





















# Introduction

## 1.1 Background and BMP Area

This Beach Management Plan (BMP) has been prepared for East Devon District Council (EDDC), and their partner, the Environment Agency. The BMP area covers the coastline from Seaton Hole, in the west, to the Harbour Wall, on the east side of the River Axe, and the Axe River up to the Axe Bridge, as shown in Figure 1-1.



Figure 1-1 Seaton BMP area

## 1.2 The Problem

The Seaton coastline is at risk of both flooding and erosion. To reduce these risks, various coastal defences have been constructed along the frontage over the years, with the existing defences consisting of primarily a rock revetment and a number of walls/seawalls. These coastal defences protect various assets, including:

- Up to 28 properties (and 8 flats) at risk of erosion at West Seaton.
- Highways and utilities on the cliff top at West Seaton. Included with this is a section of the alternative and important local coastal route is also at risk (at the junction Old Beer Road and the B3172).

- Up to 67 residential and 27 non-residential properties at Seaton.
- Up to 6 properties at risk of erosion on the east bank of the Axe Estuary harbour.

This BMP has been prepared to address these issues and provide a way forward to manage flood and coastal erosion risk at Seaton, allowing for the present-day funding limitations and environmental and technical constraints and opportunities.

## 1.3 Aims and Objectives of the Beach Management Plan

The purpose of the BMP is to identify the management activities to reduce the flood and coastal erosion risk between Seaton Hole, in the west, and the Harbour Wall, on the east side of the River Axe, and the Axe River up to the Axe Bridge for the next 20-30 years, whilst recognising and managing the environmental and amenity implications of doing so. The BMP defines a maintenance and monitoring programme for the next 5 years to implement those identified activities, all within in the context of the long-term (100 year) policy intent for this area (as defined by the Shoreline Management Plan (SMP) (Halcrow, 2011) and outlined in Table 1-1 below).

The specific objectives of the BMP are:

1. Ensure Seaton’s coastal defences provide an appropriate standard of service.
2. Determine an appropriate management regime for Seaton spit. **\*See Section 1.6 below.**
3. To compliment Seaton Town Council’s vision for the Seafront.
4. To carry out (1), (2) and (3) in an integrated, justifiable and sustainable way.

Table 1-1 Summary of the SMP policies that apply to the BMP area

Policy Unit	Short Term (to 2025)	Medium Term (to 2055)	Long-term (to 2105)
6a30 Seaton (West) to Seaton Hole	Continue to maintain existing defences under a Hold the Line policy.	Continue to maintain existing rock revetment, until it becomes ineffective; at this time consider moving the revetment back to the base of the retreating cliff toe under a Managed Realignment policy.	Continue to maintain existing rock revetment, until it becomes ineffective; at this time consider moving the revetment back to the base of the retreating cliff toe under a Managed Realignment policy.
6a29 Axe Estuary (Spit) to Seaton (West)	Continue to maintain existing defences under a Hold the Line policy to maintain protection to Seaton.	Continue to maintain existing defences under a Hold the Line policy.	Continue to maintain existing defences under a Hold the Line policy.
6a28 Axe Estuary (Spit)	Allow natural coastal evolution to continue through No Active Intervention.	Allow natural coastal evolution to continue through No Active Intervention.	Allow natural coastal evolution to continue through No Active Intervention.
6a25 Axe Estuary (Mouth Breakwater to Axmouth North)	Continue to maintain defences through Hold the Line Policy.	Continue to maintain defences through Hold the Line Policy.	Continue to maintain defences through Hold the Line Policy.

## 1.4 Development of the BMP

The BMP has been developed utilising best practice contained in the CIRIA Beach Management Manual, 2nd Edition (CIRIA, 2010). It has been prepared in six stages, with ongoing communications with stakeholders throughout. A diagram showing the staged approach to preparing the BMP is presented in Figure 1-2.

- Stage 1 – Project Initiation and Development Planning:** Starting with a project meeting, the purpose of this stage was to refine the project scope and set clear aims and objectives for the development of the BMP going forward. A Stakeholder Engagement Plan (SEP) was prepared to ensure that community engagement was focussed. The SEP identified key groups and individuals who should be engaged with as part of the project and the ways in which they would be engaged with throughout the development of the BMP. A Briefing Note was also prepared, which provided a summary of the BMP, and was available to use during the initial stages of the community engagement when raising awareness of the BMP.
- Stage 2 – Data Collection:** The purpose of this stage was to review the suitability of the existing and available data and identify any critical data gaps.
- Stage 3 – Establish Baselines:** The purpose of this stage was to update the existing baseline information on coastal processes, environment, coastal defences and economics, which underpins the BMP options development and decision-making process (see Stage 5). The findings of the work were recorded within four reports; Coastal Processes Baseline, Environmental Baseline, Defence Baseline, and Economics Baseline (discussed in Section 1.5 and included in Appendix A to D respectively).
- Stage 4 – Identify Issues & Existing Management Regime:** There are a number of issues related to Flood and Coastal Erosion Risk Management (FCERM) within the BMP area. Some of the issues are already addressed by existing management practices, be it in part or fully. However, in some instances these issues are only addressed in part or not addressed at all. As part of the BMP process those FCERM issues were identified, from which it was determined how they are addressed at present and what actions could be taken to resolve them. The findings of this work are presented in Appendix E (Technical Note on Issues, Current Management Practices and Actions).
- Stage 5 – Development Management Options:** The options development stage identified and appraised the different management activities that could be implemented to manage flood and coastal erosion risk between Seaton Hole, in the west, and the Harbour Wall, on the east side of the River Axe, and the Axe River up to the Axe Bridge for the next 20-30 years. The options appraisal was completed in accordance with best practice guidance and followed a staged approach to ensure that the decision-making process was transparent and auditable. **This report covers this stage of the BMP development process.**
- Stage 6 – BMP Development:** This stage involves the production of the main BMP document and Options Appraisal Report. In line with the aims and objectives, the BMP identifies the measures to develop and implement more sustainable longer-term solutions along the BMP frontage and sets out a plan to maintain and monitor the beach. Going forward, the BMP will then be used by EDDC and the Environment Agency to inform, guide and assist them when making decisions on how to best manage the coast going forward. The BMP also includes recommendations for further studies and investigations to refine the preferred long-term option and inform its implementation.
- Community Engagement:** Stakeholder engagement and liaison with the local community was integral to the options appraisal process and the definition of a preferred option. Consultation with the Seaton BMP stakeholder group took place during the BMP development to seek local

