

REPORT

Maintenance and Reinforcement of West Itchenor Sea Wall

Client:	West Itchenor Parish Council
Reference:	PC7633-WM-RP-251022-1033
Status:	S2/C01
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Enhancing Society Together

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Executive Summary

This report, prepared for West Itchenor Parish Council, evaluates the current condition of the West Itchenor Sea Wall and explores options for its maintenance and improvement to manage coastal flooding, erosion, and surface water drainage. The sea wall is a critical flood defence protecting critical village infrastructure, residential properties and freshwater and intertidal habitat. Recent inspections and analysis confirm that the wall is generally in fair condition, with localised areas rated poor due to scour, crest variability, and paver displacement. The April 2024 storm event highlighted its vulnerability, causing overtopping and structural damage. Under the current maintenance regime, the residual life of the sea wall is estimated at 5 years, and without intervention, failure is likely, resulting in significant flooding and loss of critical infrastructure.

The existing structure does not meet the Environment Agency's target of a 1-in-20-year standard of protection; its actual performance is closer to a 1-in-1-year event. Sea level rise will further increase overtopping frequency and accelerate deterioration. Failure of the sea wall would lead to extensive flooding of properties and critical assets, including sewer lines, electrical substations, and the only all-tide access road to the village. The North Solent Shoreline Management Plan sets a "Hold the Line" policy for this frontage, requiring maintenance or replacement of defences.

Six strategic options were appraised:

- Option 1: Do Nothing – as a baseline to assess alternative options against;
- Option 2: Do Minimum – involving light-touch maintenance
- Option 3: Do Minimum Plus – involving raising the crest to 3.22mOD to achieve a present-day 1-in-20-year standard.
- Option 4: Sustain the Standard of Protection – maintaining 1-in-20-year standard of protection.
- Option 5: Improve the Standard of Protection – improving to 1-in-200-year standard of protection.
- Option 6: Managed Realignment – involving setting back the line of defence to promote the creating of intertidal habitat.

For Options 4 and 5 both earthworks and crest wall solutions have been considered, and a high-level screening / appraisal of these options has been undertaken, assessing the technical, environment and social pros and cons of each, as well as a high-level cost estimate.

The recommended approach is a staged strategy:

- Stage One involves immediate repairs and crest raising to 3.22mOD.
- Stage Two proposes improving the standard of protection to a 1-in-200-year return period. This is achieved through crest wall construction, or a combination or crest wall and earthworks, to a level of either +4.18mOD (up to year 2075 / +50-years) or +4.49mOD (up to 2100 / +75-years).
- Stage Three would further raise the crest to +4.82mOD by 2125 / +100-years to meet long-term sea level rise projections.

This phased approach balances technical feasibility, environmental considerations, and cost-effectiveness while aligning with SMP policy and maintaining critical village infrastructure and ecological value to the rear of the sea wall.

1 Introduction

1.1 Project Location

Itchenor is a village situated on the Manhood Peninsula in West Sussex, about 4.5 miles southwest of Chichester as shown in Figure 1-1.



Figure 1-1: Site Location

The northern area of the village borders Chichester Harbour. The West Itchenor sea wall, which is the focus of this report, runs approximately 500m from the east side of Itchenor sailing club and is topped by a footpath which at the west end, returns up to Spinney Lane, Figure 1-2.



Figure 1-2: Location of West Itchenor Sea Wall

1.2 Project Background

The West Itchenor sea wall (hereafter referred to as ‘the sea wall’), labelled as ‘New Lipchis Way’ on some maps, is understood to be an earth embankment faced on its seaward side with grouted concrete paving slabs (pavers), with a vegetated rear face, as shown in Figure 1-3. The crest of the embankment is used as a footpath. The sea wall is currently maintained by the Environment Agency.



Figure 1-3: West Itchenor Sea wall (photo taken By Haskoning during a site visit on the 27/10/25).

On the seaward side of the wall is mudflats and saltmarsh of varying height below the Mean High Water (MHW) level of approximately 2.06mODN. On the landward side is a basin, through which flows a rife[1]. This large area (known locally as ‘the lake’) is lower than MHW and benefits from a sluice gate structure, which controls flows from the point where the rife discharges through the sea wall into the Chichester Channel. The presence of the sluice gate allows surface water to attenuate within the lake regardless of tide levels, before discharging when tide levels allow. The lake acts as a crucial holding area for managing surface water drainage, Figure 1-4, and managing the fresh water habitat.

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[1] *A rife is a term from Sussex dialect referring to a small river or stream usually discharging in to the sea. Rifes may have been widened, deepened or straightened to suit local farming of flood risk management practices.*



Figure 1-4: The Lake inundated following heavy rainfall on 29/10/25

Over the centuries, several properties have been built on part of the land behind the sea wall. Whilst much of this area remains a natural freshwater habitat, some of the areas closer to adjoining properties have been turned to lawn and are subject to occasional flooding. These properties rely on both the sea wall and the existence of the low land behind the sea wall for protection and to collect rainwater run off at a level well below the MHW level. Some owners have sought to reduce their flood risk by building up levels on their land, which reduces the potential capacity of the lake, and in turn limits the natural diversity of the ecosystem.

Behind the sea wall also contains critical elements of the village's infrastructure including:

- Gravity and pumped sewer lines.
- Other storm water rifes and drainage ditches.
- Electrical substations.
- Communications and IT cabling and junctions.
- The main and only public road servicing West Itchenor, and only all-tide emergency access to the Chichester branch of the Harbour.

Given the area's reliance on both the sea wall and the existence of the low land behind the wall, a breach or removal of the sea wall would result in the loss of the vital village infrastructure listed above, and the loss of properties through flooding and erosion. This would cause significant disruption to the village and highlights the importance of maintaining flood defences in the area. This point is explored further in Section 2 where the standard of protection and coastal flood and erosion risk is assessed.

West Itchenor Parish Council have assess the economic impacts of this and concluded that if the sea wall fails and is not repaired/raised twelve homes will be lost at a value of £15 million and the infrastructure lost so to enable the northern part of the village to operate and not be abandoned it will be necessary to build a bridge/causeway along Itchenor Road past the pond, in the low lying area beyond the church and into Spinney Lane, reconstruct and relocate the complete sewage system including pumping stations, raise sub stations and electricity cables, raise communication cables and chambers and gas and water mains and chambers. The cost of this would be at least a further £15 million, a total of at least £30 million which would be at least ten times more than the cost of the medium-term solution to 2075 at approximately £3 million. The long-term crest wall solution to 2125 would cost around £1 million at current prices. These options are explored in Section 3.

Further information on the history of the area can be found in Appendix A1 - West Itchenor Sea Wall – Background.

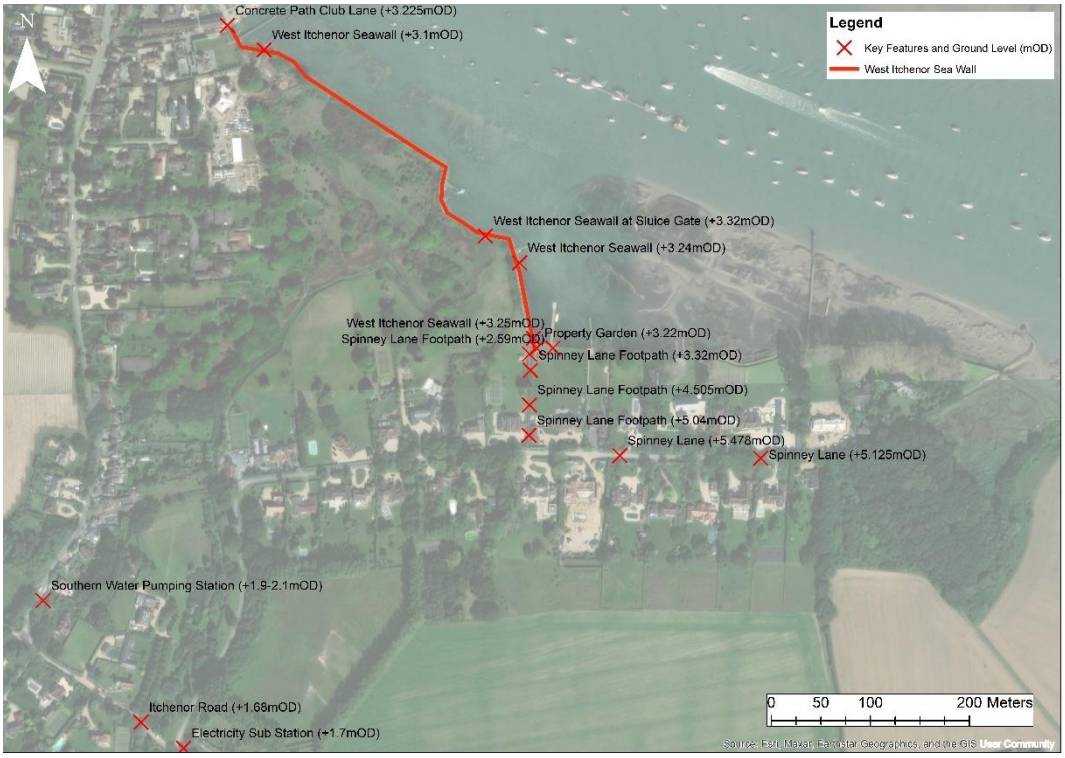


Figure 1-5: Map highlighting important infrastructure currently protected by the sea wall and spot levels.

On the 9th of April 2024, it was reported that Itchenor experienced a high tide of approximately +6.1mCD (+3.36mODN), which resulted in overtopping of the sea wall, with the land behind flooding to a depth of approximately 2m. Several areas of the sea wall were damaged during the event, most commonly by the partial collapse and scour of the rear slope (as shown in Figure 1-6), as well as the loosening of pavers which line the seaward face of the sea wall. There was also considerable erosion to the footpath surface and some localised flooding to the sailing club, residential properties, and Spinney Lane. In addition, the sewage pumping stations shut down, and a combination of sewage and floodwater ran into the low-lying land and some residential properties. Southern Water report that the pumped mains are equipped with overload sensors that progressively shut down the pumps down the line, and so any areas below the flood level are liable to sewage overspill. A high-level overview of surface water management in provided in Section 2.

Since the event on 9th April 2024, the Environment Agency has repointed some of the pavers on the seaward side of the sea wall and, if resources allow, plan to repoint the remaining pavers in the coming months. It is currently unknown if, or when, repairs to the footpath are planned, which should include general maintenance repairs and the raising of the crest level where levels have dropped. As of writing this report, the footpath remains open for public use.



Figure 1-6: Partial collapse and scour of rear slope (photo dated 17/04/25).

Whilst these repairs are welcomed by West Itchenor Parish Council, the risk of further overtopping and failure of the sea wall in the short, medium, and long term still exists. For this reason, West Itchenor Parish Council identified a need to work with a consultant with expertise in the assessment, design, construction, and maintenance of sea walls; an understanding of the relevant regulatory policies; and knowledge of the local area, in particular in terms of seawater flood defence and land and stormwater flood management. On this basis Haskoning have been commissioned to undertake a Technical Options Appraisal for the sea wall.

1.3 Scope of Study

As outlined in the Maintenance and Reinforcement of West Itchenor Sea Wall Terms of Reference for Consultants (refer to Appendix A2 - Maintenance and Reinforcement of West Itchenor Sea Wall Terms of Reference for Consultants), the scope of this study is to:

- Investigate relevant issues relating to coastal flooding, erosion, and surface water drainage.
- Evaluate various options to manage the problems faced, in the short, medium and longer term.
- Prepare a report which will provide the basis for a pre-application meeting with Chichester District Council and other relevant authorities.

The report shall cover the following items:

- Recommend the optimum strategy to ensure and / or increase ecological diversity on the seaward and landward side of the sea wall.
- Identify the least impact logistics plan for working on the sea wall and adjacent areas.
- Seek ‘low carbon’ solutions and cost-effective solutions.
- Determine, possibly through a staged approach to construction, the appropriate balance between the desire for certainty about future effectiveness necessary to ensure asset values, whilst recognising the timescales for predicted sea level rise.

- Consider the critical western and eastern ends of the sea wall, which are complex particularly with regards to maintaining effective land drainage.
- Ensure the effective operation of the present land drainage system for West Itchenor, which currently relies on the below tide level sea wall catchment area.
- Estimate the approximate cost of recommended work programmes.

Included within the scope was a request to address the following questions, which have been discussed and addressed throughout the subsequent sections.

1. To improve the ecology to the seaward side of the sea wall, would it be of benefit to raise the mud level to encourage sea grass, as has been done on an experimental basis to in an area just to the West of Itchenor?
2. To optimise the ecology on the land side of the sea wall, would it be of benefit to install a two-way sluice where a limited flow of sea water would enter this currently fresh water ecosystem? If the above was considered, how would the retention capacity of the below sea level area be retained?
3. In extending the sea wall to a height which complies with long term sea level projections, and bearing in mind the need to optimise logistics, maintain a foot path, and minimise ecological impact, what form of sea wall is preferable?
4. As part of a programme of 'managed retreat' and to increase the amount of sea water marsh, would it work to build a sea wall close to existing residences, and near parts of Itchenor and Spinney Lane, while allowing the existing sea wall to decay.
5. At both ends of the existing sea wall, storm water drainage runs directly out to the harbour at present. What changes are required to storm water drainage? Could these drainage routes be re-routed so that they emptied into the below-tide basin behind the sea wall?
6. If a 100% 'managed retreat' policy was followed, what would the outline cost be for new infrastructure (sewage, water, electricity, data), roads, and what would be the loss in terms of housing? How would that cost compare to the cost of improving the sea wall?

1.4 Structure of Report

The report has been structured in the following way to provide the best logical response to West Itchenor Parish Council's scope.

- Section 2 - Site Characteristics and Baseline Studies: this section provides a summary of background information, data review and baseline studies to help fulfil the scope.
- Section 3 - Options Appraisal: this section provides a summary of options considered and assessed in the context of future management of the sea wall.
- Section 4 - Conclusions & Recommendations: this section provides a summary of options and costs, and provides a recommended way forward.

2 Site Characteristics and Baseline Studies

The following section provides a summary of background information, data review and baseline studies undertaken to help fulfil the Scope of Study.

The section is structured as follows:

- 2.1: Flood and Coastal Erosion Risk Management Context
- 2.2: West Itchenor Sea Wall Condition Assessment
- 2.3: West Itchenor Sea Wall Standard of Protection
- 2.4: Coastal Flood and Erosion Risk
- 2.5: Surface Water Flood Risk
- 2.6: Preliminary Ecological Appraisal

2.1 Flood and Coastal Erosion Risk Management Context

2.1.1 Shoreline Management Plan

Shoreline Management Plans (hereby known as SMPs) help to deliver the ambitions of the National Flood and Coastal Erosion Risk Management Strategy. They set out a planned approach to managing flood and coastal erosion risk around the coast of England to 2105. The SMP covering the sea wall is the North Solent SMP, which extends from Selsey Bill to Hurst Spit, often referred to as SMP13.

Within this SMP, the coastline has been divided into 9 areas based on analysis of coastal processes and the character of the shoreline. The sea wall sits within 'Area 2: Chichester Harbour'. Within this area, the coastline has been divided further into 17 subsection units.

The sea wall sits within 'Unit 5A05L Ella Nore Lane to Fishbourne'[2]. The overall SMP management policy from present day up to 2105 is **'Hold the Line' (maintain / replace)**. Figure 2-1 below highlights the coverage of Unit 5A05L Ella Nore Lane to Fishbourne and the Hold the Line Policy.

The management plan notes the following key points:

- No case for national funding to provide defences but works by landowners to maintain existing structures may be acceptable. Potential creation of intertidal compensatory habitat at Horse Pond in the long term, required to compensate for habitat losses within the harbour.
- The **Hold the Line Policy is applicable** where **protection is currently provided by coastal defence structures** or managed beaches, and the intention is to retain a defence along approximately the current alignment. This will involve **replacing defences when needed**. **Defence type, method** and **standard of protection** may be **modified over time**.

[2] https://environment.data.gov.uk/shoreline-planning/unit/SMP13/5A05

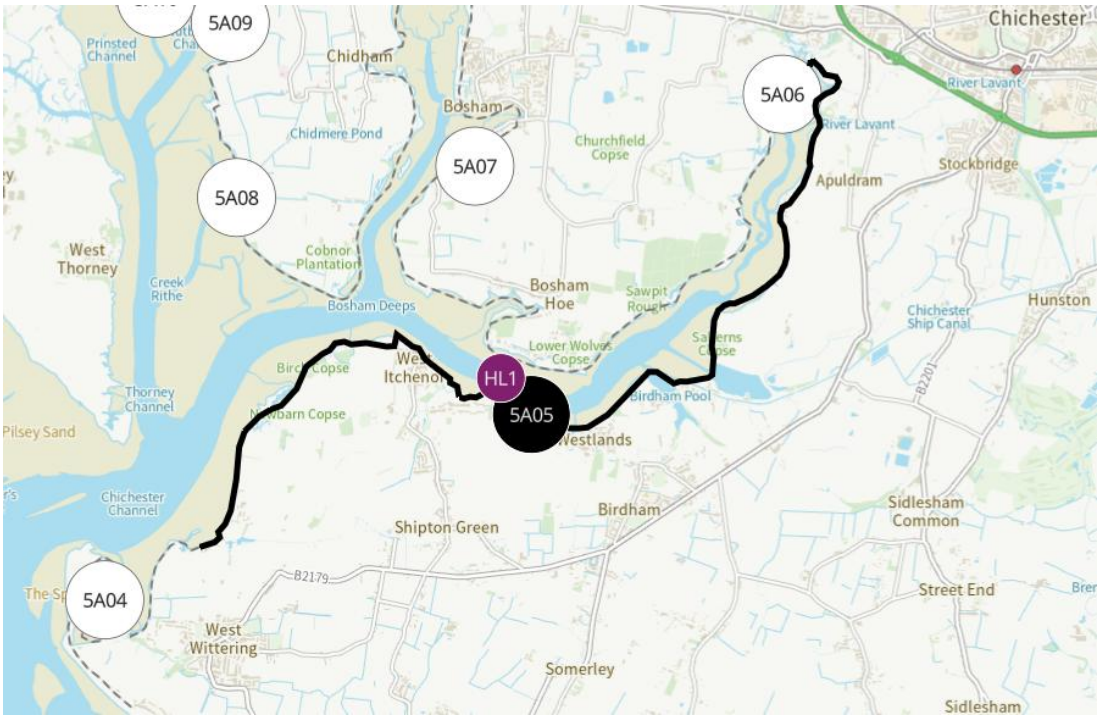


Figure 2-1: Coverage of Unit 5A05L Ella Nore Lane to Fishbourne and the Hold the Line Policy

The SMP summary of rationale behind final policy options highlights that due to the environmental designations within Chichester Harbour, maintenance of defence structures will result in the continued loss of European and national nature conservation designated habitats such as inter-tidal foreshore habitats, through coastal squeeze. These losses will need to be mitigated within the same designated area or compensated for elsewhere.

