
LA Total		**4**	**97**	**347**

Table C5.25 Total number of properties at risk from erosion, per epoch, for Portsmouth City Council Ward under a NAI scenario

There are no properties at risk from erosion for Portsmouth City Council under a With Present Management scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Southampton City Council	Bargate	0	0	1
	Bevois	0	0	1
	Bitterne Park	0	1	74
	Peartree	0	0	4
	Portswood	0	1	13
	Woolston	0	4	0
LA Total		**0**	**6**	**93**

Table C5.26 Total number of properties at risk from erosion, per epoch, for Southampton City Council Ward under a NAI scenario

Local Authority	Electoral Ward	Number of properties in erosion risk zones		
		Epoch 1 (0-20 years)	Epoch 2 (20-50 years)	Epoch 3 (50-100 years)
Southampton City Council	Woolston	0	0	4
LA Total		**0**	**0**	**4**

Table C5.27 Total number of properties at risk from erosion, per epoch, for Southampton City Council Ward under a WPM scenario