knowledge/information and to help guide the selection of beach management options. All comments made have informed the options appraisal.

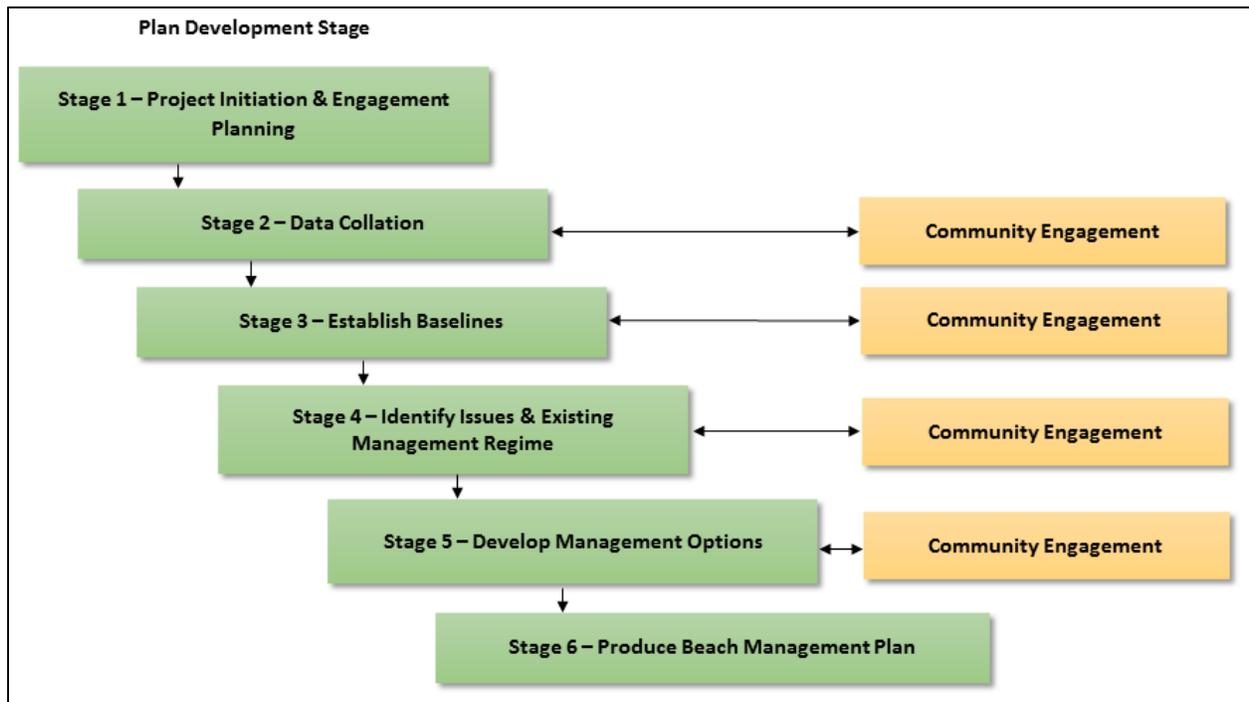


Figure 1-2 BMP development process

## 1.5 The Basis of this Report

This Options Appraisal Report is a supporting document to the BMP and covers Stage 5 of the BMP development process (as described in Section 1.4 and shown in Figure 1-2). This report provides full details of the options appraisal that was completed to identify the potential future flood and coastal erosion risk management options for the Seaton BMP frontage.

The selection of a preferred option / management approach for the BMP frontage was undertaken via a staged approach, which rationalised a long-list of options to a short-list of options, from which a preferred option(s) was selected. This is shown in Figure 1-3, and references to the relevant sections within this report are listed below:

- Long-list appraisal (described in detail in Section 2).
- Short-list appraisal (described in detail in Section 3); and
- Selection of the preferred option (described in detail in Section 4).



Figure 1-3 Options appraisal process – staged approach to option selection

The options appraisal is underpinned by the information and evidence presented in the four baseline studies:

- Coastal Processes Baseline: coastal processes, shoreline interactions and shoreline evolution (presented in Appendix A).
- Environmental Baseline: environmental setting and features (presented in Appendix B).
- Defence Baseline: coastal defence assets, condition and performance (presented in Appendix C).
- Economics Baseline: economic basis (i.e. the economic benefits) for both ongoing and future beach management and flood and coastal erosion risk management activities (discussed in more detail in Section 1.6 and Appendix D).

The Do-Nothing scenario is appraised and presented within the four baseline studies. ‘Do-Nothing’ as an option was discounted at long-list stage. All options considered going forward are ‘Do-Something’ and seek to prevent the occurrence of flood and coastal erosion risk damages.