Whilst the SMP does not recognise the sea wall as a potential area considered for managed realignment, primarily as the site already benefits from a formal flood defence, the site sits on the boundary of designated sites. Therefore, options for managed realignment along this frontage will be considered in this report, as an alternative to the SMP Hold the Line Policy, to present option(s) which mitigate the risk of coastal squeeze on the designated sites.

Following a review of recent planning applications within the Chichester Harbour area, we note that two applications were approved in 2025: one to increase the height of the existing sea wall at Foreshore, Harbour Way, Chidham (Application Number: 21/01896/FUL), and another to renew the existing sea defence wall along the harbour boundary at Sandhead, Rookwood Land, West Wittering (Application Number: 23/00700/FUL).

Both applications concluded, through the Imperative Reasons of Overriding Public Interest (IROPI) process, that there were no viable alternative solutions and that protecting homes serves a significant public interest. At the Shoreline Management Plan (SMP) level, the IROPI case highlights that approximately 51,000 residential and commercial properties are potentially at risk and safeguarded under the policy. The cumulative impact of these measures reinforces the public interest in maintaining effective coastal defences.

2.1.2 Chichester Harbour Management Plan 2024-2025

The Chichester Harbour Management Plan 2024-2025[3] outlines the partnership framework for managing the protected landscape of Chichester Harbour. It sets policies and strategies to conserve and enhance the harbour's natural and historic qualities while managing use, such as recreation and development, in a sustainable way.

Section PP10 'Shoreline Defences' recognises that hard sea defences are often necessary to protect homes and businesses from flooding, they can also contribute to coastal squeeze, impacting natural habitats. The Chichester Harbour Conservancy generally supports proposals that:

- Remove existing permanent hard defences;
- Implement managed realignment, where appropriate;
- Apply **adaptive management strategies**, where suitable;
- Use materials that can naturally degrade (i.e. timber rather than rock or concrete); and

However, in areas with existing defences, the Chichester Harbour Conservancy generally supports proposals that:

- **Replace existing defences**, providing it can be **demonstrated that the defences are still required** and are the most **appropriate solution for the location**.
- Do not have an adverse impact on habitats, species or safety of navigation.

2.1.3 Other Considerations

This section outlines additional contextual and policy-related factors relevant to West Itchenor, including local planning frameworks, key stakeholders, historical and environmental sensitivities, and public access routes.

- West Itchenor Parish Council is a key stakeholder and local-level council for this project. Therefore, the project must consider Chichester District Council's specific local policies that preserve the historical Saxon character and surrounding landscape while ensuring connections with the natural world through interactions along the shoreline.
- Regarding local master plans and planning policy, the area of interest is situated within the district level of Chichester District Council and the county level of West Sussex County Council. A review of The Chichester Local Plan: Key Policies 2021–2039[4] was conducted by Haskoning. The plan includes development management policies, which are designed to provide the vision and framework for future projects within the Chichester area.
- The Environment Agency will be involved in the flood risk management of the proposed scheme given it is responsible for the maintenance of existing assets found along the sea wall. Furthermore, it worked in tandem with West Sussex County Council to produce the West Sussex Local Flood Risk Management Strategy: 2025-2030.[5]
- The New Lipchis Way (Part of the King Charles III Coastal Path) is an approximately 38-mile long distance footpath, running from Liphook in Hampshire to West Wittering in West Sussex. The path runs along the sea wall near its southern terminus of West Wittering. All options should seek to retain the footpath.

[3] CH-Management-Plan-2024-25-Refresh.pdf
[4] Chichester_Local_Plan_2021-2039_-_Adoption_Version.pdf
[5] West Sussex Local Flood Risk Management Strategy

2.2 West Itchenor Sea Wall Condition Assessment

Haskoning undertook a visual condition assessment and grade description of the sea wall in accordance with the Condition Assessment Manual (Environment Agency, 2012). The inspection was undertaken on the 15th July 2025 between 14:00-15:00. Table 2-1 below includes a brief description of the condition grades used in the condition assessment.

Table 2-1: Description of Condition Grades (Environment Agency,2012)

Grade	Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset
3	Fair	Defects that could reduce the performance of the asset
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation needed.
5	Very Poor	Severe defects resulting in complete performance failure.

The visual condition assessment split the length of the sea wall into 20 sections of 25m each, as shown in Figure 2-2, extending from Itchenor sailing club in the west to Spinney Lane in the east.



Figure 2-2: West Itchenor Sea Wall – Chainage

Table 2-2 shows the weighted condition of each 25m section. In general, the sea wall is in fair condition with less than 20% of the sea wall being in poor condition.

The key observations that have led to the scores are as follows:
Established vegetation in the gaps between the paving slabs

- Some movement of paving slabs on the exposed face
- Crest height variability along the sea wall
- Uneven and undesirable vegetation on the landward face of the embankment
- Failed sections to the rear of the sea wall due to overwashing.

Table 2-2: Summary table of the Sea Wall Condition assessment

Chainage (m)	Condition Grade	Chainage (m)	Condition Grade
0-25	3 - Fair	250-275	4 - Poor
25-50	3 - Fair	275-300	4 - Poor
50-75	3 - Fair	300-325	3 - Fair
75-100	3 - Fair	325-350	3 - Fair
100-125	3 - Fair	350-375	3 - Fair
125-150	3 - Fair	375-400	3 - Fair
150-175	3 - Fair	400-425	3 - Fair
175-200	3 - Fair	425-450	4 – Poor
200-225	3 - Fair	450-475	3 - Fair
225-250	3 - Fair	475-500	3 - Fair

A summary of the notable concerns identified during the visual inspection, which prompted a condition rating of 4 (Poor) are summarised in the table below.

Table 2-3: Key issues which prompted a Condition Rating of 4

Key Features	Chainage (m)	Location of Chainages with a Condition Rating of Four
Established Vegetation in gaps between panels on the exposed face of the embankment – indicating this area is more exposed to greater forces via wind and waves.	250 - 275, 275 - 300	
Clear washout and erosion of the crest caused by overtopping.	250 - 275, 275 - 300	
Landward edge being significantly lower than seaward edge.	250 - 275, 275 - 300	
Landward slope being steep with uneven vegetation.	250 - 275, 275 - 300, 425 - 450	
Slumping of the wall.	425 - 450	
Gaps in the grouting between panels on the exposed face of the embankment – indicating this area is more exposed to greater forces via wind and waves.	425 - 450	

The Environment Agency's Asset Management Website[6] was also reviewed, which provides information on the following:

- Asset Type.
- Target Condition the asset should be maintained at.
- Actual Condition of the asset as assessed by the Environment Agency.
- Current Standard of Protection provided by the asset (e.g. 1 in X return period event).
- Effective Crest Level in mOD (defined as the lowest crest level along the coastal defence / sub-section of the defence).

[6] *https://environment.data.gov.uk/asset-management/index.html?element=http%3A%2F%2Fenvironment.data.gov.uk%2Fasset-management%2Fid%2Fasset%2F145336&layer=all-assets*

Table 2-4 summarises the findings from the Asset Management Website. The findings highlight that the last inspection date was in April 2024, which was prior to the 6th of April 2025 storm, and found the condition grade of the sea wall to be predominantly 'Fair' with one section graded 'Good'. In addition, the findings highlight that the sea wall should have a 1 in 20-year return period standard of protection, despite crest levels varying from +2.0mOD to +3.3mOD.

Table 2-4: Summary table of the Environment Agency's Sea Wall Condition Assessment

Asset ID	Asset Type	Actual Condition	Target Condition	Current Standard of Protection (1:X yrs)	Effective Crest Level (mODN)[7]	Last Inspection date[8]	Asset ID Locations
146588	Embankment	Fair	Fair	20	2.15	29/04/2024	
146589	Embankment	Good	Fair	20	2	04/04/2024	
145336	Embankment	Fair	Fair	20	3.3	29/04/2024	
145337	Embankment	Fair	Fair	20	3.3	04/04/2024	
145338	Embankment	Fair	Fair	20	3.15	29/04/2024	
261309	Outfall	Fair	Fair	N/A	N/A	24/04/2025	

Comparing the Environment Agency condition inspection in 2024 to the Haskoning condition assessment in 2025, the condition in three notable areas has dropped to 'Poor' following the April 2025 storm event.

2.3 West Itchenor Sea Wall Standard of Protection

2.3.1 Sea Wall Crest Level Assessment

West Itchenor Parish Council provided a scan copy of an Environment Agency survey titled "Sea Wall Elevation Map" (unknown survey date) which provides crest level data along the sea wall, which broadly supports the effective crest levels listed in Table 2-4. Figure 2-4 shows that crest levels vary between approximately 2.81m and 3.33m *(levels assumed to be relative to Ordnance Datum Newlyn).* The survey shows that the levels beyond the transitions of the defence are lower, 2.64m at the western end and 2.54m at the eastern end respectively. The crest level is more typically around 3.0m along its length with some variability of approximately +/- 100mm.

Note; there is a discrepancy around Assets 146588 and 146589, Table 2-4, where the crest levels from the Environment Agency Asset Management Website are lower than those shown in Figure 2-3. For this reason, levels were also reviewed against the Environment Agency 2024 Point Cloud Data (Defra Survey Data Download), Figure 2-4. The crest level across the full length of West Itchenor Sea Wall ranges between 2.9 and 3.2m, confirming the average crest level of the embankment is approximately 3.0m.

[7] The Effective Crest Level as defined by the EA Asset Management Database is the lowest crest level along a coastal defence. The effective crest levels of Asset 146588 and 146589 are lower than indicated within the EA Survey Plan.
[8] Some of the inspection dates are from before the 6th April 2024 Flood Event and therefore the EA condition rating and effective crest level may not be up to date. There is no more recent data available on the EA Asset Management Database.

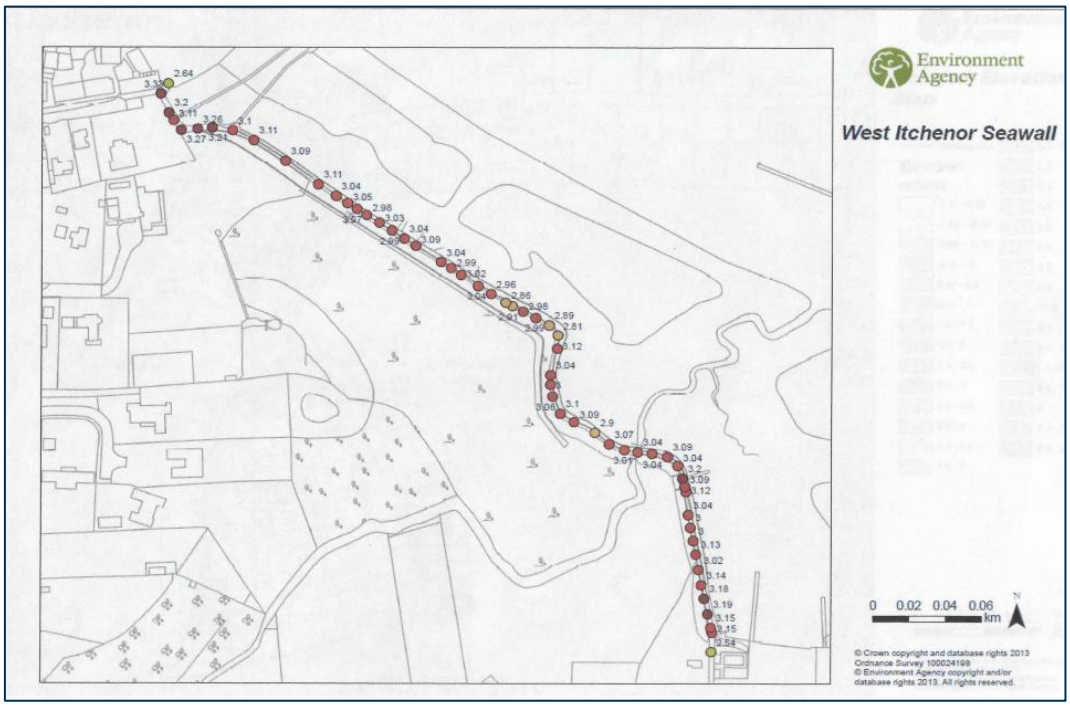


Figure 2-3: West Itchenor Sea Wall Elevation Plan

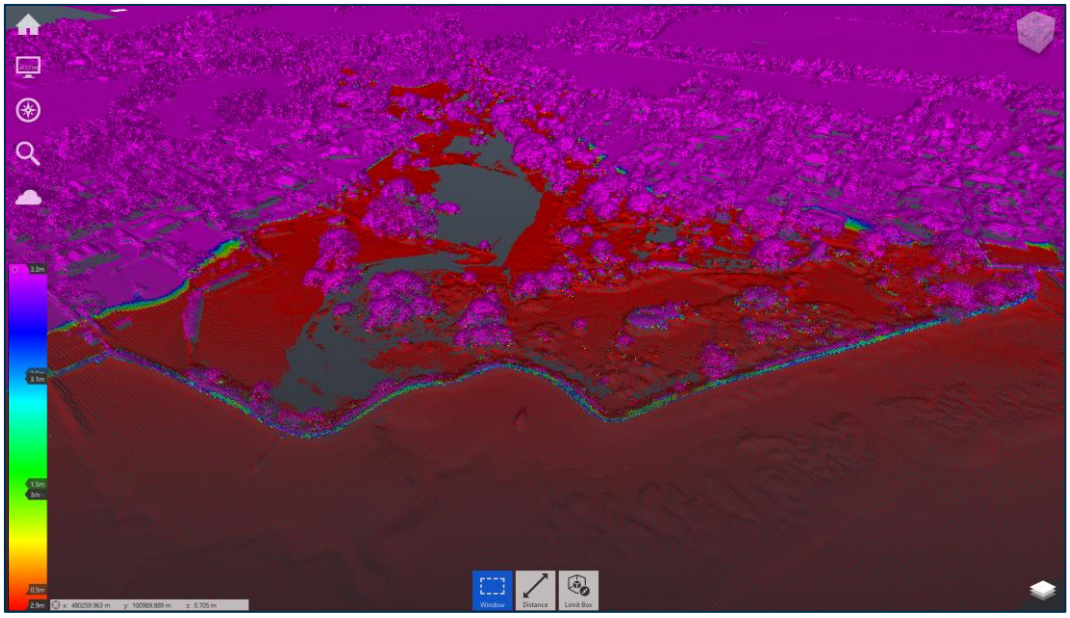


Figure 2-4: Embankment Crest Levels at West Itchenor

2.3.2 Astronomical Tidal Levels

The Admiralty Tide Tables published by the UK Hydrographic Office states the following tidal levels for the nearest Standard Port of Chichester Harbour.

Table 2-5: Present Day Predicted Astronomical Tidal Levels

Location	HAT	MHWS	MHWN	MLWN	MLWS	LAT
Chart Datum [9](mCD)	5.26	4.80	3.90	1.80	0.90	0.21
Ordnance Datum (mODN)	2.52	2.06	1.16	-0.94	-1.84	-2.53

2.3.3 Predicted Extreme Water Levels

Table 2-6 provides predicted extreme water levels for present day (2025) and +25-year increments within Chichester Harbour. A summary of how these water levels have been calculated is provided below the table.

Table 2-6: Predicted extreme water levels within Chichester Harbour (output point 4604_3) – (UKCP18 RCP8.5 70th percentile)

Return Period	Total water level (mOD)				
	2025 (present day)	2050 (+25yrs)	2075 (+50yrs)	2100 (+75yrs)	2125 (+100yr)
T1	2.91	3.09	3.34	3.65	3.98
T5	3.08	3.26	3.51	3.82	4.15
T10	3.15	3.33	3.58	3.89	4.22
T20	3.22	3.40	3.65	3.96	4.29
T50	3.31	3.49	3.74	4.05	4.38
T75	3.35	3.53	3.78	4.09	4.42
T100	3.38	3.56	3.81	4.12	4.45
T200	3.45	3.63	3.88	4.19	4.52
T500	3.55	3.73	3.98	4.29	4.62
T1000	3.62	3.80	4.05	4.36	4.69

- Baseline extreme water levels, dated 2017, are available from the Environment Agency as part of the Coastal Flood Boundary (CFB) datasets. These datasets provide extreme water levels for a range of return period events from a 1 in 1 to a 1 in 10,000-year event and have a base date of 2018. The CFB dataset utilised comes from the Estuaries and Harbour version, specifically output point 4604_3, which is approximately 600m from Itchenor sailing club, Figure 2-5.
- The UK Climate Change Projections 2018 (UKCP18) provides a summary of the latest climate change projections for the UK and includes sea level rise projections under a variety of climate change scenarios up to 2100. The Environment Agency recommends that the RCP8.5 70th percentile projection scenario is considered when calculating sea level rise for coastal defence design. The Environment Agency may however request that sensitivity tests are undertaken using the 95th percentile projections which could add a further 13cm to the water level for year 2075. Water levels for the latter are provided in Appendix A3 - Additional Predicted Extreme Water Levels.

[9] *Chart Datum at the Standard Port of Chichester Harbour is 2.74m below Ordnance Datum (Newlyn)*

- In line with Environment Agency Guidance[10], the baseline extreme water levels provided by the Environment Agency were 'scaled-up' using the UKCP18 sea level rise projections to determine predicted extreme water levels in the future.



Figure 2-5: Location of output points from the Environment Agency Coastal Flood Boundary datasets

2.3.4 Standard of Protection Assessment

Extreme water levels have been compared with a representative cross-section of the sea wall (Figure 2-6 to Figure 2-9 below) to evaluate the current standard of protection and to assess how this may diminish over time due to predicted sea level rise.

[10] *https://www.gov.uk/guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances*

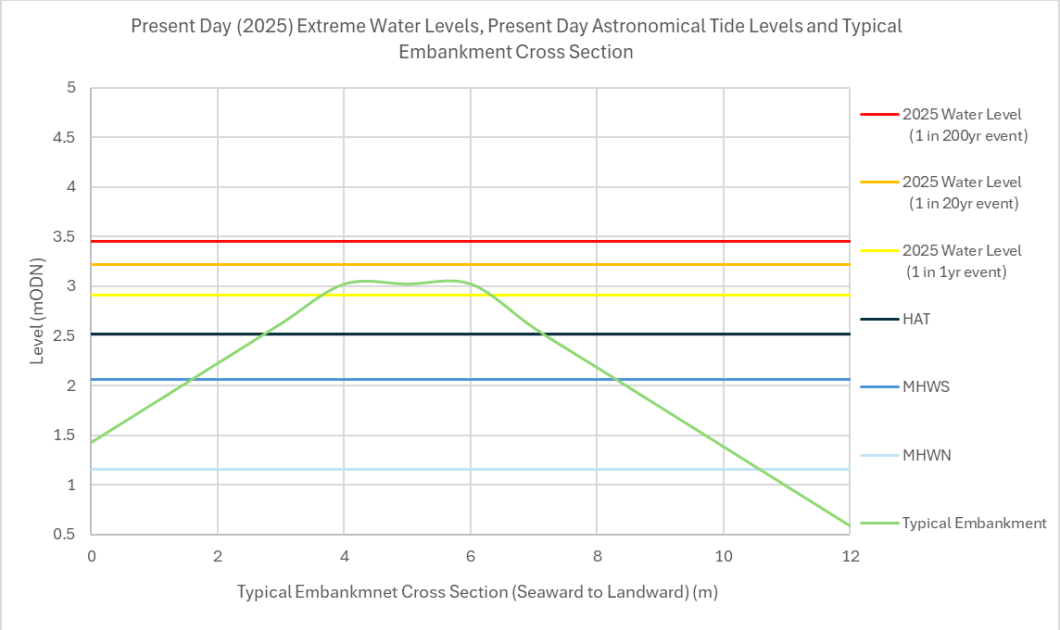


Figure 2-6: Present Day (2025) Extreme Water Levels and Typical Section

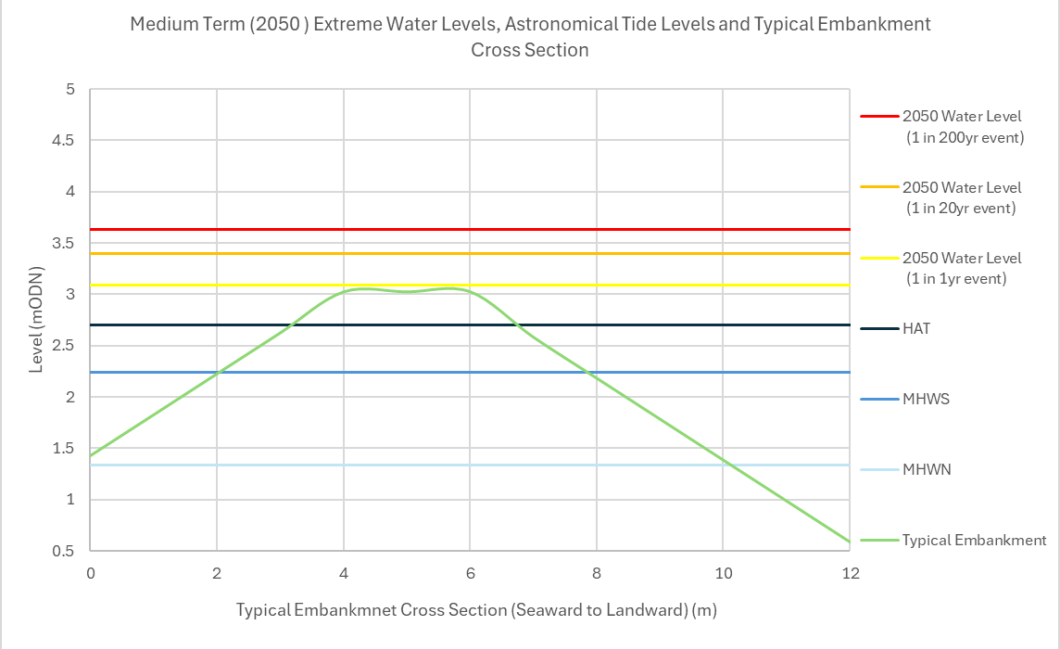


Figure 2-7:Medium Term (2050) Extreme Water Levels and Typical Section

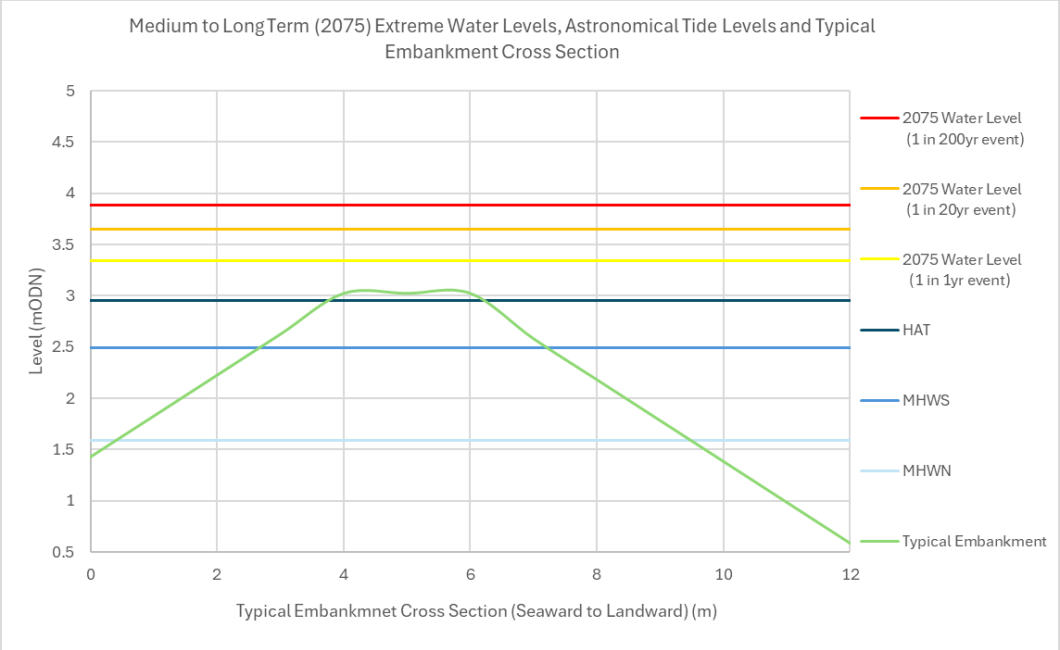


Figure 2-8: Medum to Long Term (2075) Extreme Water Levels and Typical Section

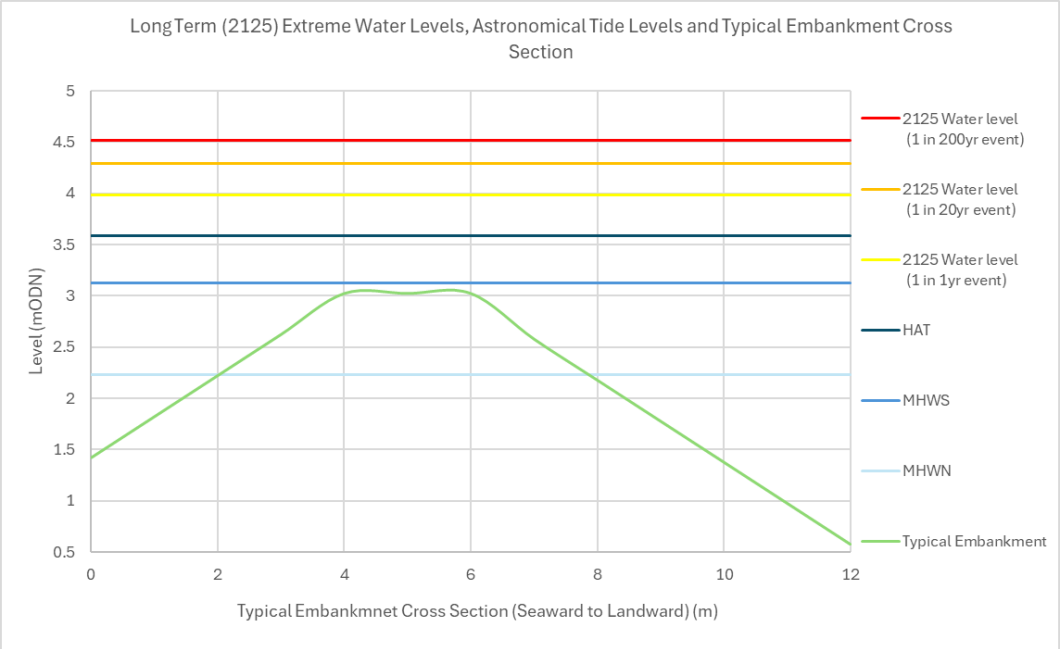


Figure 2-9: Long Term (2125) Extreme Water Levels and Typical Section

The following can be concluded:

- It is clear that the existing sea wall does not meet a present day (2025) 1 in 20-year standard of protection rating as is stated by the Environment Agency Asset Database, Table 2-4. The level and variability of the crest along with the overall condition of the sea wall may in fact make the actual standard of protection closer to 1 in 1-year (considering extreme still water levels only). Refer to Figure 2-10 as a recent example of the sea wall being close to overtopping during Storm Bram (7th December 2025).
- In the medium term (2050) the trend continues, with the sea wall just below the 1 in 1-year extreme water level.

- In the medium-long term (2075) the sea wall is approximately 300mm below the 1 in 1-year extreme water level and the MHWS level is approximately 300mm below the crest level.
- In the long term (2125) the sea wall is well below the 1 in 1-year extreme water level and just below the HMWS level.

It is worth noting that the frequency and severity of overtopping will put further strain on the condition and accelerate the degradation of the defence. Without intervention, the sea wall faces three key risks, namely:

- Risk of age-related deterioration associated with insufficient and infrequent maintenance activities,
- Risk of overtopping during flood events above a 1 in 1-year flood event in the present day,
- Risk of frequent overtopping, possibly on every tide in the medium to long term.

This assessment alone, highlights the immediate importance of maintaining the existing crest level of the sea wall and the need to consider solutions to mitigate against the risk of over washing which will increase in frequency and severity over time.



Figure 2-10: High Tide - 7th December 2025

2.4 Coastal Flood and Erosion Risk

2.4.1 Coastal Flood Risk

In addition to reviewing the standard of protection the sea wall provides from extreme still water levels, the Chichester District Council Strategic Flood Risk Assessment (SFRA)[11], completed at the end of 2023, has been reviewed. The SFRA provides flood extent and depths from wave overtopping and over washing for the following scenarios:

- Present day (2023) 1 in 30-year and 1 in 200-year Defended and Undefended scenarios.
- Long term (2096 and 2121) 1 in 200-year Defended and Undefended scenarios.

Figure 2-11 to Figure 2-12 below provides the Present Day (2023) 1 in 30-year and 1 in 200-year flood extent and depth for the current 'defended scenario', whilst Figure 2-13 provides the Long Term (2121) 1 in 200-year flood extent and depth for the current 'defended scenario'. These demonstrate and confirm the findings from the previous section regarding the low standard of protection provided by the sea wall, and how the seawall provides no protection during this scenario. Figure 2-14 below provides the Long Term (2121) 1 in 200-year flood extent and depth for the 'undefended scenario' representing failure and loss of the sea wall. The flood extent is close to identical to the defended scenario, further highlighting the ineffectiveness of the sea wall in the future as it becomes over washed.

The flood maps also highlight the following:

- During a present-day (2023) 1 in 30-year flood event for the defended scenario, flood mapping indicates that a property at the western end of Spinney Lane and end of Orchard Lane is at risk of flooding, along with several properties along Itchenor Road, as highlighted on Figure 2-11. In addition, access through Spinney Lane and Itchenor Road would be cut off.
- During a present-day (2023) 1 in 200-year flood event, the flood extent is similar immediately behind the sea wall due to topographical constraints, but the flood depth is greater with additional properties along Spinney Lane, Itchenor Road and elsewhere at risk of flooding.
- During the Long Term (2121) 1 in 200-year flood event, the flood extent and depth increase further for both the defended and undefended scenario.

These maps alone highlight the importance of maintaining the Hold the Line Policy, and as a minimum, maintaining the target 1 in 20-year return period standard of protection, not only to protect properties, but to also maintain access to the Village and protect the Village infrastructure as highlighted on Figure 1-5.

[11] https://www.chichester.gov.uk/article/38687/Strategic-flood-risk-assessment-2023

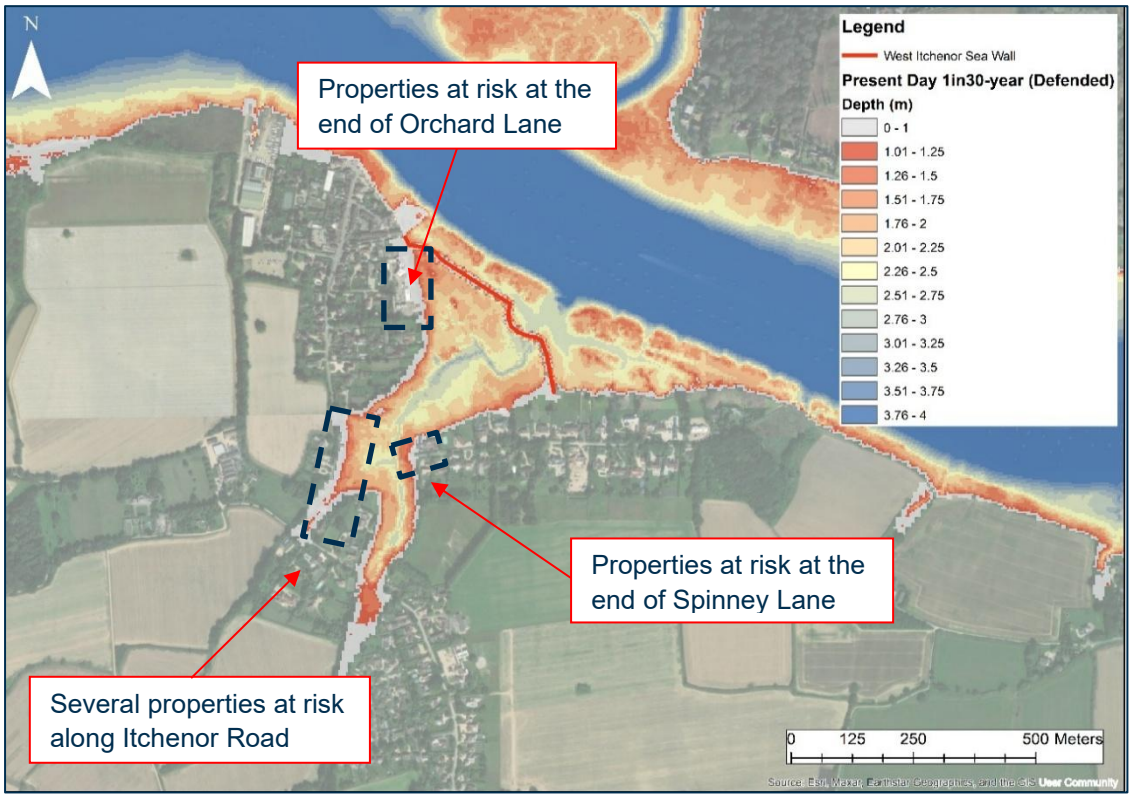


Figure 2-11: Present Day (2023) 1 in 30-year flood extent and depth – Defended Scenario.

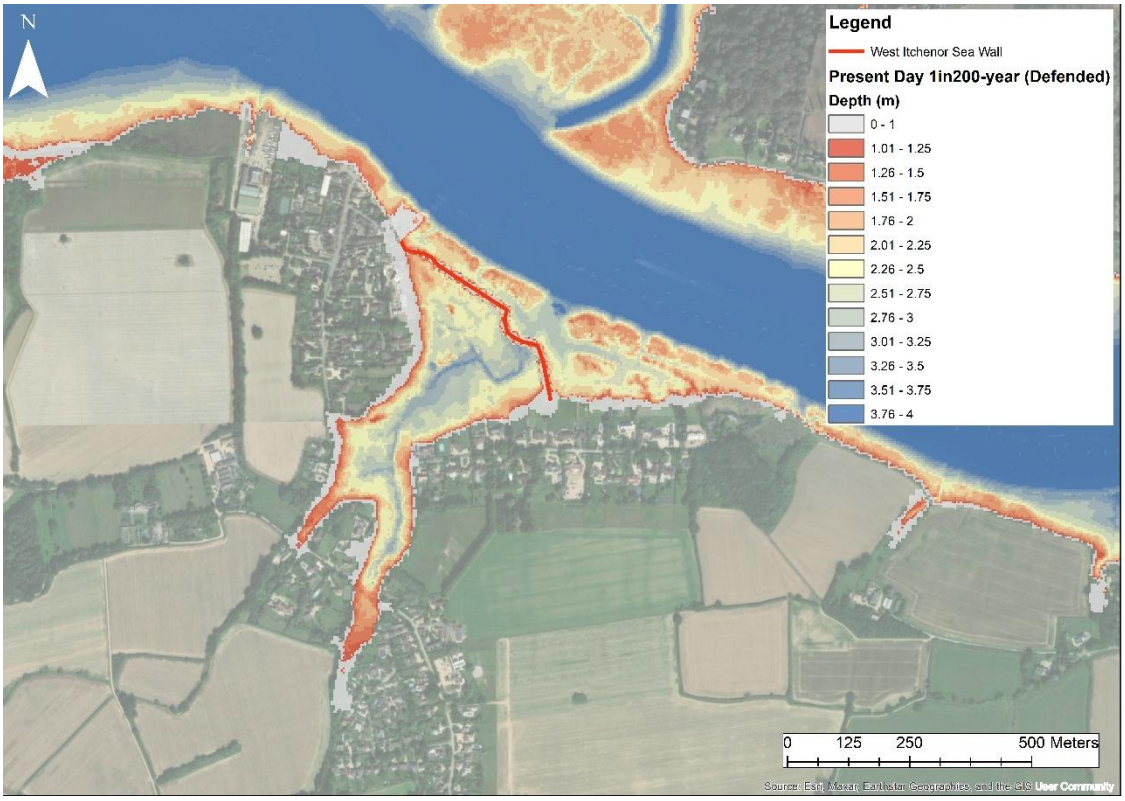


Figure 2-12: Present Day (2023) 1 in 200-year flood extent and depth – Defended Scenario.

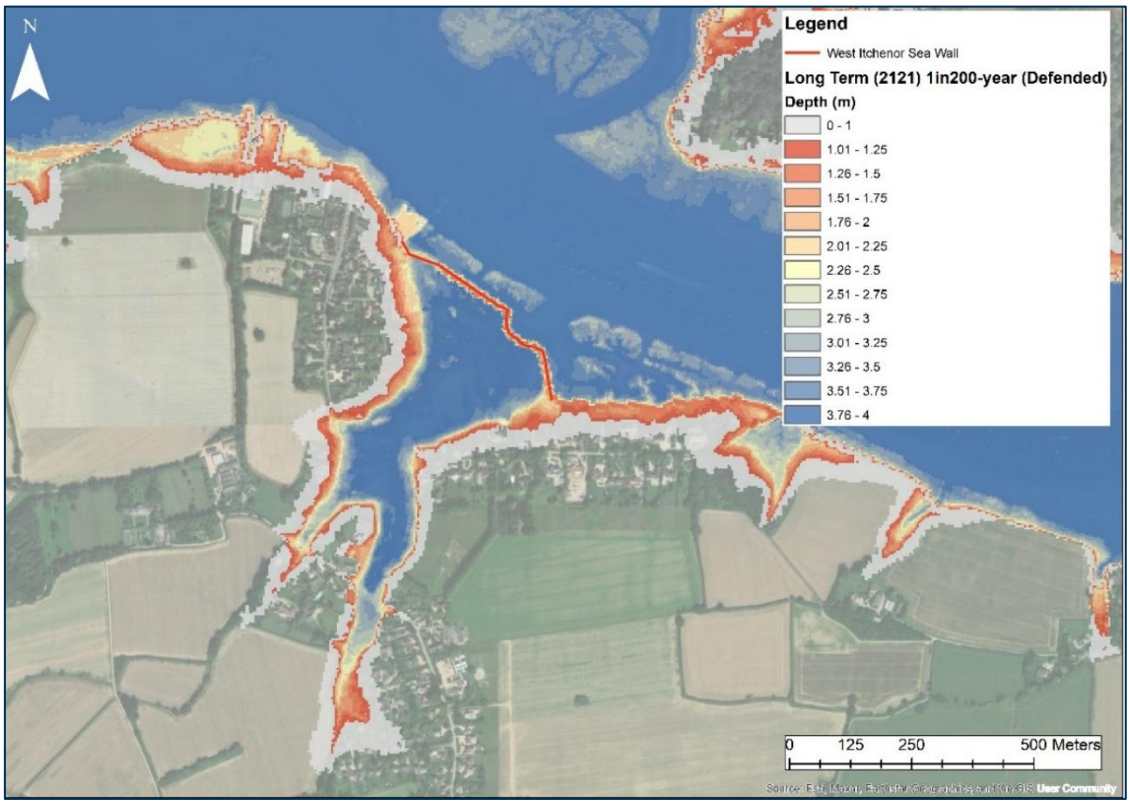


Figure 2-13: Long Term (2121) 1 in 200-year flood extent and depth – Defended Scenario.