## 1.6 Appropriate Management Regime for Seaton spit

Objective two of the BMP is to ‘define an appropriate management regime for Seaton spit’. Dating back to the 1970’s, material has been dredged from the Axe Estuary to form what is now the Axe Harbour basin. The dredged material has been disposed of within trenches dug into Seaton spit. There are now concerns that this practice is threatening the integrity of the seawall at Seaton and the spit itself. In recognition of this, and in line with the aims and objectives of the BMP, formal consideration of dredge disposal options has been undertaken.

The initial stages of the options appraisal processes were completed for Seaton spit alongside the BMP frontage and a long-list of options was devised. However, many of the options being explored involved the disposal of dredge material removed from the harbour below the Mean High Water Mark, which therefore required consultation with the Marine Management Organisation (MMO). The MMO confirmed that sediment sampling would be required in addition to ongoing consultation with them. Until the results, analysis and review of the sediment sampling were returned and subsequent decisions made by MMO, the options appraisal process for Seaton spit was put on-hold. Details of the options appraisal processes and option selection for the management of Seaton spit is therefore provided in a separate report; ‘Options Appraisal - Axmouth Harbour’, which forms Appendix F to the overarching Seaton BMP Report.

***Please note: where an option considers the removal of dredge material from the spit, or the disposal of it for beneficial use within the BMP area, it has been included here.***

## 1.7 Funding of Beach Management Activities

### 1.7.1 Funding Opportunities

Funding for flood and coastal erosion risk management can be achieved via a number of sources, some examples are provided below, with more details provided in the Economics Baseline Report (Appendix D; Section 4.2).

- Environment Agency via FCERM-GiA. FCERM-GiA funding must be used to provide measures that protect against flood and erosion damages and realise the ‘benefits’. Any business case submitted to the Environment Agency National Projects Assurance Services must demonstrate ‘confidently’ that the problem of flooding/erosion would be ‘solved’ and not need further protecting for the duration of the ‘benefits’ claimed.
- Environment Agency funding streams (as identified in Operational instruction 492\_09, Environment Agency, 2017), including:

- Capital budgets – allocated to the construction, provision, purchase and replacement of assets owned and managed by the Environment Agency. This is expenditure that leads to the creation of tangible and intangible assets which are included on the Environment Agency asset register. Capital assets must have a value greater than the £5k.
- Capital Works Expensed in a Year (CWEiY) – this is budget allocated to works on assets that are not included on the Environment Agency asset register and includes works to replace an existing asset or structure / significantly improve the useful life of the existing asset or structure beyond its original design. CWEiY is treated by Defra as part of the grant in aid capital allocation.
- Revenue Budgets – allocated as operating expenditure. This includes the likes of maintenance of existing structures of the structure that is not below target or useable condition; or capital works valued to be less than £5k).
- Directly via the assets owner / responsible authority, such as EDDC via local levy, or Devon County Council.
- Third party funding, such as utilities companies, local landowners and residents.

### 1.7.2 Method to Calculate Available Funding

The economic appraisal is based on assessment of the costs and benefits of each option. This is expressed as the benefit:cost ratio (BCR) for each option. The BCR then forms part of the Partnership Funding calculation to determine how much of the required costs can be claimed from central Government via the FCERM-GIA, and how much of the costs will have to be found from other sources of funding (refer to BOX 1 below). This partnership funding calculation also takes into account the numbers of properties protected against the risk of flooding and erosion, the level of social deprivation of the areas at risk, and legal environmental requirements.

To provide the costs part of the BCR, for each option appraised broad costs have been developed based on industry standard rates and recent CH2M ‘now Jacobs’ experience of similar types of works. In accordance with national guidance, a 60% optimism bias is then applied to total calculated costs.

The benefits part of the BCR is based upon the Do-Nothing scenario damages calculated for the Economics Baseline Report (refer to Appendix D). In summary, this calculated that over the 100-year appraisal period, there are:

- Up to 28 properties (and 8 flats) at risk of erosion at West Seaton. The discounted Present Value (PV) of these properties is estimated to be £4,843,131.
- Highways and utilities on the cliff top at West Seaton, including a section of the alternative and important local coastal route is also at risk (at the junction Old Beer Road and the B3172). The discounted Present Value (PV) is estimated to be £664,454 (which includes costs that would be incurred to manage changes to the junction).
- Up to 67 residential and 27 non-residential properties at risk of fluvial/coastal flooding at Seaton. The discounted Present Value (PV) of these properties is estimated to be £571,000 (at present-day, not accounting for the effects of climate change and sea level rise).
- Up to 6 properties at risk of erosion on the east bank of the Axe Estuary harbour. The discounted Present Value (PV) of these properties is estimated to be £357,761.
- In total therefore, the Do-Nothing scenario damages for the BMP frontage could be up to £6,436,346.

In order to obtain a 100% PF score for the BMP frontage against £6,436,346 of benefits being at risk of erosion and flooding under a 1:100 year event (moderate risk) being moved to low risk, then

approximately £600,000 of FCERM-GiA could be available before third-party contributions are needed to deliver solutions. This splits out as about £490k for the western erosion risk part of the BMP frontage, £70k for the central/eastern coastal flood risk part of the BMP frontage, and £40k for eastern erosion risk part of the frontage. Based on this, a significant proportion of any future funding needs for beach management activities will need to come from non-FCERM-GiA sources.

### **BOX 1: Future funding of coastal defences**

The way in which flood and coastal erosion risk management schemes are funded in England changed in April 2012. The previous system of funding, whereby only the highest priority schemes received 100% grant-in-aid (GIA) from central government was replaced by a new funding system.

Whilst some schemes will still be eligible for the full 100% grant-in-aid from central government, the new approach allows more schemes to be delivered with a lower percentage GIA contribution from central government, with the shortfall in funding to be made up from other funding sources – this is referred to as ‘Partnership Funding’ (Defra, 2011(a); Defra, 2011(b); and EA, 2012).