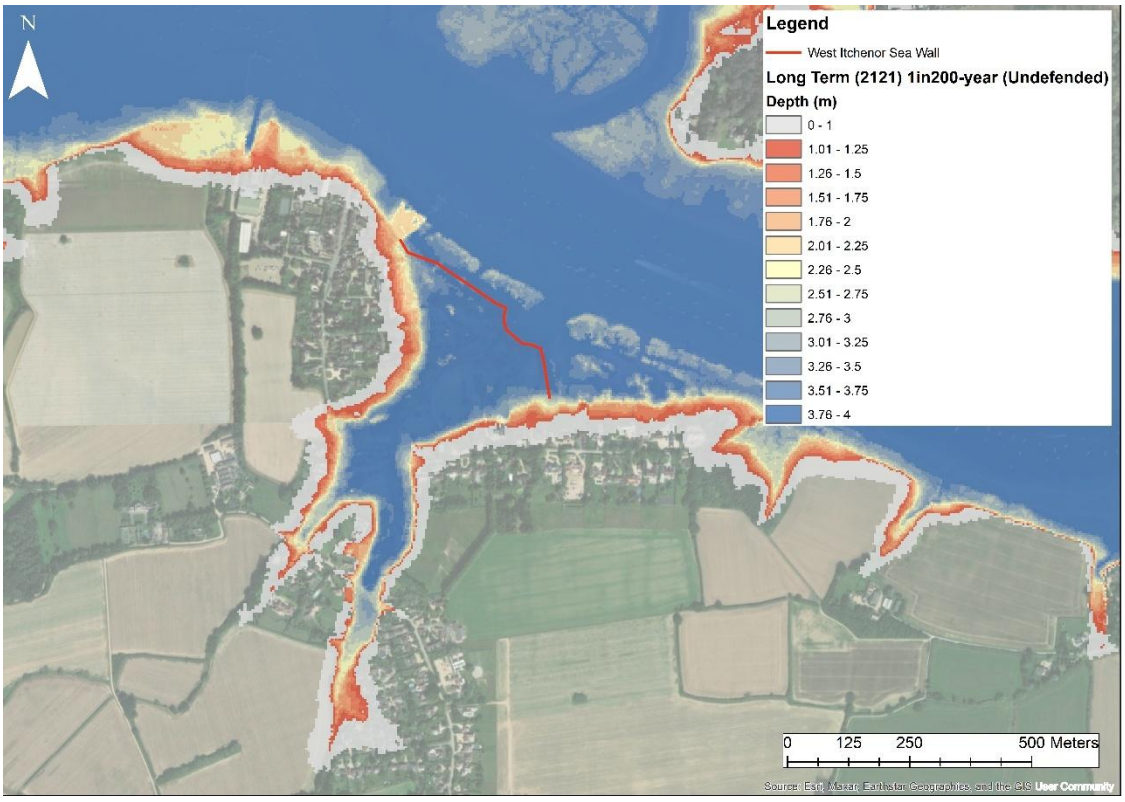


Figure 2-14: Long Term (2121) 1 in 200-year flood extent and depth – Undefended Scenario.

2.4.2 Coastal Erosion Risk

In January 2025, the Environment Agency released an update to the National Coastal Erosion Risk Mapping (NCERM) data. The update uses new data and considers climate change, including sea level rise scenarios, to show current and future erosion risk based on two scenarios; Shoreline Management Plan 'SMP' Policy and No Future Intervention (NFI).

The NCERM data only covers areas not protected by formal flood defences, meaning the section along the sea wall is excluded. However, erosion projections for the adjacent undefended areas are available, offering insight into the potential coastal erosion risk should the sea wall fail or be removed.

Figure 2-15 provides the adjacent NCERM erosion projections under a NFI scenario and shows the land area likely to be at risk of coastal erosion by year 2055 and 2105 under the UKCP18 RCP8.5 70th %-ile sea level rise scenario, as presented in Section 2.4.3.

To the north of the sea wall, near the Itchenor Sailing Club, erosion of approximately 24 metres is projected by 2055, increasing to 46 metres by 2105. To the south, erosion is predicted to reach 7 metres by 2055 and 20 metres by 2105. Given that the sea wall lies between these two areas, it is reasonable to expect that erosion in this central section would fall within the range of these projections. This is indicated by the red line on Figure 2-15. Two properties, Orchard House and Pier Point, are in close proximity to the delineated black dashed line and at risk of damage induced by erosion. All other properties in the surrounding area behind the West Itchenor sea wall, as suggested by Figure 2-14, are not at risk.

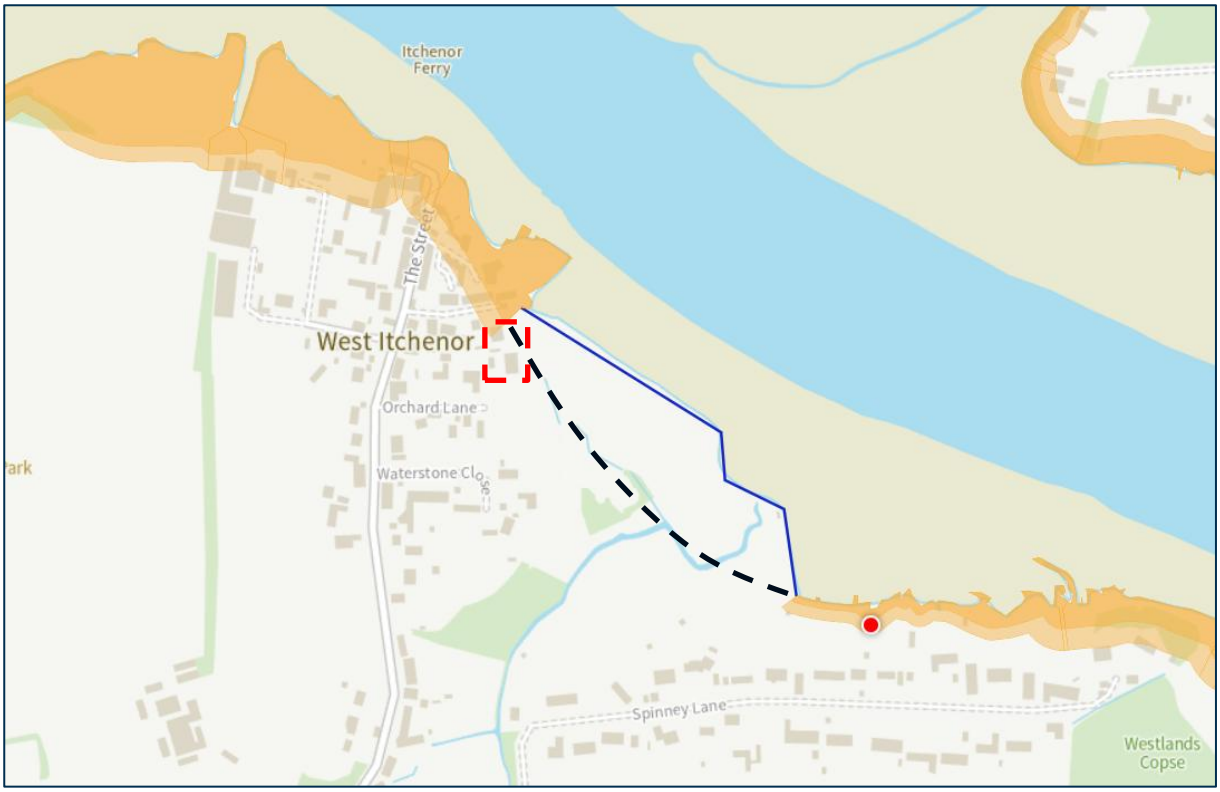


Figure 2-15: Environment Agency NCERM NFI data (2025).

2.5 Surface Water Flood Risk

Surface water flood risk is the danger from heavy rainfall overwhelming drainage systems, causing water to sit or flow over land. The Environment Agency considers West Itchenor generally as 'Very Low' risk (i.e. less than a 0.1% change of a flood each year) of annual surface water flooding up to year 2060. However, locally the surface water flood map provided by the Environment Agency, see Figure 2-16 below, shows areas at risk from surface water flooding, which includes an area adjacent to Itchenor Sailing Club and areas within 'The Lake'.



Figure 2-16:Surface Water Flood Map – Yearly chance of flooding (Left: year 2025 & Right: year 2040-2060)

Figure 2-17 shows the foul and surface water drainage assets at West Itchenor, which comprises of a gravity and pumped system. As mentioned previously, a significant amount of surface water runs into 'The Lake' where water is attenuated before discharging when tide levels allow. A localised area of concern is The Street and Club Lane by Itchenor Sailing Club. The surface run off from the Street into Club Lane includes a large volume of surface water running east from the Conservancy car park down the access road into the Street. In recent storms the Club Lane ditch has overflowed into Chandlers Reach. At the end of the Club Lane at Low Water it discharges into the harbour. At High Water it floods into Itchenor Sailing Club. Therefore, in addition to managing issues in relation to coastal flooding and erosion, surface water drainage down Club Lane is in need of additional capacity and some redirection at times of high water. A suggested option for this is discussed in Section 3.1.4. Note: the drawing in Figure 2-17 is also provided in Appendix A4 – West Itchenor Drains.

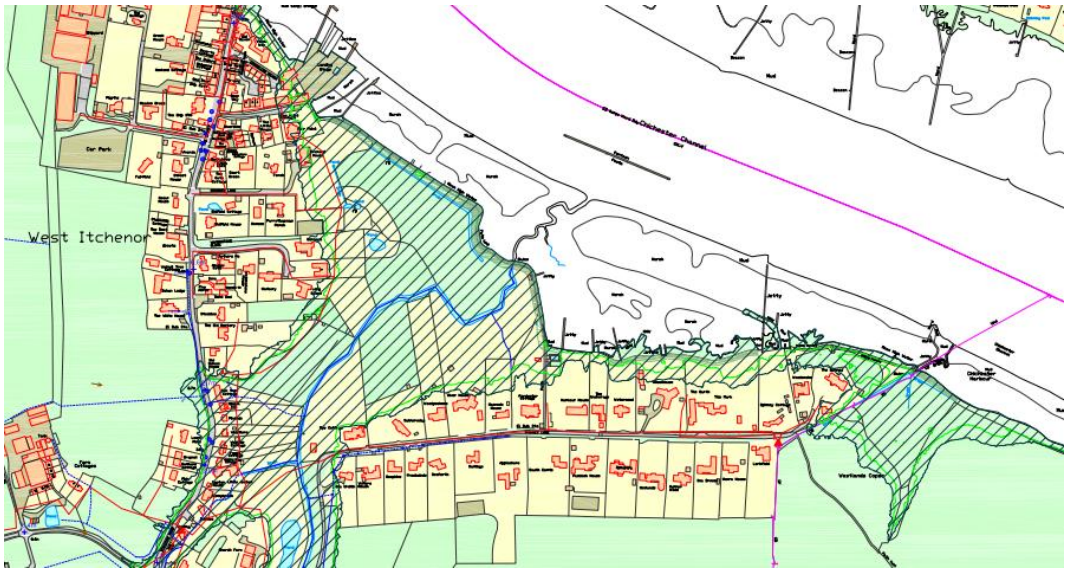


Figure 2-17: West Itchenor Surface Water Drainage Assets

Figure contains ordnance survey data, Crown Copyright 2016. OS Licence No. 100050851

2.6 Preliminary Ecological Appraisal (PEA) Report

A desk-based Preliminary Ecological Appraisal Report (PEA) has been prepared which focuses on the terrestrial ecological content of the land around the sea wall. This report can be found within Appendix A5: Preliminary Ecological Appraisal Report. The report covers relevant legislation and policy, overview of the designated statutory sites and habitats, protected and notable species, and conclusions and recommendations.

Notable recommendations when considering options are to start with options that avoid impacts to ecological receptors, following by mitigation, compensation and enhancement.

3 Options Appraisal

3.1 Introduction

A review of potential options has been considered and assessed in the context of the future management of the sea wall, managing surface water drainage and the questions outlined in the Terms of Reference for Consultants. A high-level screening / appraisal of these options has been undertaken, assessing the technical, environment and social pros and cons of each, as well as a high-level cost estimate, informed by the site findings discussed in Section 2.

The following options are discussed in detail in the subsequent sub-sections. All options, with the exception of Option 6, are based on maintaining the existing alignment of the West Itchenor sea wall.

- 3.3: Option 1: Do Nothing (baseline scenario).
- 3.4: Option 2: Do Minimum.
- 3.5: Option 3: Do Minimum 'Plus'.
- 3.6: Option 4: Sustain the Standard of Protection – with sub-options 4a, 4b and 4c.
- 3.7: Option 5: Improve the Standard of Protection. – with sub-options 5a, 5b and 5c.
- 3.8: Option 6: Managed Realignment with sub-options 6a and 6b.

For all options except Option 1: Do Nothing (baseline scenario), several overarching factors have been considered, including freeboard allowances, construction feasibility, cost estimates (where possible) and management of surface water along Club Lane. These considerations are detailed below.

3.1.1 Freeboard

In addition to setting the design water level for an event, a further allowance for residual uncertainty is included in setting a design crest level, often referred to as freeboard. Freeboard calculations consider aspects such as settlement of the structure over time, wave surcharge allowance and uncertainty allowance (i.e., uncertainty on water level predictions).

A summary of the approach to account for this residual uncertainty is set out in 'Accounting for residual uncertainty: updating the freeboard guide (Environment Agency, 2017)'. Within this guide a range of freeboard values are provided ranging from 300 to 900mm depending on uncertainty factors such as availability and quality of data available to inform decision making.

To simplify the appraisal process and due to the high quality of data available at this stage and benign wave environment, a 300mm freeboard allowance has been added to all options.

3.1.2 Construction Feasibility

An initial review on the buildability of each option has been undertaken, informed by discussions between West Itchenor Parish Council and property owners to ascertain acceptable access / haul routes for plant, areas to temporarily store material and the potential for barge access. Initial plans, as shown on Figure 3-1, are as follows:

- Two locations where large vehicles could enter from Itchenor Road or The Street.
- A temporary haul route running mostly alongside the west bank of the rife. This could require some temporary bridges to cross the rife.

- Secondary access route for smaller plant and material transportation. This includes utilisation of the footpath on top of the sea wall and, depending on the option being constructed, a route to the rear of the sea wall.
- Two material holding areas.
- Option of barge access at certain Chichester Harbour Conservancy approved times of the year.

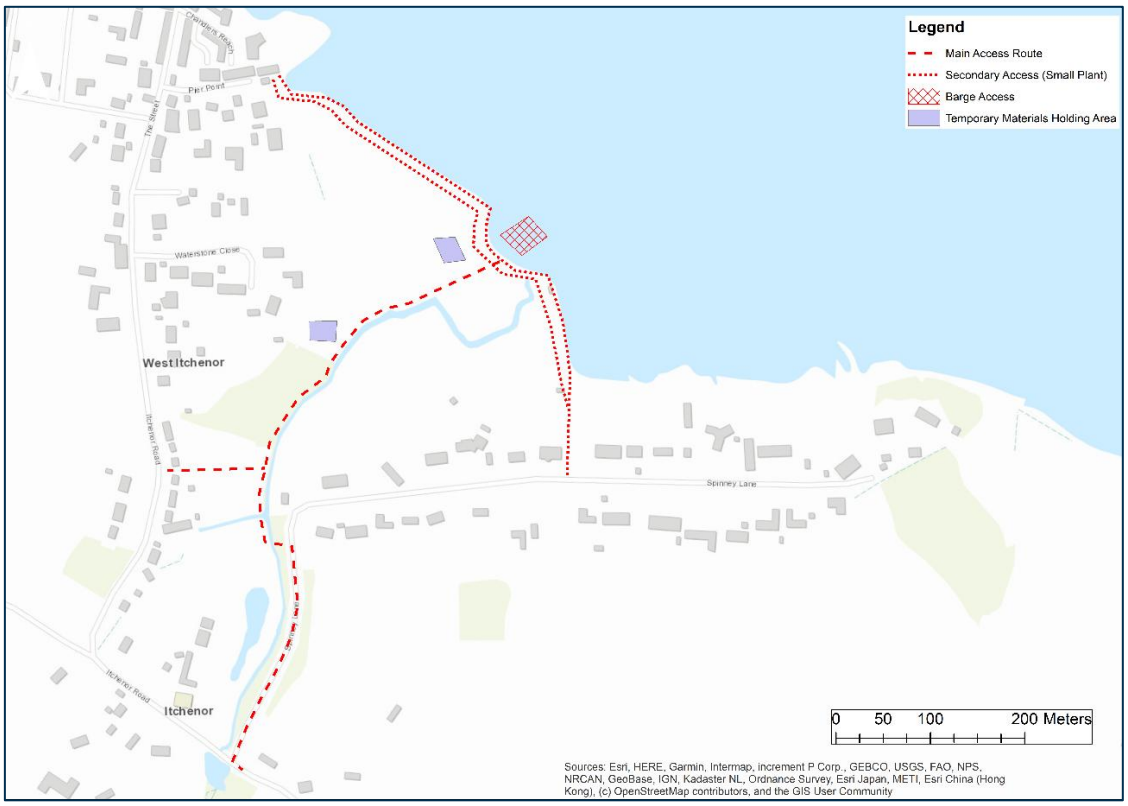


Figure 3-1: Indicative Construction Logistics Plan

3.1.3 Cost Estimation

High level cost estimates have been developed to inform the viability of delivering Options 2, 3, 4, 5 and 6.The cost estimates have been rounded to the nearest £100k, which is in keeping with projects of this scale at an early stage of development. Costs have been based on the SPONS Unit Cost Database and benchmarked against Haskoning's experience of delivering other similar schemes within the region.