This Partnership Funding approach will allow schemes that would have historically been deferred, due to failure to meet the 100% GIA qualifying criteria, to proceed earlier than would be expected if they were solely dependent on receiving central government funding.

This change in approach reflects the fact that flood and coastal erosion risk management schemes provide multiple benefits to communities, not just protection against flood and erosion risks. For example, a defence may reduce risks to transport and services infrastructure that is critical to an area’s economy and development potential. A defence may also provide public space or, where a beach is recharged, an important tourism and recreational resource.

The different, multiple beneficiaries from FCERM funded schemes presents the potential to access the various funding sources that are used by those beneficiaries, and this may be one way of achieving Partnership Funding. Given this possibility, the following are potential Partnership Funding routes that could be explored to deliver future FCERM activities along the coast (from McNally *et al.*, 2012).

- Private investment (e.g. developer/landowner pays);
- Water company investment;
- Community Infrastructure Levy;
- Section 106 Agreements (Town & Country Planning Act, 1990);
- Council Tax;
- Public Works Loan Board;
- Business Rate Supplements;
- Business Improvement Districts;
- Asset Backed Securities;
- General Drainage Charge/Special Drainage Charge;
- Local Authority fees and charges;
- Trusts;
- Regional Growth Fund;
- Business Rate Retention;
- Tax Increment Finance;
- Local Government Bonds; and
- Coastal Communities Fund.

## 1.8 Issues, Current Management Practices and Actions

There are a number of issues related to Flood and Coastal Erosion Risk Management (FCERM) within the BMP area. Some of the issues are already addressed by existing management practices, be it in part or fully. However, in some instances these issues are only addressed in part or not addressed at all. As part of the BMP process, those FCERM issues were identified, from which it was determined how they are addressed at present and what actions could be taken to resolve them. The findings of this work are presented in Appendix E (Technical Note on Issues, Current Management Practices and Actions).

Where possible, some of the FCERM-related issues were incorporated into the options appraised, whilst some of the non-FCERM were considered alongside the options appraised. A summary of the 'non-FCERM issues' are listed in Table 1-2 and indication is given (in Column 3) as to whether it is possible to consider them alongside the preferred options. Where it not possible to achieve these issues through an option, they have been included within the BMP Action Plan for EDDC to consider going forward.

Table 1-2 Summary of the non-FCERM issues

Non-FCERM Issue	Description of Non-FCERM Issue	Consider Alongside Preferred Final Option?
Debris falling from cliff	A consequence of erosion of the cliffs between Seaton Hole and West Seaton is the accumulation of debris at the cliff toe, for example an outfall pipe and a large section of trees and vegetation. Such items could represent a health and safety hazard to beach users and removal of such items should be considered.	No
Pollution of beach at Old Beer Road	It has been observed that pollution is entering the sea from the brook running adjacent to Old Beer Road (west). The BMP should seek to identify options to improve beach quality on the beach, which is also used by tourists.	No
landscape and connectivity with the beach	The stakeholder group have raised concerns over the height of the existing Environment Agency wall which can cut off views from Esplanade, and the lack of connectivity between the Esplanade and beach as a result of the limited access points through the seawall itself.	No
Opportunities for Concessions	EDDC Streetscene who manage the beach, and the stakeholder group have expressed a desire to encourage more activity on the beach to attract visitors, generate income to maintain the area and add to the economic activity within the Town.	No
Seaton Sea Front Enhancement	Seaton Town Council have been granted planning permission for the enhancement of the Esplanade between the point known as Fishermen's Gap adjacent to the junction with Marine Place, and the junction with Beach Road. The Beach Management Plan should aim to complement and guide these plans.	Achieved (see Section 5.2, bullet 2 above)
Waterborne Transport	Seaton currently lacks landing facilities for tourist boats (for example Stuart Line Cruises in Exmouth) and as such, it is difficult for operators to regularly run services as landing onto the beach is heavily weather dependant. The stakeholder group would like to see improved landing facilities considered as part of options for management of the frontages.	No
Overnight anchorage	Overnight anchorage and development of an enclosed bay. Moorings are also being looked at as part of aspirations to improve of waterborne access (see above).	No
Public Engagement	Consult locals and visitors when determining future of Seaton.	Achieved

Non-FCERM Issue	Description of Non-FCERM Issue	Consider Alongside Preferred Final Option?
Car parking on harbour road	There is a local feeling that Devon County Council charging for Parking on harbour road all year round has resulted in a decrease in visitors to the beach and town centre in the winter period.	No
Beach access	Access over shingle for walking, wheelchairs and pram, is difficult. Addition of matting.	No
Beach huts	The beach huts should remain on the beach.	Achieved – not anticipated change to current status of the beach huts
Boat access across the beach	Extend slipway at Fisherman's gap for day-trippers to launch boats from.	No
Beach access across the beach at western end	Construct a walkway along the cliff from West Walk to Seaton Hole similar to Sidmouth and Lyme Regis to improve connectivity of the coastal path.	No
Improved walking access on top of cliffs	Improve foot access over landslip at Old Beer Road, such as a bridge to reduce the length of the diversion route inland.	No
Seawall enhancements	Change the colour of the seawall.	No
Seawall enhancements	More seating along the seawall.	No
Seawall enhancements	More shelter along the seawall.	No
Seawall enhancements	Increased lighting along the seawall.	No
Seawall enhancements	Addition of public toilet along seawall.	No







































material from the spit to the west. The question is raised 'would movement of material from the spit go-against the SMP policy'. It is therefore recommended that the SMP Group is consulted with to discuss this option and agree a way forward if necessary.

- **Lyme Bay Coastal Flood Forecasting sensitivity testing:** The Lyme Bay Flood Coastal Flood Forecasting Phase 2 project, completed for the Environment Agency, included modelling of a range of return periods for the present day, but only included a limited assessment of climate change for a sub-set of these return periods, which is insufficient for a full economics appraisal of future flood damages. Therefore, it is recommended that if a 'scheme' for Seaton is going to be progressed, a more detailed assessment of flood risk/damages that assesses climate change impact for a full range of return periods is undertaken to determine a more accurate assessment of benefits and damages now and in the future, which can then be used to better determine the viability of options for the frontage.
- **Beer groyne study:** There are many unknowns and uncertainties related the option to shorten the concrete groyne at Beer, namely, once shortened where would the material go? To better understand this, a sediment tracing experiment could be undertaken in the first instance.
- **Control structure sensitivity test:** As explained above, recycling options may also require the inclusion of control structures, which come with cost implications. Should recycling prove to be a preferred option, then a sensitivity test should be completed to determine the likely cost of including such structures (ultimately the type, size, number and spacing will determine the cost)

## SECTION 4

Table 4-1 West Seaton in-combination options (erosion risk)

Location	Option Number	Option Description	In Combination 1	In Combination 2	In Combination 3	In Combination 4
Seaton Hole	11	Upgrade concrete encased revetment (tie into adjacent rock revetment) or replace with a new structure (i.e. improve/significantly extend the working life of the asset beyond its original design)	11	11	11	11
Seaton Hole / Old Beer Road	15	Maintain 'old and new' revetment and re-profile by re-packing rock (i.e. improve/significantly extend the working life of the asset beyond its original design)	15	15	15	15
The Pillar	23	Replace gabion baskets with new defences (e.g. a more substantial wall structure)	23		23	
The Pillar	24	Extend 'new' revetment to Check House Wall (replace former gabion baskets)		24		24
Check House Wall	29	Upgrade Check House Wall (e.g. add a thicker concrete layer) or replace with a new structure (i.e. improve/significantly extend the working life of the asset beyond its original design)	29	29	29	29
Seaton Spit (seaward face) / Seaton/Seaton Hole / Old Beer Road	33	Recycle material from east to west to increase beach volume (and make wider). An access route may need to be created to allow plant access through the seawall; this is only likely to be required if access cannot be achieved through the existing Fisherman's Gap. <b>Note control structures may also be required, with associated implications on coastal processes, shoreline interactions and costs).</b>			33	33
West Walk Promenade	37	Maintain the concrete / stone blockwork seawall.	37	37	37	37

	Seaton Hole	Seaton Hole / Old Beer Road	The Pillar	The Pillar	Check House Wall	Seaton Spit (seaward face) / Seaton/Seaton Hole / Old Beer Road	West Walk Promenade	Cost	BCR	Raw PF score	Third party funding required
	11	15	23	24	29	33	37				
<b>In Combination 1</b>	£487,278	£338,550	£84,374		£86,381			£996,584	5.53	52%	£483,104
<b>In Combination 2</b>	£487,278	£338,550		£71,761	£86,381			£983,970	5.60	52%	£470,490
<b>In Combination 3</b>	£487,278	£338,550	£84,374		£86,381	£920,613		£1,917,196	2.87	27%	£1,403,716
<b>In Combination 4</b>	£487,278	£338,550		£71,761	£86,381	£920,613		£1,904,583	2.89	27%	£1,391,103

SECTION 4

Table 4-2 Seaton and west bank Axe Estuary in-combination options (flood risk)

Location	Option Number	Option Description	In Combination 1	In Combination 2
Seaton	43	Improve drainage behind the seawall to encourage water that has overtopped the defences to flow back to sea	43	43
Seaton Spit (seaward face) / Seaton	49	Recycle material from east to west to increase beach volume (and make wider). An access route may need to be created to allow plant access through the seawall; this is only likely to be required if access cannot be achieved through the existing Fisherman's Gap or via the Axe Yacht Club. <b>Note control structures may also be required, with associated implications on coastal processes, shoreline interactions and costs).</b>		49
Seaton Spit (seaward face)	53	Do nothing	53	
Axe Estuary (west side)	58	Option being developed by the Environment Agency	58	58
Seaton	40	Maintain the existing concrete seawall.	40	40

	Seaton	Seaton Spit (seaward face) / Seaton	Seaton Spit (seaward face)	Axe Estuary (west side)	Seaton	Cost	BCR	Raw PF score	Third party funding required
	43	49	53	58	40				
<b>In Combination 1</b>	£24,379		£0	£487,000		£511,379	1.12	16%	£427,247
<b>In Combination 2</b>	£24,379	£920,613		£487,000		£1,431,992	0.40	6%	£1,347,859

Table 4-3 East bank Axe Estuary (erosion risk)

Location	Option Number	Option Description	In Combination 1	Cost	BCR	Raw PF score	Third party funding required
Axe Estuary (east side)	60	Maintain existing walls (stone wall 1, sheet pile wall, stone wall 2) (this includes related monitoring, surveys etc and measures to address ALW Corrosion, such as timing of replacement of sheet piles) (i.e. improve/significantly extend the working life of the asset beyond its original design)	£763,990	£763,990	0.47	5%	£723,692