The following items have been used as the basis for the high-level cost estimates

- Preparation work, which includes removal/demolition/temporary work/tidal working etc.
- Contractors General & Preliminaries – 15%
- Contractors Overheads and Profit – 15%
- Design Costs and Investigations – 15%
- Contract Admin & Supervision – 15%
- Planning, Licensing and Consents – 15%
- Council Staff Costs – 10%
- Compensation (Land) – 10% (5% for option 4c and 5c due to smaller footprint).
- Compensation (Ecological Enhancements) – 1%
- Contingency – 60%*

*In Environment Agency and broader UK Government appraisal guidance, a starting figure of 60% is used for contingency at a strategy or pre-feasibility stage of a flood and coastal erosion risk management project. This is an uplift applied to the estimates total present value costs to provide a robust cost estimate.

3.1.4 Surface Water Management

As noted previously, in recent storms the Club Lane surface water management ditch has overflowed into Chandlers Reach. At the end of the Club Lane at low water it discharges into the harbour and at high water it floods into Itchenor Sailing Club. An option to manage this is to widen and deepen the surface water ditch in Club Lane and to engage a discharge with back flap at low water under the sea wall. At times of high water we propose to redirect the water beneath the landward side of the wall through a new pipe within the base of the sea wall running east through Pierpoint and Orchard House into the marsh via a new outlet into the repositioned ditch running into the rife. The water can then collect within the marsh until discharged through the sluice at low water. An indicative plan is shown in Figure 3-2.

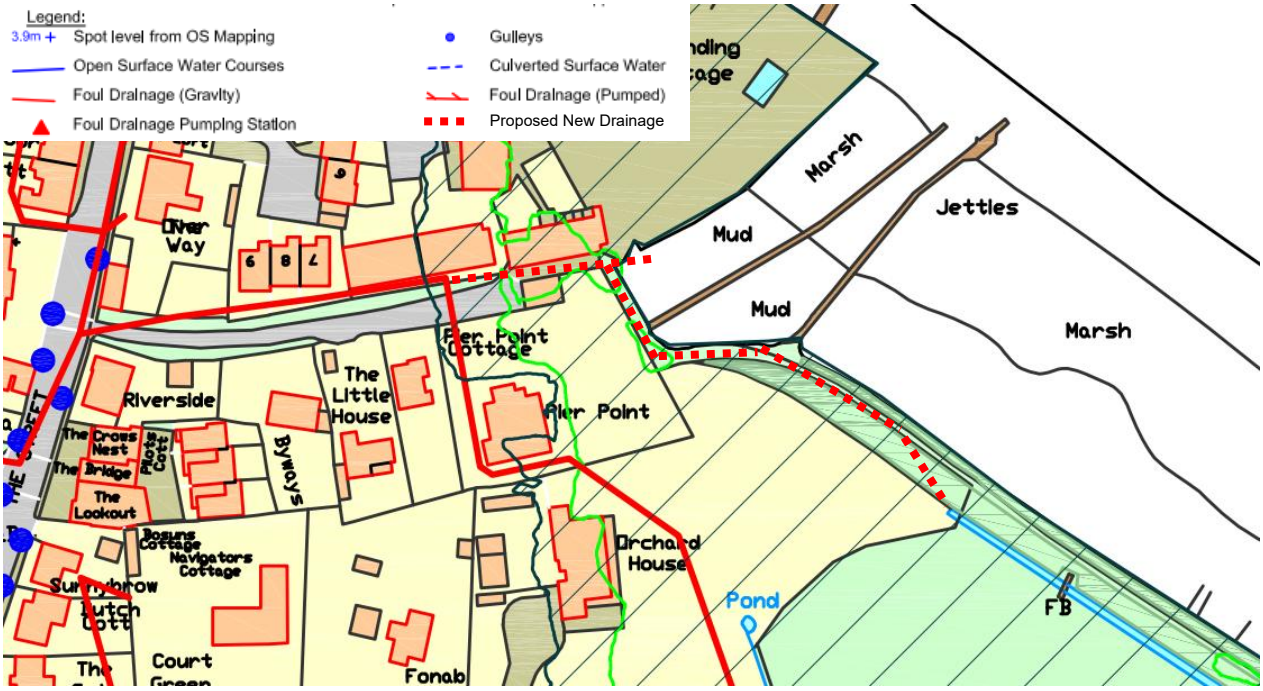


Figure 3-2: Indicative Plan for Surface Water Management Improvements

3.2 Option 1: Do Nothing (baseline scenario)

The Do-Nothing scenario is a 'walkaway' option. Under this scenario all maintenance activities cease. The sea wall would degrade in condition and overtopping incidents would increase in frequency due to the failing condition of the defence and exacerbated over time by sea level rise. Without maintenance the seaward face would continue to degrade, and the concrete pavers would come loose. The crest of the embankment would continue to be eroded and ultimately the sea wall would breach at one or multiple locations, most likely during a surge event. Based on findings, it is anticipated that under the Do-Nothing scenario the sea wall would have a residual life of approximately 5-years before a failure / breach through the wall occurs.

Figure 3-3 created using flood extents from the 2023 Chichester District Council SFRA, shows the predicted flood extent and depth for a 1 in 200-year return period event for the 'Undefended' scenario for year 2023 and 2123, which represents a failure of the sea wall. This figure clearly shows the benefit of the sea wall

and how several properties, the lake and critical infrastructure, as highlighted in Figure 1-5, would become inundated as early as a present-day extreme event.

The Do-Nothing scenario is not considered to be a viable option as it does not deliver on the SMP Policy of Hold the Line and would lead to the significant flooding and erosion risk as discussed in Section 2.4.

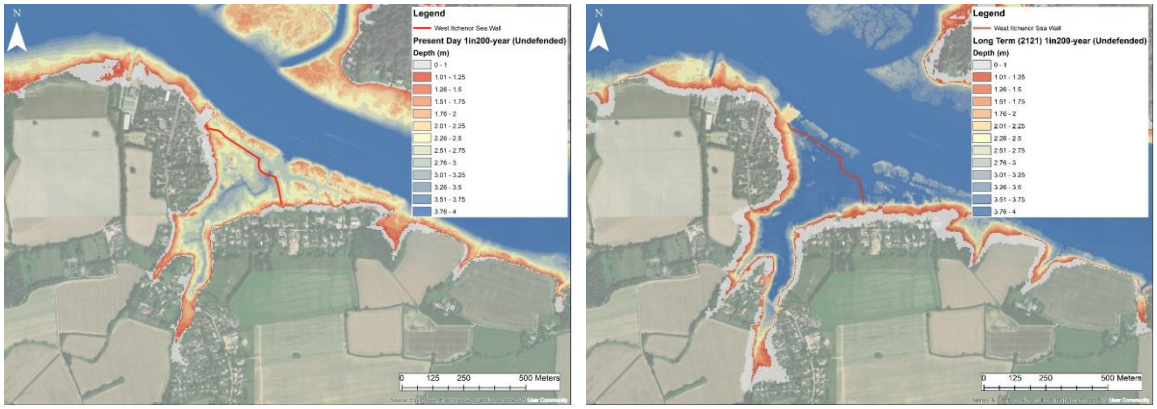


Figure 3-3: Left: Present Day (2023) 1 in 200-year flood extent and depth – Undefended Scenario & Right: Long Term (2121) 1 in 200-year flood extent and depth – Undefended Scenario.

3.3 Option 2: Do Minimum

The Do Minimum scenario would see a continuation of the status quo, with the sea wall being maintained in a 'light touch manner' over time by the repair and replacement of the pavers, bringing the crest level of the footpath to approximately 3.0mOD (being the existing average level) to ensure a consistent but lower than standard level over the full length of the sea wall and repairing any scour to the landward side. This would help to prevent against an uncontrolled breach / failure of the sea wall. The Environment Agency has already started repairing pavers and this maintenance regime should conclude with the remainder of the pavers being repaired, as well as repairs to the scour areas on the rear slope.

Table 3-1: High level appraisal of Option 2: Do Minimum

Criteria	Positives	Negatives
Technical	✓ Improves the integrity of the sea wall and standard of protection provided for a short period of time. ✓ Surface water management can remain as per the status quo, at least for the short-term and potentially wouldn't be worsened if/when the sea wall fails.	× Maintaining a crest level of +3.0mOD would keep the standard of protection below the Environment Agency's target of a 1 in 20-year. × Overtopping incidents are expected to become more frequent and severe over time, particularly with projected sea level rise (see Section 2.3). This increased overtopping would accelerate the deterioration of the sea wall structure and increase the annual maintenance requirements. The present day and future coastal flood risk, as described in Section 2.5.1, would remain. × The current maintenance budgets and resource available is already insufficient, and therefore maintenance will become more challenging over time. As such, the residual life of the Sea wall under this option is estimated to be up to 10-15 years. Note: the residual life will significantly reduce if the scour to the rear of the sea wall is not repaired.

		× Over time, additional scour prevention measures to the rear of the sea wall are likely to be required to managed to increase frequency of overtopping. × Option does not align with the SMP Policy of 'Hold the Line' beyond the short term due to the likely failure with limited maintenance.
Environment	✓ Preventing failure of the sea wall in the short term will help protect 'the Lake' and the freshwater habitat within. ✓ In the longer term, following eventual failure of the sea wall, this option reduces the risk of coastal squeeze and pressure on mudflats and saltmarsh habitat. *It is important to note that ground levels behind the sea wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.* ✓ Low carbon	× Eventual failure of the sea wall will result in the loss of 'The Lake' and the freshwater habitat within via tidal inundation and erosion.
Social	✓ Maintaining the sea wall will maintain the footpath and reduce the risk to people, properties and infrastructure in the short-term. ✓ Low visual impact	× Greater frequency of overtopping of the sea wall and ultimate loss of footpath following failure of the sea wall. Properties and other assets remain at risk of tidal flooding.
Economic	✓ Low cost ✓ Funded by the Environment Agency	× No control over timescales.
	The exact length of sea wall repair undertaken by the Environment Agency is unknown, however based on condition assessment, a length of 75m is considered to be in poor condition. To grout pavers over a 75m length, as well as repair 200m (50%) of the footpath, the cost will be approximately £20-30k.	

Given the reasons outlined above, it is not considered a viable medium to long-term solution. However, it may be appropriate as a short-term measure if its implementation is intended to 'buy time' while a more sustainable or adaptive long-term solution is developed.

3.4 Option 3: Do Minimum 'Plus'

The Do Minimum "plus" scenario would see a continuation of the status quo. The existing maintenance regime would be maintained. However, the sea wall would initially be brought up to the Environment Agency's target of a 1 in 20-year standard of protection with no freeboard allowance. This would be delivered through a one-off capital maintenance scheme to ensure the sea wall had a consistent crest level of at least 3.22mOD. Delivering a minimum present day 1 in 20-year standard of protection, refer to Figure 3-4, without increasing the overall footprint of the sea wall itself. Following the capital maintenance works, the existing maintenance regime would resume as described above for Option 2, but across the entire length of the West Itchenor sea wall.

Table 3-2: High level appraisal of Option 3: Do Minimum Plus

Criteria	Positives	Negatives
Technical	✓ As the crest level of the wall has been improved, the risk of damage and scour to the rear will reduce and the residual life could be anticipated to be in the order of 20-years, providing maintenance continued. ✓ Surface water management can remain as per the status quo, at least for the short-term and potentially wouldn't be worsened if/when the sea wall fails.	× Under this scenario the sea wall would still be at risk of overtopping, increasing in line with projected sea level rise (i.e. the standard of protection would reduce over time). The present day and future coastal flood risk, as described in Section 2.5.1, would still remain. In addition, the greater frequency of overtopping will reduce the capacity of The Lake to store surface water run-off. × The current maintenance budgets and resource available is already insufficient, and therefore maintenance will become more challenging over time. As such, the residual life of the sea wall under this option is estimated to be 10-15-years, similar to Option 2 above. Note: the residual life will significantly reduce if the scour to the rear of the sea wall is not repaired. × Over time, scour prevention measures to the rear of the sea wall are likely to be required to managed to increase frequency of overtopping. × Option does not align with the long term SMP Policy of 'Hold the Line' due to the likely failure with limited maintenance.
Environment	✓ Preventing failure of the sea wall in the short term will help protect 'the Lake' and the freshwater habitat within. ✓ In the longer term, following eventual failure of the sea wall, this option reduces the risk of coastal squeeze and pressure on mudflats and saltmarsh habitat. *It is important to note that ground levels behind the sea wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.* ✓ Low carbon	× Eventual failure of the sea wall will result in the loss of 'The Lake' and the freshwater habitat within via tidal inundation and erosion.
Social	✓ Preventing failure of the sea wall will maintain the footpath and reduce the risk to people, properties and infrastructure up to a present day 1 in 20-year event, but only for 10-15-years. ✓ Low visual impact	× Greater frequency of overtopping of the sea wall and ultimate loss of footpath following failure of the sea wall. Properties and other assets remain at risk of tidal flooding.
Economic	✓ Low-medium cost ✓ Funded by the Environment Agency	× No control over timescales.
	To grout pavers and upgrade footpath along 400m length, and repair the rear slope along 75m length, the cost will be approximately £160-200k.	

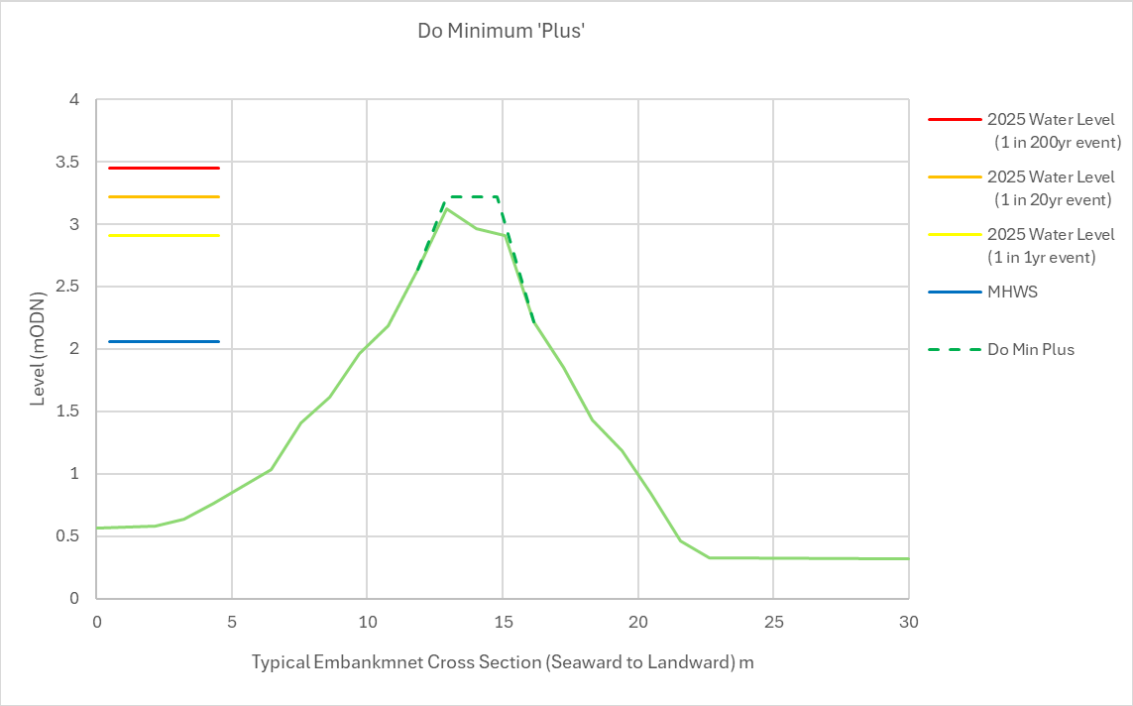


Figure 3-4: Do Minimum Plus Sketch

In isolation, the Do Minimum “plus“ scenario is not considered to be a viable option as it does not deliver on the SMP Policy of Hold the Line beyond the short to medium term. The Do Minimum “plus” option may be considered a viable option in the short to medium term if it is implemented to create time for a long term or more adaptive solution to be developed.

3.5 Option 4: Sustain the Standard of Protection

The 'Sustain the Standard of Protection' option would see the existing standard of protection (taken as the Environment Agency's recommended 1 in 20-year standard of protection) sustained into the future i.e. accounting for sea level rise. Several options could be considered which would see the defence level of the sea wall raised to maintain a 1 in 20-year standard of protection. This option can be constructed as a single full raising (i.e. up to a +100-years water level) or in stages (i.e. initially up to a +25-years water level and then gradually increasing the crest height over time).

Under this scenario the sea wall would still be at risk of overtopping in greater than 1 in 20-year events, however the risks associated with increased overtopping due to sea level rise would be mitigated for the lower return periods. The seaward side of the sea wall would require continued maintenance (i.e. grouting and replacement of pavers), which is likely to increase in frequency over time. However, with continued maintenance, it is anticipated that a 100-year residual design life could be achieved.

The following levels would be required to achieve a 1 in 20-year standard of protection.

- **2050 (+25-years):** +3.7mOD (0.5m approx. higher).
- **2075 (+50-years):** +3.95mOD (0.75m approx. higher).
- **2100 (+75-years):** +4.26mOD (1.06m approx. higher).
- **2125 (+100-**years): +4.59mOD (1.39m approx. higher).

This option can be delivered through various approaches, either individually or in combination, as outlined below:

- **Option 4a:** Earthworks to the rear of the sea wall.
- **Option 4b:** Earthworks to the front, crest, and rear of the sea wall.
- **Option 4c:** Construction of a crest wall.

3.5.1 Option 4a: Earthworks to Rear of Sea wall

Earthworks to raise and widen the crest of the embankment and slacken the rear slope of the embankment to a minimum 1 in 3 gradient, leaving the seaward face in its current position. This option, unlike the Do Minimum option includes a minimum 300mm of 'freeboard'. As highlighted by the figure below, to provide a 1 in 20-year Standard of Protection for 2050 the footprint of the rear slope extends approximately 8m into the lake, and a further 2m up to 2125. As the sluice gate operates at a level of -0.6mOD (between MLWN and MHWN), the outlet would need to be raised in 2075 (+50 years) by at least 0.43m to achieve the same discharge level between the tides, and a further 0.31m by 2100 (+75 years) and 0.33m by 2125 (+100 years), also to avoid increased siltation. An example of earthworks raising is presented in Figure 3-5.