## SECTION 4

**Table 4-4 Change scenario 'unlimited funding' options**

Location	Option Number	Option Description	Option Cost
Seaton Hole (CBU 1)	12	Cliff drainage scheme (shallow drainage measures, e.g. could comprise machine-excavated catch-drains of nominal 4m depth that intercept shallow groundwater before it reaches the coastline)	£29,331
Seaton Hole (CBU 1)	13	Cliff drainage scheme (deep drainage measures, e.g. could involve drilling vertical boreholes in an array and pumping the water away / gravity drainage)	£143,745
Seaton Hole (CBU 1)	14	Cliff-face stabilisation at (e.g. netting to stop loose material falling to the beach and rock bolts to hold blocks of failed bedrock in place)	£20,946
Seaton Hole / Old Beer Road	16	Upgrade 'old and new' revetment with new rock (e.g. increase height and width)	£2,756,153
Old Beer Road (CBU 2 + 3 + 4)	17	Cliff drainage scheme (shallow drainage measures, e.g. could comprise machine-excavated catch-drains of nominal 4m depth that intercept shallow groundwater before it reaches the coastline)	£86,208
Old Beer Road (CBU 2 + 3 + 4)	18	Cliff drainage scheme (deep drainage measures, e.g. could involve drilling vertical boreholes in an array and pumping the water away / gravity drainage)	£367,125
Old Beer Road (CBU 2 + 3 + 4)	19	Cliff-face stabilisation (e.g. netting to stop loose material falling to the beach and rock bolts to hold blocks of failed bedrock in place)	£62,837
Old Beer Road (CBU 2 + 3 + 4)	20	Piling to limit expansion of the active landslide	£313,660
Seaton Hole to Check House Wall	32	Extend the West Walk Promenade (concrete / stone blockwork seawall) along the length of the cliffs as far as Seaton Hole	£3,924,214
Seaton Hole / Old Beer Road	35	Beach control structures - timber groynes	£4,144,644
Seaton Hole / Old Beer Road	36	Beach control structures - rock groynes	£3,984,873
Seaton	51	Beach control structures - timber groynes	£3,666,416
Seaton	52	Beach control structures - rock groynes	£3,541,108
Axe Estuary (east side)	61	Upgrade existing walls (stone wall 1, sheet pile wall, stone wall 2) (this includes related monitoring, surveys etc and measures to address ALW Corrosion)	£2,637,955

## 4.6 Consultation on Preferred Options

The preferred options were presented for review and comment at two separate consultation events (listed below), and separately with Natural England, Jurassic Coast Trust and East Devon AONB.

- Stakeholder workshop on options – 28<sup>th</sup> November 2017.
- Public Exhibition and Public Consultation – including a public exhibition at Seaton Tesco for one afternoon on the 6<sup>th</sup> December and subsequent public consultation from the Thursday 7<sup>th</sup> December until 2<sup>nd</sup> January. During this time, the exhibition material was available for view via the EDDC website and publicised through press release, the stakeholder group, posters and social

media. During this period over 150 people viewed our website, and to date 20 completed consultation responses have been received and reviewed.

Both stakeholders and the local community were generally in support of the preferred in-combination options. A summary of the results is provided below, with a full analysis presented in Appendix K.

#### 4.6.1 West Seaton

The majority of consultees favoured Option In-Combination 2, which is to upgrade/replace concrete encased revetment, maintain 'old and new' revetment and re-profile by re-packing rock, extend 'new' revetment to Check House Wall (replace former gabion baskets), and upgrade/replace Check House Wall. Only a slightly smaller number of consultees favoured Option In-Combination 3 (as above, but replacing the gabion baskets with a new defence).

Beach recycling received mixed opinions; those that supported this option did so for reasons of minimal visual and environmental impact, whilst those that were not in favour of this option thought that the eastern end would be exposed to risk of erosion and the movement of material would not help as it would be moved back. Some strong views against beach recycling were received often because of the impact on the wide, open bay of control structures.

#### 4.6.2 Seaton and West Bank Axe Estuary

Opinions on beach recycling are also carried forward to this length of coastline from above (see Section 4.6.1).

#### 4.6.3 East Bank Axe Estuary

Consultees were in favour the option to maintain existing walls and address ALW Corrosion along the east bank of the River Axe.

### 4.7 Final Preferred Option

Of the suitable options assessed, the preferred in-combination options for the BMP are outlined as below.

#### 4.7.1 West Seaton

In view of the outcomes of the options appraisal, stakeholder and consultation feedback, and affordability, **the recommended preferred option for West Seaton is In-Combination 2**. Although this option excludes beach recycling, it does not mean that it cannot be considered in the future. However, given the priority to protect the base of the cliffs from erosion and the need to address the current state of the existing defences, available resources should be focussed this way.

With that, this preferred options also comes with the following recommendations and actions:

1. There remains a need to address the risk of cliff erosion from the top-down. A key finding of the BMP is that groundwater saturation of the cliffs is a key driver to cliff erosion at Seaton and for the cliffs to be fully protected this issue needs to be addressed; protecting from marine erosion at the toe alone will not solve the problem. The action is to therefore for EDDC to investigate suitable options for cliff-top drainage (that are agreeable environmentally and affordable), and for EDDC to identify a funding stream for this erosion risk management activity. A study into surface water flows on the cliff-top would also be required in support. Further, due to the unavailability of funds via FCERM-GiA for cliff-top measures, EDDC will need to fund / seek third-party funds (e.g. DCC Highways) to implement this investigation / works.

2. Beach recycling along the Seaton beach could help to address low beach levels, however, there is no evidence and data to suggest that once moved and re-placed, the recycled material would stay in place / achieve the required levels of protection. Given that control structures are in the main not favoured by stakeholders and local residents, are expensive and could potentially cause adverse effects along the coast, it is recommended that beach recycling is only considered in isolation. Therefore, for this option to be taken forward, the action would be for a study to be undertaken to determine the suitability of beach recycling and an assessment of the quantities that could be removed and where from and to.