Figure 3-5: Example of earthwork solutions



Figure 3-6: Plan of Option 4a: Earthworks to Rear of Sea wall

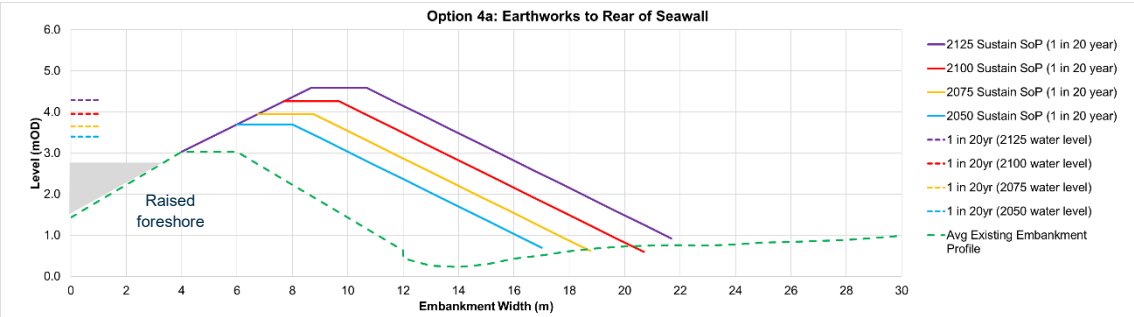


Figure 3-7: Cross section of Option 4a: Earthworks to Rear of Sea wall

Table 3-3: High level appraisal of Option 4a: Earthworks to Rear of Sea wall

Criteria	Positives	Negatives
Technical	✓ As the crest level of the sea wall has been improved, the risk of damage and scour to the rear will reduce and with continued maintenance it is anticipated that a 100-year residual design life for the sea wall could be achieved. ✓ Maintaining the lake allows for the continuation of surface water run-off and management, albeit the sluice gate will need raising over time. ✓ On the basis that maintenance will continue, this option aligns with the long-term SMP Policy of 'Hold the Line'. ✓ Solution can be adaptable and used in combination with other solutions. ✓ Ability to maintain existing access / egress arrangements from the lake to footpath without the need for 'active measures' (e.g. flood gates / boards).	× Under this scenario the sea wall would still be at risk of overtopping in greater than a 1 in 20-year event, so the present day and future coastal flood risk, as described in Section 2.5.1, would remain. In addition, the greater frequency of overtopping will reduce the capacity of the lake to store surface water run-off when assuming some joint probability and correlation. × Solution relies on the integrity, stability and maintenance of the existing sea wall. This risk could be partially managed by an alternative arrangement, as discussed below. × Solution introduces challenges with interface to tie-in options due to spatial constraints. × Drainage ditch to the rear of the sea wall would need diverting via a new ditch. Location of the diversion will need to be determined based on construction phasing.
Environment	✓ Preventing failure of the sea wall will help protect the lake and the freshwater habitat within. ✓ Ability to raise foreshore levels locally in front of the sea wall, via use of dredged material for example, to between 2-3mOD, to encourage the promotion of salt marsh in the short to medium term. *It is important to note that ground levels behind the sea wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.*	× Preventing the failure of the sea wall will lead to the gradual loss of salt marshes and mudflats, as it prevents natural landward migration in response to rising sea levels. × 8-10m strip of the lake will be taken up by the new embankment. × Necessary permissions anticipated to be more challenging and time consuming than crest wall solution. × Higher carbon solution due to material volumes.
Social	✓ Preventing failure of the sea wall will maintain the footpath, and relieve pressure on it, and reduce the risk to people, properties and infrastructure up to a 1 in 20-year event.	× Properties and other assets remain at risk of flooding during events greater than a 1 in 20-year. × Not as suitable along the eastern and western ends of the sea wall as the option would extend into gardens. × Greater visual impact
Economic	Single Construction Phase: • 4a.1 Sustain 1 in 20-year (+25 years): £2.1M. • 4a.2 Sustain 1 in 20-year (+50 years): £2.8M (inc. £120k for raising of slice gate). • 4a.3 Sustain 1 in 20-year (+75 years): £3.1M (inc. £120k for raising of slice gate). • 4a.4 Sustain 1 in 20-year (+100 years): £3.4M (inc. £120k for raising of slice gate).	

An alternative section has also been considered, as shown in Figure 3-8, where the existing footpath remains in place, and the earthworks to raise and widen the crest of the embankment start from the rear of the footpath. This sub-option does increase the footprint of the rear slope by an additional 2-3m and the

frequency of inundation to the footpath would increase over time during storm events, unless raised, however puts less pressure on the existing sea wall.
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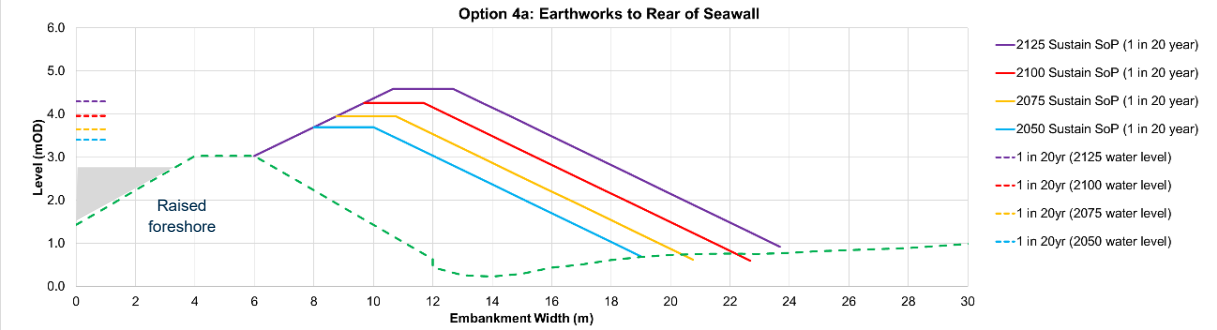


Figure 3-8: Option 4a – alternative arrangement

3.5.2 Option 4b: Earthworks to the front

Earthworks to raise and widen the crest of the embankment and slacken the slopes. This option, compared to Option 4a, would leave the rear embankment in its current position and extend the embankment seaward. To provide a 1 in 20-year Standard of Protection for 2050 the footprint of the rear slope extends approximately 8m seaward, and a further 2m up to 2125.

This option would have a significant detrimental impact on the mudflat and saltmarsh habitat. Also, as the line of defence will be moved seaward it will not be in line with the SMP and the Chichester Harbour Management Plan. For these reasons alone, this option has not been considered further.

3.5.3 Option 4c: Crest Wall

Construction of a crest wall, either to the rear of the footpath or along the rear slope, to increase the crest level of the sea wall. This option relies heavily on the existing sea wall and could be constructed in a variety of forms including plastic piles, steel sheet piles, and through a series of posts and planks. Example solutions are presented in Figure 3-9. Depending on material choice, the crest wall can be cladded, for example in timber, to improve the visual appearance.



Left: Photo of crest wall during construction using UC pile and timber planks



Centre: Photo of crest wall during after construction using UC pile and timber planks



Right: Photo of crest wall during construction using sheet piles

Figure 3-9: Examples of Crest Wall solutions

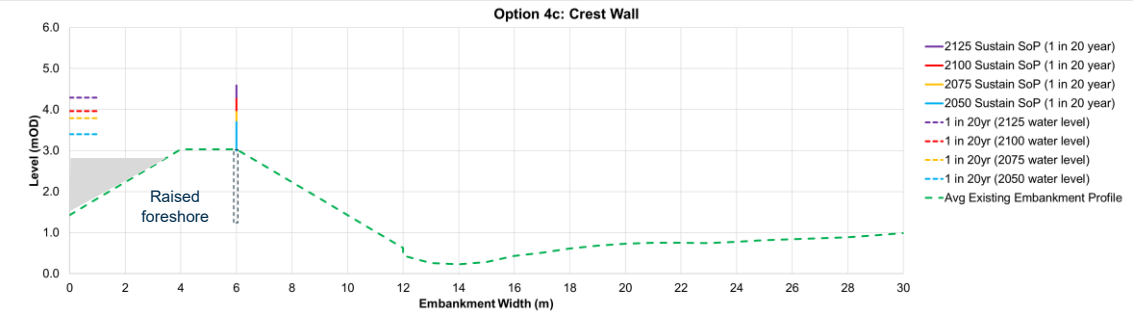


Figure 3-10: Cross section of Option 4c: Crest Wall

Table 3-4: High level appraisal of Option 4c: Crest Wall

Criteria	Positives	Negatives
Technical	✓ As the crest level of the wall has been improved, the risk of damage and scour to the rear will reduce and with continued maintenance it is anticipated that a 100-year residual design life for the sea wall could be achieved. ✓ Maintaining The Lake allows for the continuation of surface water run-off and management, albeit the sluice gate will need to be raised over time. ✓ On the basis that maintenance will continue, this option aligns with the long-term SMP Policy of 'Hold the Line'. ✓ A relatively cost effective and quick solution to sustain the standard of protection, and 'buy time' whilst an alternative larger scale solution is progressed that improves the standard of protection. ✓ A relatively straight forward buildability process, (e.g. pre-augering to prepare for ground penetration and minimise disturbance to the sea wall) with less construction logistical challenges. ✓ Solution can also act as a guardrail to the rear of the footpath to prevent landward falls. ✓ Solution can be adaptable (i.e. crest level increase over time) and used in combination with other solutions. ✓ Depending on the material of the sea wall the crest wall could also act as a 'cut off' wall to reduce seepage through the sea wall. ✓ Solution more favourable with interface to tie-in options.	× Under this scenario the sea wall would still be at risk of overtopping in greater than a 1 in 20-year event, so the present day and future coastal flood risk, as described in Section 2.5.1, would remain. In addition, the greater frequency of overtopping will reduce the capacity of The Lake to store surface water run-off. × The depth of the crest wall below ground level could be substantial (e.g. greater than 2-3m) to achieve stability and the greater the retained height the greater the pile depth. × Relies heavily on the structural integrity of the sea wall. × Seepage though the crest wall and sea wall could be challenging to control and will need careful design. × The height of the crest wall could be considered unacceptable but would largely be screened by vegetation. × Challenges associated with existing access / egress arrangements from the lake to footpath and therefore may require 'active measures' such as stop logs or flood boards installed at certain locations along the length, placing an operational burden on property owners, the Environment Agency or West Itchenor Parish Council. × Footpath would become inundated during flood event unless raised (i.e. used in conjunction with an earthworks solution).
Environment	✓ No encroachment into the lake. ✓ Preventing failure of the sea wall will help protect the lake and the freshwater habitat within. ✓ Ability to raise foreshore levels locally in front of the sea wall, via use of dredged material for example, to between 2-3mOD, to encourage the promotion of salt marsh in the short to medium term. *It is important to note that ground levels behind the sea wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.* ✓ Drainage ditch to the rear of the sea wall would remain in place.	× Preventing the failure of the sea wall will lead to the gradual loss of salt marshes and mudflats, as it prevents natural landward migration in response to rising sea levels. × Medium carbon

	✓ Necessary permissions anticipated to be less challenging and time consuming than earthwork solution.	
Social	✓ Preventing failure of the sea wall will maintain the footpath, and relieve pressure on it, and reduce the risk to people, properties and infrastructure up to a 1 in 20-year event. ✓ Minimal encroachment into gardens along the eastern and western ends of the sea wall.	× Properties remain at risk of flooding during events greater than a 1 in 20-year.
Economic	Single Construction Phase: <u>UC Pile and Post Solution</u> • 4c.1 Sustain 1 in 20-year (+25 years): £770k. • 4c.2 Sustain 1 in 20-year (+50 years): £1.2M (inc. £120k for raising of slice gate). • 4c.3 Sustain 1 in 20-year (+75 years): £1.3M (inc. £120k for raising of slice gate). • 4c.4 Sustain 1 in 20-year (+100 years): £1.35M (inc. £120k for raising of slice gate). <u>Sheet Pile Solution</u> • 4c.1 Sustain 1 in 20-year (+25 years): £1.5M. • 4c.2 Sustain 1 in 20-year (+50 years): £2.1M (inc. £120k for raising of slice gate). • 4c.3 Sustain 1 in 20-year (+75 years): £2.5M (inc. £120k for raising of slice gate). • 4c.4 Sustain 1 in 20-year (+100 years): £3.0M (inc. £120k for raising of slice gate).	

3.5.4 Option 4 Conclusion

The ‘Sustain the Standard of Protection’ Option is a viable option with cost ranging from £770k to £3M. This option aligns with the SMP Policy of Hold the Line in the long term. The option maintains the lake to assist with managing surface water and improves the coastal flood risk protection to properties and critical village infrastructure for return period events up to a 1 in 20-year event, but still at risk during more severe events.

Options could be designed such that they are delivered in a phased manner, with modest increases in crest level occurring in the short term (0.5m for 2050 +25-years), whilst ensuring that future adjustments to accommodate projected sea level rise are possible. A combination of options could also be taken forward, where a crest wall is used in conjunction with earthworks, or a variety along the sea wall to avoid encroachment into property gardens for example.

Example phasing / combinations include:

- Full height raising of the sea wall via earthworks (Option 4a.1 to 4a.4) along full length or part length of sea wall.
- Full height raising of the sea wall via crest wall (Option 4c.1 to 4c.4) along full length or part length of sea wall.
- Partial raising of the sea wall via earthworks and partial raising via crest wall (e.g. Option 4a up to year 2050 followed by Option 4c up to 2100 or 2125), as per example below, along full length or part length of sea wall.

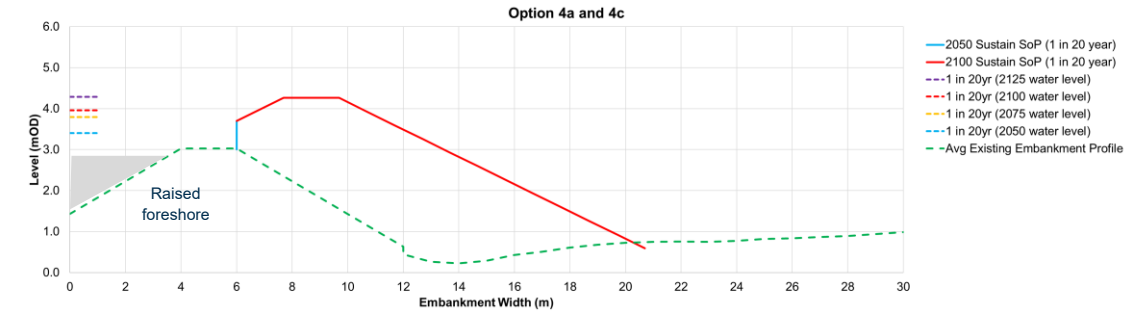


Figure 3-11: Example of option with partial crest wall and partial earthworks

3.6 Option 5: Improve the Standard of Protection

The 'Improve the Standard of Protection option' would see the standard of protection improved to a 1 in 200-year level into the future. Several options could be considered which would see the defence level of the sea wall raised in line with sea level rise, to maintain a 1 in 200-year standard of protection. This option can be constructed as a single full raising (i.e. up to a +100-years water level) or in stages (i.e. initially up to a +25-years water level and then gradually increasing the crest height over time).

Under this scenario the sea wall would significantly improve the risk of overtopping. The seaward side of the sea wall would require continued maintenance (i.e. grouting and replacement of pavers), which is likely to increase in frequency over time. However, with continued maintenance, it is anticipated that a 100-year residual design life could be achieved.

The following levels would be required to achieve a 1 in 200-year standard of protection.

- **2050 (+25-years):** +3.93mOD (0.73m approx. higher).
- **2075 (+50-years):** +4.18mOD (0.98m approx. higher).
- **2100 (+75-years):** +4.49mOD (1.29m approx. higher).
- **2125 (+100-**years): +4.82mOD (1.62m approx. higher).

This option can be delivered through various approaches, either individually or in combination, as outlined below:

- **Option 5a:** Earthworks to the rear of the sea wall.
- **Option 5b:** Earthworks to the front, crest, and rear of the sea wall.
- **Option 5c:** Construction of a crest wall.

3.6.1 Option 5a: Earthworks to Rear of Sea wall

Earthworks to raise and widen the crest of the embankment and slacken the rear slope of the embankment to a minimum 1 in 3 gradient, leaving the seaward face in its current position. As highlighted by the figure below, to provide a 1 in 200-year Standard of Protection for 2050 through to 2100, the footprint of the rear slope extends approximately 10m into the lake, and a further 3m up to 2125. As the sluice gate operates at a level of -0.6mOD (between MLWN and MHWN), the outlet would need to be raised in 2075 (+50 years) by at least 0.43m to achieve the same discharge level between the tides, and a further 0.31m by 2100 (+75 years) and 0.33m by 2125 (+100 years), also to avoid increased siltation.



Figure 3-12: Plan of Option 5a: Earthworks to Rear of Sea wall

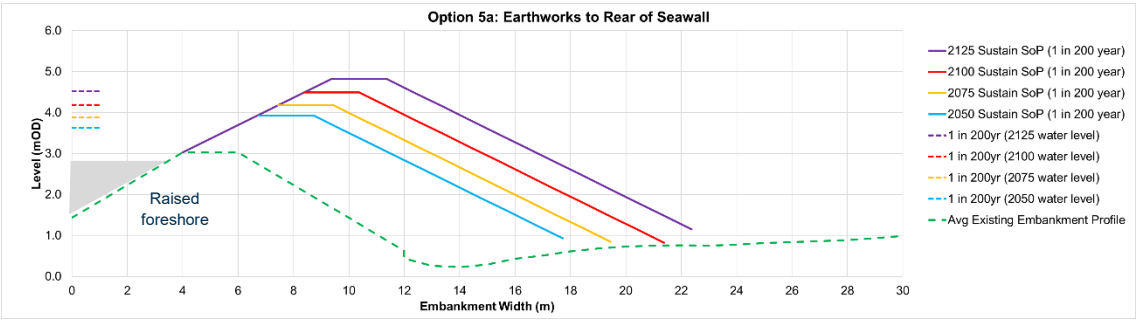


Figure 3-13: Cross section of Option 5a: Earthworks to Rear of Sea wall

Table 3-5: High level appraisal of Option 5a: Earthworks to Rear of Sea wall

Criteria	Positives	Negatives
Technical	✓ As the crest level of the sea wall has been improved, the risk of damage and scour to the rear will significantly reduce and with continued maintenance it is anticipated that a 100-year residual design life for the sea wall could be achieved. ✓ Maintaining the lake allows for the continuation of surface water run-off and management, albeit the sluice gate will need to be raised over time. ✓ Under this scenario the sea wall would provide protection to overtopping up to a 1 in 200-year event, resulting in a significant improvement to the present day and future coastal flood risk. ✓ On the basis that maintenance will continue, this option aligns with the long-term SMP Policy of 'Hold the Line'. ✓ Solution can be adaptable and used in combination with other solutions. ✓ Ability to maintain existing access / egress arrangements from the lake to footpath without the need for 'active measures'.	× Solution relies on the integrity, stability and maintenance of the existing sea wall. This risk could be partially managed by an alternative arrangement, as discussed in Section 3.5.1. × Solution introduces challenges with interface to tie-in options due to spatial constraints. × Drainage ditch to the rear of the sea wall would need diverting via a new ditch. Location of the diversion will need to be determined based on construction phasing.
Environment	✓ Preventing failure of the sea wall will help protect the lake and the fresh water habitat within. ✓ However, raising foreshore levels locally in front of the sea wall, via use of dredged material for example, to between 2-3mOD, could help the promotion of salt marsh in the short to medium term. *It is important to note that ground levels behind the sea wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.*	× Preventing the failure of the sea wall will lead to the gradual loss of salt marshes and mudflats, as it prevents natural landward migration in response to rising sea levels. sea wall × 10-13m strip of The Lake will be taken up by the new embankment. × Necessary permissions anticipated to be more challenging and time consuming than crest wall solution. × *Higher carbon solution due to material volumes*
Social	✓ Preventing failure of the sea wall will maintain the footpath. ✓ Properties and other assets will be protected up to a 1 in 200-year event.	× Not as suitable along the eastern and western ends of the sea wall as the option would extend into gardens. × Greater visual impact
Economic	Single Construction Phase: • 5a.1 Improve 1 in 200-year (+25 years): £2.4M • 5a.2 Improve 1 in 200-year (+50 years): £3.1M (inc. £120k for raising of slice gate). • 5a.3 Improve 1 in 200-year (+75 years): £3.4M (inc. £120k for raising of slice gate). • 5a.4 Improve 1 in 200-year (+100 years): £3.7M (inc. £120k for raising of slice gate). × More expensive than Option 4.	