#### 4.7.2 Seaton And West Bank Axe Estuary

In view of the outcomes of the options appraisal, stakeholder and consultation feedback, and affordability, **the recommended preferred option for Seaton and West Bank Axe Estuary is In-Combination 1.**

Although this option excludes beach recycling, it does not mean that it cannot be considered in the future. However, given the priority to reduce flood risk from overtopping and via the Axe Estuary available resources should be focussed this way.

With that, this preferred options also comes with the following recommendations and actions:

1. Beach recycling along the Seaton beach could help to address low beach levels, however, there is no evidence and data to suggest that once moved and re-placed, the recycled material would stay in place / achieve the required levels of protection.
  - Any beach recycling works should refer to the findings of the Lyme Bay Flood Coastal Flood Forecasting Phase 2 project (CH2M, 2017), also discussed in Section 4.5.
    - The project included a sensitivity assessment to investigate how different beach profile conditions (including emergency profile, i.e. low beach levels, baseline, and increased profile, i.e. higher beach levels), could affect the amount of overtopping occurring under a 1:200 return period event. This assessment included the coastline at Seaton, specifically the slipway at Fishermans Gap, profile 6a01177 (western end of the seawall), profile 6a01169 (central-eastern section of the seawall) and profile 6a01163 (opposite the Axe Yacht Club).
    - The key findings suggest that beach levels lower than the baseline result in an increase in overtopping rates and increasing beach levels (shingle filled to the edge of the promenade with a wider berm than present) returns overtopping rates that are the same as (or a little less) than with the baseline profile.
    - This would suggest that drawing beach material way from the seawall could increase rates of overtopping, whilst increasing the height and width of the beach could reduce rates of overtopping.
  - Given that control structures are in the main not favoured by stakeholders and local residents, are expensive and could potentially cause adverse effects along the coast, it is recommended that beach recycling is only considered in isolation.
  - Therefore, for this option to be taken forward, the action would be for a study to be undertaken to determine the suitability of beach recycling and an assessment of the quantities that could be removed and where from and to.
2. As requested by the Stakeholder Group, any recommendations made by the BMP should consider the existing plans for the 'Seaton Sea Front Enhancement'. The action is when taking forward the option to improve the drainage behind the seawall, it must be done in consultation with the plans for 'Seaton Sea Front Enhancement'.

- The preferred option for the management of flooding via the Axe Estuary is being looked at by Mott Macdonald on behalf of the Environment Agency. The action is to therefore liaise closely with the Environment Agency when developing the business case for this option.

Table 5.1 Summary overtopping discharges for sensitivity assessment using emergency and increased beach profiles at Seaton, Devon (for 1:200 year return period event)

Source: CH2M, 2017

Profile	Mean overtopping discharge at tide peak (l/s/m) (1 in 200 year event)		
	Emergency Profile	Baseline Profile	Increased Profile
Slip Way with Gate	1.72	1.08	0.81
Slip Way with No Gate	5.07	2.87	2.54
6a01177	3.18	1.72	0.97
6a01169	1.63	0.96	0.96 *
6a01163	0.18	0.11	0.07

Note: \* There is no change from the baseline profile.

### 4.7.3 East Bank Axe Estuary

In view of the outcomes of the options appraisal, stakeholder and consultation feedback, and affordability, **the recommended preferred option for the East Bank of Axe Estuary is In-Combination 1.**

With that, this preferred options also comes with the following recommendations and actions:

- The implementation of this option is dependent on outcomes of ongoing monitoring and surveys. The action is to therefore monitor the walls on a regular basis and undertake remedial works as and when required. Appropriate funding should be allocated for this to occur.

# References

CH2M, 2017. *Overtopping Analysis*. Technical Note produced for the Environment Agency as part of the Lyme Bay Coastal Flood Forecasting Phase 2 project.

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Defra, 2011a. Partnership Pays: An introduction to the future funding and management of flood and coastal erosion management projects for Local Authorities and Internal Drainage Boards.

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Appendix A – Coastal Processes  
Baseline Report



# Appendix B – Environmental Baseline Report



# Appendix C – Defence Baseline Report



# Appendix D – Economics Baseline Report



## Appendix E – Issues, Current Management Practices and Actions



Appendix F – Long-List Appraisal Table



Appendix F – Long-List Appraisal Table is provided on the accompanying CD.



Appendix G – Short-List Appraisal  
Table



Appendix G – Short-List Appraisal Table is provided on the accompanying CD.