3.6.1.1 Alternative solution to minimise footprint

In addition to a 'traditional' earthwork solution, alternative solutions are available to support the raising of the sea wall but over a shorter footprint. Examples include FLEX MSE which is a vegetated retaining wall system that uses geotextile bags filled with soil and interlocking plates to create a strong, flexible structure for erosion control, retaining walls and landscaping.



Left & Centre: Flex MSE Wall During Construction


Right: Flex MSE Wall Post Construction

Key features and benefits of this solution include:

- Durability: it is designed to withstand significant differential settlement without failing.
- Environmental benefits: it uses a high percentage of recycled materials and allows for complete vegetation, offering a low-carbon solution.
- Flexibility: it can be used on a variety of sites, including those with complete or sloped landscapes.
- Cost effective: whilst cost is similar to a traditional earthwork solution, typically around £250 - £300 per square meter, it can be installed quicker, and saves on earthworks material volumes.
- Minimal foundation: it typically requires a much smaller foundation compared to conventional measures, with some installations only needing a 300mm wide/deep foundation.
- Buildability: the bags and plates can be installed by hand.
- Footprint: typically designed and installed at steeper gradients than traditional earthwork solutions (i.e. steeper than 1:3 gradient).

Whilst it may be technically feasible to apply this solution along the full rear length of the sea wall, it is not considered as suitable as a traditional earthwork approach. This is primarily because it lacks the flexibility required for phased implementation (as it will require some 'unpacking' in order to raise). However, it could offer a practical alternative in specific locations, such as along the eastern and western most ends where the sea wall abuts property boundaries, as well as around the sluice gate, enabling simpler construction adjacent to the existing brick retaining walls (see photo below). Tie-in options are discussed further in Section 3.9.


Left: Western End of Sea Wall


Centre: Brick Retaining Wall at Sluice Gate


Right: Eastern End of Sea Wall

3.6.2 Option 5b: Earthworks to the front, crest, and rear of the sea wall

As with Option 4b, this option would have a significant detrimental impact on the mudflat and saltmarsh habitat. Also, as the line of defence will be moved seaward it will not be in line with the SMP and the Chichester Harbour Management Plan. For these reasons alone, this option has not been considered further.

3.6.3 Option 5c: Crest Wall

Construction of a crest wall, either to the rear of the footpath or along the rear slope, to increase the crest level of the sea wall. This option relies heavily on the existing sea wall and could be constructed in a variety of forms including plastic piles, steel sheet piles, and through a series of posts and planks, as per Option 4.

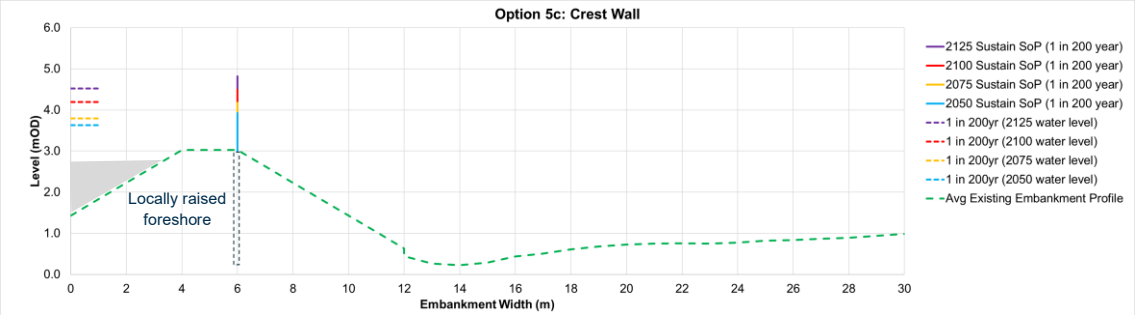


Figure 3-14: Cross section of Option 5c: Crest Wall

Table 3-6: High level appraisal of Option 5c: Crest Wall

Criteria	Positives	Negatives
Technical	✓ As the crest level of the wall has been improved, the risk of damage and scour to the rear will reduce and with continued maintenance it is anticipated that a 100-year residual design life for the sea wall could be achieved. ✓ Maintaining the lake allows for the continuation of surface water run-off and management, albeit the sluice gate will need raising over time. ✓ Under this scenario the sea wall would provide protection to overtopping up to a 1 in 200-year event, resulting in a significant improvement to the present day and future coastal flood risk. ✓ On the basis that maintenance will continue, this option aligns with the long-term SMP Policy of 'Hold the Line'. ✓ A relatively cost effective and quick solution to improve the standard of protection, and 'buy time' whilst an alternative larger scale solution is progressed. ✓ A relatively straight forward buildability process, (e.g. pre-augering to prepare for ground penetration and minimise disturbance to the sea wall) with less construction logistical challenges.	× The depth of the crest wall below ground level could be substantial (e.g. greater than 3-4m) to achieve stability and the greater the retained height the greater the pile depth. × Relies heavily on the structural integrity of the sea wall. × Seepage though the crest wall and sea wall could be challenging to control and will need careful design. × The height of the crest wall could be considered unacceptable but would largely be screened by vegetation. × Challenges associated with existing access / egress arrangements from the lake and therefore may require 'active measures' such as stop logs or flood boards installed at certain locations along the length, placing an operational burden on property owners, the Environment Agency or West Itchenor Parish Council. × Footpath would become inundated during flood event unless raised (i.e. used in conjunction with an earthworks solution).

	✓ Solution can also act as a guardrail to the rear of the footpath to prevent landward falls. ✓ Depending on the material of the sea wall the crest wall could also act as a 'cut off' wall to reduce seepage through the sea wall. ✓ Solution can be adaptable (i.e. crest level increase over time) and used in combination with other solutions. ✓ Solution more favourable with interface to tie-in options.	
Environment	✓ Small footprint meaning no encroachment into the lake. ✓ Preventing failure of the sea wall will help protect the lake and the freshwater habitat within. ✓ Ability to raise foreshore levels locally in front of the sea wall, via use of dredged material for example, to between 2-3mOD, to encourage the promotion of salt marsh in the short to medium term. *It is important to note that ground levels behind the sea wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.* ✓ Drainage ditch to the rear of the sea wall would remain in place. ✓ Necessary permissions anticipated to be less challenging and time consuming than earthwork solution.	× Preventing the failure of the sea wall will lead to the gradual loss of salt marshes and mudflats, as it prevents natural landward migration in response to rising sea levels. × Medium carbon
Social	✓ Preventing failure of the sea wall will maintain the footpath. ✓ Properties will be protected up to a 1 in 200-year event. ✓ Minimal encroachment into gardens along the eastern and western ends of the sea wall.	
Economic	Single Construction Phase: <u>UC Pile and Post Solution</u> • 5c.1 Improve 1 in 200-year (+25 years): £870k • 5c.2 Improve 1 in 200-year (+50 years): £1.3M (inc. £120k for raising of slice gate). • 5c.3 Improve 1 in 200-year (+75 years): £1.4M (inc. £120k for raising of slice gate). • 5c.4 Improve 1 in 200-year (+100 years): £1.45M (inc. £120k for raising of slice gate). <u>Sheet Pile Solution</u> • 5c.1 Improve 1 in 200-year (+25 years): £1.8M • 5c.2 Improve 1 in 200-year (+50 years): £2.5M (inc. £120k for raising of slice gate). • 5c.3 Improve 1 in 200-year (+75 years): £3.1M (inc. £120k for raising of slice gate). • 5c.4 Improve 1 in 200-year (+100 years): £3.5M (inc. £120k for raising of slice gate). × More expensive than Option 4.	

3.6.4 Option 5 Conclusion

The 'Improve the Standard of Protection' Option is a viable option with costs ranging from £870k to £3.5M. This option will deliver on the SMP Policy of Hold the Line in the long term. This option maintained The Lake to assist with managing surface water and significantly improved the coastal flood risk protection to properties and critical village infrastructure up to a 1 in 200-year event.

In a similar manner to Option 4 'Maintain SoP', Option 5 could be designed such that they are delivered in a phased manner, with increases in crest level occurring in the short term (0.73m for 2050 +25-years), whilst ensuring that future adjustments to accommodate projected sea level rise are possible. A combination of options could also be taken forward, where a crest wall is used in conjunction with earthworks.

Example phasing / combinations include:

- Full height raising of the sea wall via earthworks (Option 5a.1 to 5a.4) along full length or part length of sea wall.
- Full height raising of the sea wall via crest wall (Option 5c.1 to 5c.4) along full length or part length of sea wall.
- Partial raising of the sea wall via earthworks and partial raising via crest wall (e.g. Option 5a up to year 2075 followed by Option 5c up to 2100 or 2125), along full length or part length of sea wall.

3.7 Option 6: Managed Realignment

Managed realignment can be defined as setting back the line of defence to a new line inland of the original, or preferably to rising ground, and promoting the creation of intertidal habitat and wave attenuation on the land between the old and new defences (or rising ground). Removal of the original front-line defence can be achieved as follows:

- Full removal of the original front-line defence.
- Partial removal/lowering of the original front-line defence to help encourage a breach.
- Do-nothing to the original front-line defence and allow to naturally breach over time.

The tide can inundate the exposed land during each tidal cycle allowing the new floodplain to expand until it meets the new inland line. Depending on many factors, the flooded land will over time be occupied by intertidal habitats including mudflats and potentially saltmarsh if levels are sufficient.

Figure 3-15 shows a cross section of typical saltmarsh within Chichester Harbour. On the left hand side of the figure are mudflats, moving further inland, as elevation increases different species and habitats develop. In order for saltmarsh to develop a progression of elevations through the intertidal zone is required. The broader the range of elevations, in particular above present day mean high water springs, the more resilient the saltmarsh will be to sea level rise. Where saltmarsh is constrained, for example by a sea wall over time the saltmarsh will be "squeezed" by sea level rise and increased rates of erosion due to increasing frequencies of inundation.

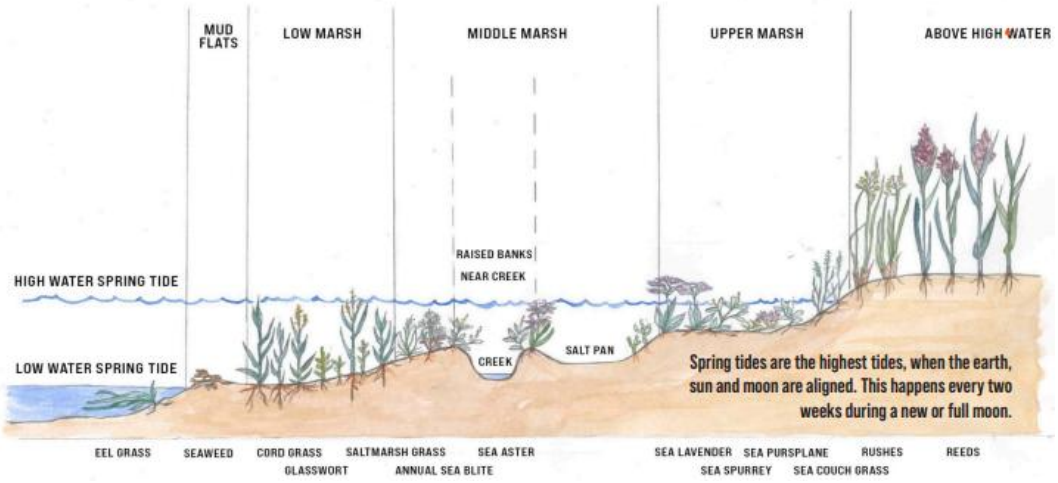


Figure 3-15: Saltmarsh Zones and Species Succession (Chichester Harbour Conservancy, unknown date)

Ground levels to the rear of the sea wall are low, typically between 0.5m and 1.0mODN. Seaward from the sea wall, in the estuary, are some fragmented pockets of saltmarsh which are between 1.0m and 2.0mODN. The fact that the existing saltmarsh is fragmented and generally in poor condition demonstrates that it may be too low in elevation.

In order to create healthy saltmarshes, either seaward from the existing defence alignment, or within the hinterland between a realigned defence and the existing saltmarsh, it is likely that some degree of ground level raising would be required.

Opportunities for this are fairly limited, with the two most realistic options being beneficial use of dredged sediments or redistributing the existing embankment material across a newly created hinterland. The latter option would only achieve very modest changes in elevation, or changes in elevation over a very small area. However, one way this could be achieved is to have a very shallow (say 1 in 5 or 1 in 8) seaward facing slope along the realigned embankment.

Notwithstanding the opportunities and challenges noted above, two options for managed realignment have been considered. At this stage, options considered have been limited to areas between property boundaries and the sea wall, to avoid impacts to infrastructure and properties. There may be other options further landward but these would have significant impacts to infrastructure and properties, and would compromise the remaining size of The Lake for surface water storage.

3.7.1 Option 6a: Localised Managed Realignment

Under the localised realignment option, a new set-back embankment would be constructed. The example in Figure 3-16 is based around a new embankment length of approximately 200m, and the total partial removal of the sea wall and would create approximately 0.5 hectares of intertidal habitat.

This option would require the importation of a large volume of fill material. It is possible that material could be re-used from the existing sea wall, however little is known about the composition of this structure and therefore it cannot be assumed to be suitable material to construct a new tidal flood defence. It may however be suitable to use locally to raise ground levels within the newly created intertidal zone.

Ground levels along the alignment of the new set-back embankment vary however they are typically within the region of 0.5m to 1.0mODN.

The following levels would be required to achieve a 1 in 200-year standard of protection.

- **2050 (+25-years):** +3.93mOD (3.63m high).
- **2075 (+50-years):** +4.18mOD (3.88m high).
- **2100 (+75-years):** +4.49mOD (3.99m high).
- **2125 (+100-**years): +4.82mOD (4.32m high).

Due to the significant work required for this option, a 1 in 20-year standard of protection has not been considered as the costs are considered disproportionate to the benefit provided in terms of reducing the risk of flooding.

Figure 3-16 provides an example plan view for a local managed realignment option based on a 1 in 200-year standard of protection for 2125. Figure 3-17 provides an indicative section for the same standard of protection for year 2050 through to 2125. As shown, the footprint of the embankment is substantial with a maximum width of approximately 30m. The sluice gate could be situated outside of the footprint of this option, however the outlet would need to be raised in 2075 (+50 years) by at least 0.43m to achieve the same discharge level between the tides, and a further 0.31m by 2100 (+75 years) and 0.33m by 2125 (+100 years).

The localised realignment could be designed in such a way that it connects to a modified defence, if for example a “Do Minimum Plus”, “Sustain SoP” or “Increase SoP” option was progressed over the remainder of the embankment.



Figure 3-16: Plan of Option 6a: Localised Managed Realignment

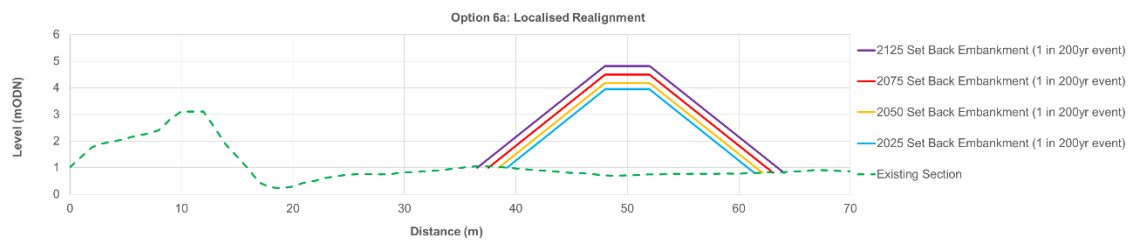


Figure 3-17: Localised Realignment Indicative Section for a 1 in 20-year event in 2025 to 2125.

Table 3-7: High level appraisal of Option 6a: Localised Realignment

Criteria	Positives	Negatives
Technical	✓ The new set-back embankment will experience little risk of damage and scour and with continued maintenance it is anticipated that a 100-year residual design life would be achievable. ✓ Maintaining the majority of The Lake allows for the continuation of surface water run-off and management, albeit the sluice gate will need to be raised over time. ✓ On the basis that maintenance will continue, this option aligns with the long-term SMP Policy of 'Hold the Line', albeit with a set-back defence line. ✓ Avoids any direct interaction with the existing Rife or sluice gate.	× Works to the existing sea wall, outside of the realignment footprint, would still be required, meaning this option would have to be implemented with either Option 4 or Option 5. Should Option 4 be implemented, the sea wall would still be at risk of overtopping in greater than a 1 in 20-year event, so the present day and future coastal flood risk, as described in Section 2.5.1, would remain. × A large area of 'The Lake' would be lost; therefore, it is probable that the risk of flooding from surface water run-off would increase. The rife and sluice gate will need to be relocated and raised over time.
Environment	✓ Maintaining and improving the sea wall will help protect 'The Lake' and the majority of fresh water habitat within, albeit with some loss of 'The Lake'. ✓ Removing some of the existing sea wall will help prevent the gradual loss of salt marsh and mudflats, however, as ground levels behind the Sea Wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Therefore, should the sea wall breach, mudflat habitat would form with a narrow saltmarsh fringe being likely without some degree of ground level raising.	× Loss of existing freshwater habitat and ecology. × Higher carbon solution due to material volumes
Social	✓ Preventing failure of the sea wall will maintain the footpath. ✓ Properties will be protected up to a 1 in 200-year event (should the existing sea wall elsewhere be raised to the same level).	× Greater visual impact
Economic	Single construction project: • 6a.1 Localised Managed Realignment to a 1 in 200-year (+75 years): £2.7M. • 6a.2 Localised Managed Realignment to a 1 in 200-year (+100 years): £3.8M. Note: for areas outside of the realignment area also need to be considered. This would be approximately 50% of the cost estimates provided for option 5, ranging from £700k for option 5c.3 to £1.7M for option 5a.3, providing a 1 in 200-year (+75 year) solution. This increases to £720k to £1.75M respectively for a 1 in 200-year (+100 year) solution.	

3.7.2 Option 6b: Large Scale Managed Realignment

Under the large scale managed realignment option, a new set-back embankment would be constructed with the alignment bordering property boundaries. The example in Figure 3-18 is based around a new embankment length of approximately 470m, and the partial removal of the sea wall and would create approximately 2.5 hectares of intertidal habitat.

As with Option 6a, this option would require the importation of a large volume of fill material. It is possible that material could be re-used from the existing sea wall, however little is known about the composition of this structure and therefore it cannot be assumed to be suitable material to construct a new tidal flood defence. It may however be suitable to use locally to raise ground levels within the newly created intertidal zone. Due to the scale of the embankment, the material from the existing sea wall will only be a small portion of the total volume required.