## Appendix H – Summary of Option Costs and Assumptions



<b>Option 11- Seaton Hole- Replace concrete revetment with a new structure (tie into adjacent rock revetment)</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Excavate mass concrete - Labour cost	m <sup>3</sup>	250	2	2007	7.91	10.04	2,509	SPONs Civil Engineering and Highwar Works Price Book (2007), Class E: EXCAVATION, pg 186
Excavate mass concrete - JCB 3CX/Montalbert 125 breaker cost	per hour	8	2	2007	14.47	18.36	147	SPONs Civil Engineering and Highwar Works Price Book (2007), PLANT COSTS - continued, pg 129
Assumed mobilisation and demobilisation cost	nr	1	2	2017	200.00	200.00	200	Assumed rate based on general delivery and collection rates of plant online
New rock revetment structure	m	50	2	2017	5,576	5,576	278,800	Based on 2017 outline design cost from TVO for rock revetment at East Beach in West Bay.
Rock maintenance	n/a	1	20	2015	43,000	44,634	44,634	£10,000 mob/demob rock gang , £16,500 per week , assumed 2 weeks work every 20 years CH2MHILL 'Stolford FAS options appraisal (2015), contractor priced from outline design drawings and quantity calcs
<b>Option 15- Seaton Hole/Old Beer Road- Maintain 'old and new' revetment and re-profile to as-built design</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Rock maintenance	n/a	1	every 20 years	2015	109,000	113,142	113,142	£10,000 mob/demob rock gang , £16,500 per week , assumed 6 weeks work every 20 years CH2MHILL 'Stolford FAS options appraisal (2015), contractor priced from outline design drawings and quantity calcs
<b>Option 23- The Pillar- Replace gabion baskets with new defences (e.g. a more substantial wall structure)</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Replace gabion basket with new seawall construction	m	8	2	2007	5,400	6,852	54,819	EA database - "SC080039 Cost Estimate for Coastal Protection 2015" (£700-5400) with 2007 base date.
Maintenance of seawall (mobilisation costs accounted for in maintenance of adjacent structure)	m	8	annual	2001	5	7	56	£5000/km year average from Waveney DC, Suffolk DC and Env Agency ' Lowestoft to Thorpeness Coastal Process and Strategy Study, Vol 3 App C: Economics' Sept 2001. It is expected that these costs will be incurred during maintenance of t
<b>Option 24- The Pillar- Extend 'new' revetment at Check House Seawall (replace former gabion baskets)</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Replace gabion basket with extension of adjacent rock revetment	m	8	2	2017	5,576	5,576	44,608	Based on 2017 outline design cost from TVO for rock revetment at East Beach in West Bay.
Maintenance of rock structure (mobilisation costs accounted for in maintenance of adjacent structure)	n/a	1	20	2015	3,300	3,425	3,425	Assumed maintenance occurs at same time as adjacent areas, therefore £10,000 mob/demob rock gang already accounted for. Short length likely to require only 1 day at £16,500 per week. Work every 20 years CH2MHILL 'Stolford FAS options appraisal (2015), contractor priced from outline design drawings and quantity calcs
<b>Option 29- Check House- Upgrade Seawall (e.g. add a thicker concrete layer ) or replace with a new structure</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Raise and modify existing wall	m	65	2	2009	568	681	44,253	"SC080039 Cost Estimate for Coastal Protection 2015, pg 14" - cost of raising a seawall (cost base - 2009)
Maintenance	m	65	annual	2001	5.00	7.00	455	£5000/km year average from Waveney DC, Suffolk DC and Env Agency ' Lowestoft to Thorpeness Coastal Process and Strategy Study, Vol 3 App C: Economics' Sept 2001
<b>Option 33- Seaton Spit, Seaton, Seaton Hole , Old Beer road - Recycle material from east to west towards Seaton Hole to increase beach volume</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Beach recycling (assumed events occur every three years)	m <sup>3</sup>	10,000	3	2009	5.00	5.99	59,931	Volume estimated based on 3,000 to 3,600m3 annual longshore transport rate stated in geomorphology baseline. The unit rate is estimated using the EA Cost Estimation for Coastal Protection Guidance (2015) pg 13 . Unit base 2009.
<b>Option 43- Seaton-Improve drainage behind the seawall to encourage water that has overtopped the defences to flow back to sea</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Drainage/pipework gang (small bore) LABOUR COST	per hour	120	2	2007	62.95	79.88	9,586	SPONs Civil Engineering and Highwar Works Price Book (2007), Class I: PIPEWORK- PIPES, pg 206. Assuming each pipe installation will take upto a week due to the road location and work required to get through the seawall.
Drains/sewer (small bore) PLANT COST	per hour	120	2	2007	36.97	46.91	5,630	SPONs Civil Engineering and Highwar Works Price Book (2007), Class I: PIPEWORK- PIPES, pg 207. Assuming each pipe installation will take upto a week due to the road location and work required to get through the seawall.
3 No. 300mm Concrete pipe (2.5m-3m deep)	m	24	2	2007	36.35	46.13	1,107	SPONs Civil Engineering and Highwar Works Price Book (2007), Class I: PIPEWORK- PIPES, pg 213. Assuming each pipe extends approximately 8m from the road to the beach.
<b>Option 49- Seaton spit, Seaton - Recycle material to increase beach volume (and make wider).</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Beach recycling (assumed events occur every two years)	m <sup>3</sup>	10,000	every 3 years	2009	5.00	5.99	59,931	Volume estimated based on 3,000 to 3,600m3 annual longshore transport rate stated in geomorphology baseline. The unit rate is estimated using the EA Cost Estimation for Coastal Protection Guidance (2015) pg 13 . Unit base 2009.
<b>Option 60- Maintain existing walls (2x stone wall and 1x sheet pile wall). This includes monitoring/surveying to address ALW corrosion.</b>								
Activity/description	Unit	Quantity	Year	Base date	Rate (£)	Uplifted Rate (£)	Sum (£)	Notes
Sheetpile repairs	m	165	2	2012	1,213.43	1,311	216,258	Average unit cost of repairs taken from 'Weymouth harbour sheet pile walls inspection and condition survey'. See 'Weymouth pile cost sheet'.
ALWC surveying	nr	1	5	2017	2,800.00	2,800	2,800	Assumed 30hrs of engineers time at £60/hr plus £1000 expenses for boat access and other costs.
Maintenance of stone walls	m	270	annual	2001	5.00	7	1,891	£5000/km year average from Waveney DC, Suffolk DC and Env Agency ' Lowestoft to Thorpeness Coastal Process and Strategy Study, Vol 3 App C: Economics' Sept 2001



# Appendix I – Cliff Inspection Technical Note



# Appendix J – In-Combination Option Maps



# Appendix K – Public Consultation Responses