Crest levels to achieve a 1 in 200-year standard of protection provided for Option 6a remain the same for this option. Due to limited high ground outside of property boundaries, the footprint of the embankment is substantial with a maximum width of approximately 30m. Depending on the alignment of the embankment, the rife may need to be relocated and the sluice gate and outlet relocated and adjusted over time, as per Option 6a.



Figure 3-18: Plan of Option 6b: Large Scale Managed Realignment

Table 3-8: High level appraisal of Option 6b: Large Scale Managed Realignment

Criteria	Positives	Negatives
Technical	✓ The new set-back embankment will experience little risk of damage and scour and with continued maintenance it is anticipated that a 100-year residual design life would be achievable. ✓ On the basis that maintenance will continue, this option aligns with the long-term SMP Policy of 'Hold the Line', albeit with a set-back defence line.	× The majority of The Lake would be lost and therefore the risk of flooding from surface water run-off would significantly increase. The rife and sluice gate will need to be relocated and raised over time. × Works to the existing sea wall, outside of the realignment footprint, would still be required, meaning this option would have to be implemented with either Option 4 or Option 5. Should Option 4 be implemented, the sea wall would still be at risk of overtopping in greater than a 1 in 20-year event, so the present day and future coastal flood risk, as described in Section 2.5.1, would remain.
Environment	✓ Removal of the sea wall will help prevent the gradual loss of salt marsh and mudflats, however, as ground levels behind the Sea Wall are low, typically between 0.5mOD and 1mOD (i.e. below MHWS). Saltmarsh is likely to establish with some degree of ground level raising.	× Significant loss of existing fresh water habitat and ecology. × *Higher carbon solution due to material volumes*
Social	✓ Footpath will be maintained, albeit on a new alignment. ✓ Properties will be protected up to a 1 in 200-year event (should the existing sea wall elsewhere be raised to the same level.	× Greater visual impact
Economic	Single construction project: • 6b.1 Localised Managed Realignment to a 1 in 200-year (+75 years): £4.6M. • 6b.2 Localised Managed Realignment to a 1 in 200-year (+100 years): £6.7M. Note: for areas outside of the realignment area also need to be considered. This would be approximately 30% of the cost estimates provided for option 5, ranging from £420k for option 5c.3 to £1.0M for option 5a.3, providing a 1 in 200-year (+75 year) solution. This increases to £435k to £1.11M respectively for a 1 in 200-year (+100 year) solution.	

3.7.3 Option 6 Conclusion

The Managed Realignment option is not considered a viable solution. Whilst this option offers environmental benefits by creating intertidal habitats between the existing West Itchenor sea wall and the proposed realignment, the significant cost is disproportionate relative to alternative solutions.

Furthermore, the suggested realignment of the sea wall will encroach onto the existing position of the lake, resulting in the loss of freshwater habitat and much of the lake. Although the storage capacity of the lake is currently unknown, Haskoning assumes that the full or partial removal of the lake will reduce the storage capacity and increase surface water flood risk in the area.

3.8 Additional Enhancement Opportunities

In addition to creating intertidal habitats described for each option, a number of additional enhancement opportunities have been considered that could be implemented with Options 2, 3, 4, 5 and 6.

3.8.1 Lagoons / Ponds

Presently within the land to the rear of the sea wall there are a number of small ponds. Without intervention in the sea wall, instances of overtopping will result in these becoming increasingly brackish. These ponds could be modified in a number of ways to either exploit the opportunities presented by increasing salinity e.g., by broadening and widening the side slopes of the ponds, these could become feeding grounds for wading birds. Conversely, they could be defended as freshwater ponds, in order to protect the habitats which, they currently support.

3.8.2 Environmentally Friendly Sea walls

Recognising that both Option 4 and Option 5 rely on the continued maintenance of the existing face of the sea wall, there is an opportunity to increase the roughness and texture of the seaward face to provide surface conditions more conducive to the growth of organisms and to increase surface area for colonisation. Roughness could be added in a variety of ways, including by embedding objects such as prefabricated hollow concrete blocks adding large woody debris, and the replacement of the 'smooth' pavers with textured concrete pavers.

3.9 Tie-ins

Raising the level of the sea wall will require a 'tie-in' at either end (i.e. at Club Lane / Itchenor Sailing Club and Spinney Lane Footpath) to avoid the risk of outflanking the defence during a flood event. Options at either end have been reviewed and are discussed in the following sub-sections.

3.9.1 Club Lane / Itchenor Sailing Club

The western end of the sea wall is bounded by property boundaries of Pier Point and Orchard House, and the existing sea wall transitions directly into Club Lane at the Itchenor Sailing Club. On the opposite side of the access road is a brick building belonging to the Sailing Club. Figure 3-19 provides photos of the tie-in area.

As shown in the photos below, the property boundaries of Pier Point and Orchard House run along the rear of the sea wall for approximately 100m, with the footpath in front varying between 1.0m and 1.5m in width. Due to these spatial constraints, earthwork solutions (Options 4a and 5a) along this section are considered unfeasible. Instead, a crest-wall solution located along the rear of the footpath (Options 4c and 5c) is recommended. This approach would maintain the existing footpath level and minimise encroachment onto the footpath.

If an earthwork solution is implemented along the remainder of the sea wall, the footpath would need to transition from an elevated level back down to the existing levels in front of the property boundaries and into Club Lane. By contrast, selecting a crest-wall solution would eliminate the need for any footpath level transitions.

At the western end, a flood gate or demountable flood board system would be required to close the gap between the boundary wall (as shown in Photo 1) and Itchenor Sailing Club.

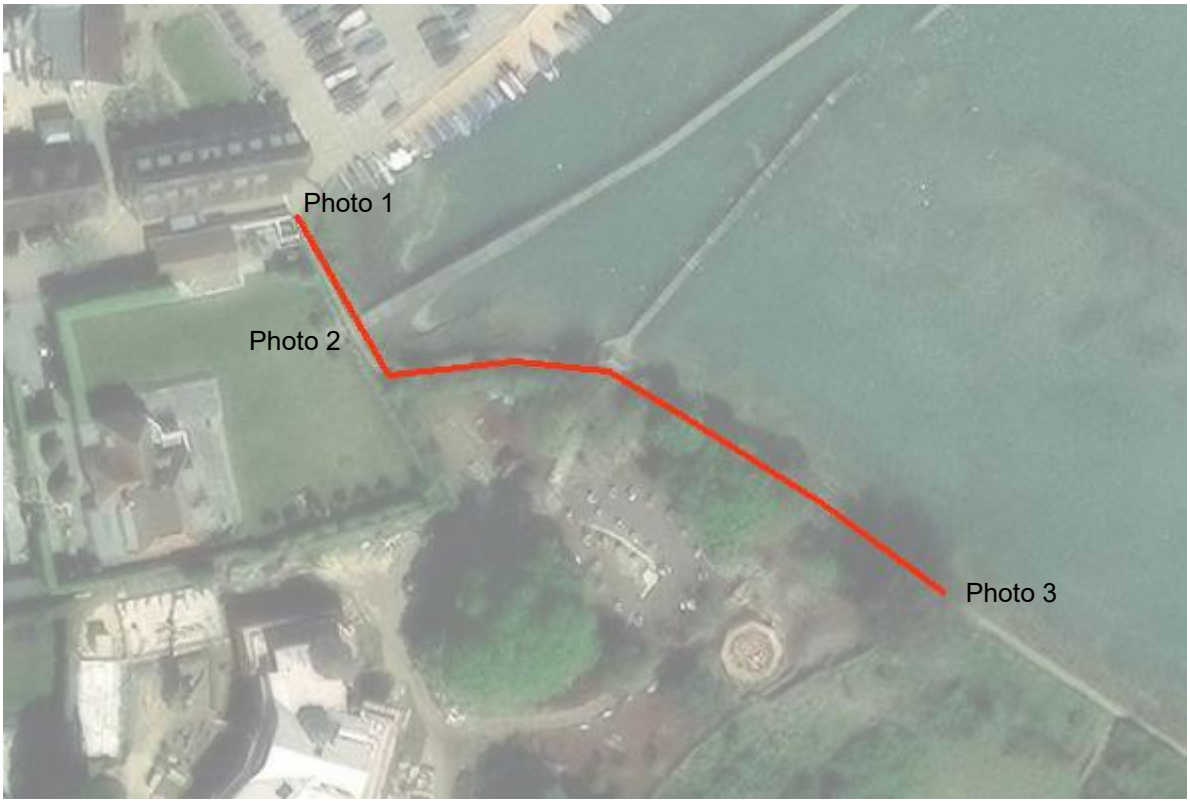




Photo 1: Western end adjacent to Itchenor Sailing Club.



Photo 2: Property boundary at Pier Point.



Photo 3: end of property boundary at Orchard House.

Figure 3-19: Photos of Club Lane / Itchenor Sailing Club tie-in area.

3.9.2 Spinney Lane Footpath

At the eastern end of the existing defence is bounded by private property boundaries. On the east side this is a brick wall and the west side this is a fence and hedge. It is notable that the path level drops by up to around 750mm from the crest of the embankment, into a hollow, before rising back up to meet Spinney Lane some 100m to the south. Figure 3-20 shows photos of the eastern tie-in area.

As shown in the photos below and similar to the western tie-in, property boundaries of Fordwater Cottage and River House run along the rear of the sea wall for approximately 120m, with the footpath in front varying between 10.0 and 1.5m in width. Due to the spatial constraints earthwork solutions (Options 4a and 5a) along this section are considered unfeasible. Instead, a crest-wall solution located along the rear of the footpath (Options 4c and 5c) is recommended. This approach would maintain the existing footpath level. Again, similar with the western tie-in, if an earthwork solution is implemented along the remainer of the sea wall, the footpath would need to transition from an elevated level back down to existing levels in front of the property boundaries and into the footpath leading to Spinney Lane.

In contrast to the western tie-in, flood gates or demountable flood boards are not considered feasible for achieving the required defence level at the Spinney Lane Footpath to close the gap and flow route. Consequently, the crest wall will need to continue up Spinney Lane, with the footpath level raised accordingly.

To maintain accessible gradients, the footpath level increase must be designed at a slope of 1 in 21 or shallower. Delivering this will require either utilising the existing boundary wall of Harbour House to retain the raised footpath or replacing the wall with a suitable retaining structure. This is illustrated in Figure 3-21.





Photo 1: Property boundary at River House.



Photo 2: Property boundary at Fordwater Cottage



Photo 3: eastern end looking down footpath to Spinney Lane.

Figure 3-20: Photos of Spinney Lane tie-in area.

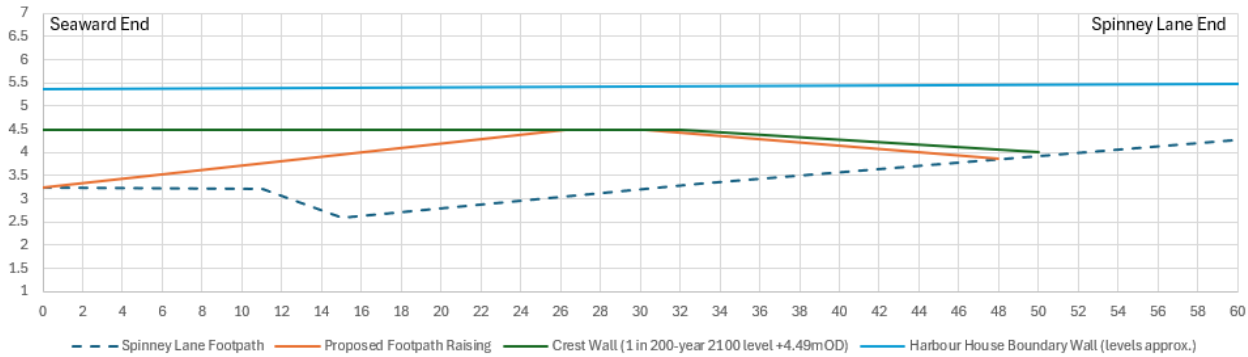


Figure 3-21: Example cross section through proposed tie-in, based on a 2100 1 in 200-year crest level.

4 Conclusion and recommendations

4.1 General Conclusions

Current observations and analysis of survey data show that the sea wall is at risk of overtopping during present day low return period flood events and therefore does not currently meet the Environment Agency's target standard of protection to a 1 in 20-year event. The condition and crest level of the defence is known to be variable, with some areas in poor condition with notable failures to the rear slope and low points along the crest, with the existing maintenance regime evident to be insufficient.

Without intervention, the sea wall is at risk of being increasingly overtopped and damaged in the imminent future. This conclusion is supported by evidence from the flood event experienced as recently as April 2024 where pavers were damaged and rear slope eroded. Under the current maintenance regime of repair works to the pavers and footpath, the residual life of the sea wall is estimated to be up to 10-15 years. This does, however, rely on the pavers being repaired annually, as well as repair works to the rear slope of the sea wall. Should repair works to the rear slope of the sea wall not be undertaken, the residual life will be much less as overtopping will lead to additional scour.

Ultimately, without intervention the sea wall will breach and result in the daily flooding of the land to its rear, resulting in the flooding of residential properties and critical village infrastructure. Projected sea level rise will exacerbate the above conclusions. Whilst there is uncertainty about how much sea level rise will be experienced by a given date, it is widely accepted that a sea level rise of several hundreds of millimeters is likely within the next 50 years, and up to 1m over the next 100 years.

The findings therefore highlight the importance of maintaining flood defences in the area and if/where possible, improve the standard of protection provided.

4.2 Recommended way forward

Several options have been considered to manage the risk of sea wall failure and flood risk. Options considered are as follows:

- Option 1: Do Nothing.
- Option 2: Do Minimum.
- Option 3: Do Minimum 'Plus'.
- Option 4: Sustain the Standard of Protection.
    - 4a: Earthworks to the rear of the sea wall
    - 4b: Earthworks to the front, crest, and rear of the sea wall.
    - 4c: Construction of a crest wall
- Option 5: Improve the Standard of Protection.
    - 5a: Earthworks to the rear of the sea wall
    - 5b: Earthworks to the front, crest, and rear of the sea wall.
    - 5c: Construction of a crest wall
- Option 6: Managed Realignment.
    - 6a Localised Managed Realignment
    - 6b Large Scale Managed Realignment

Due to the physical constraints of the area and the critical need to maintain the sea wall, all options considered focus on repairing all or part of the sea wall to prevent failure. These options aim to either:

- Maintain the current low standard of protection,
- Increase protection to the minimum 1-in-20-year standard, or
- Improve protection to a 1-in-200-year standard.

To achieve these targets, solutions have been grouped into two primary approaches: earthworks or crest wall construction. Additionally, in recognition of the challenges within Chichester Harbour, particularly coastal squeeze and the loss of intertidal habitat, managed realignment options have also been explored.

At this stage, the study indicates that all options are technically viable, though each have technical, social, environmental, and economic challenges. The required crest level increase varies by target standard, for example:

- +0.20m for a present-day 1 in 20-year event,
- +0.50m for a 2050 1 in 20-year event,
- +0.98m for a 2050 1 in 20-year event,
- +1.62m for a 2125 1 in 200-year event.

Earthworks solutions (Options 4 and 5) would encroach into the lake, impacting freshwater habitats and ecology, requiring careful mitigation. However, this is generally considered preferable to encroaching seaward into intertidal habitats. In some locations, encroachment into private properties (e.g. at tie-ins) introduces additional challenges that may be difficult to resolve. Access to and from the lake can be maintained without the need for ‘active measures’.

Crest wall solutions avoid encroachment issues into the lake and can be positioned either at the rear of the footpath or partway down the rear slope. While this approach has less impact on freshwater habitats, it may create greater visual intrusion unless screened with vegetation. Access to and from the lake would need to be maintained, potentially requiring ‘active measures’ such as flood boards or stop logs at specific points along the wall, placing an operational burden on property owners, the Environment Agency or West Itchenor Parish Council.

Managed realignment options pose similar challenges as earthwork solutions but also significantly reduce the volume of the lake which would increase the risks associated with surface water management over time. The cost of this solution is also significant compared to alternatives due to the larger volume of material required and other factors and is therefore considered disproportionate to the benefits.

The cost of the options varies depending on the form and target standard of protection. Table 4-1 below provides a summary of the cost estimates. A crest wall solution is cheaper in comparison to an earthwork solution, there is a balance between the technical, environmental and social challenges versus cost.

Table 4-1: Summary of cost estimates

Option	2050 (+25-years)	2075 (+50-years)	2100 (+75-years)	2125 (+100-years)
Option 2: Do Minimum	Funded by the Environment Agency. Alternative Funding Source: The exact length of sea wall repair undertaken by the Environment Agency is unknown, however based on condition assessment, a length of 75m is considered to be in poor condition. To grout pavers over a 75m length, as well as repair 200m (50%) of the footpath, the cost will be approximately £20-30k.			
Option 3: Do Minimum 'Plus'	Funded by the Environment Agency. Alternative Funding Source: To grout pavers and upgrade footpath along 400m length, and repair the rear slope along 75m length, the cost will be approximately £160-200k.			
Option 4: Sustain the Standard of Protection				
Option 4a	£2.1M	£2.8M	£3.1M	£3.4M
Option 4c (UC Pile and Post)	£770k	£1.2M	£1.3M	£1.35M
Option 4c (sheet pile)	£1.5M	£2.1M	£2.5M	£3.0M
Option 5: Improve the Standard of Protection				
Option 5a	£2.4M	£3.1M	£3.4M	£3.7M
Option 5c (UC Pile and Post)	£870k	£1.3M	£1.4M	£1.45M
Option 5c (sheet pile)	£1.8M	£2.5M	£3.1M	£3.5M
Option 6: Managed Realignment				
Option 6a	-	-	£2.7M + 50% of option 5 costs.	£3.8M + 50% of option 5 costs.
Option 6b	-	-	£4.6M + 50% of option 5 costs.	£6.7M + 30% of option 5 costs.

At this stage in the project, a staged approach is recommended to be explored further along with the use of a mixture of earthwork and crest wall solutions. The recommended staged approach is as follows:

- Stage One: Do Minimum 'Plus' (Option 3), whereby the remainder of the pavers are repaired, the repair of the rear slope and footpath / crest level raised to 3.22mOD, providing the minimum 1 in 20-year standard of protection for 2025 water levels. This should be undertaken by the Environment Agency as maintainer of the sea wall.

- Stage Two: Either:
    - (A): Improve the Standard of Protection (Option 5) by raising the sea wall crest level to either +3.93mOD (0.73m) to provide a 2050 1 in 200-year standard of protection or +4.18mOD (0.98m) to provide a 2075 1 in 200-year standard of protection via a crest wall solution only. Note: the footpath would remain lower than the crest level of the wall. This option would favour the proposed tie-in solutions.

    - (B): Improve the Standard of Protection (Option 5) by raising the sea wall crest level to +4.18mOD (0.98m) to provide a 2075 1 in 200-year standard of protection via a crest wall and / or embankment solution. This alternative option is described in more detail below.

Note: the footpath arrangement would need to be considered depending on the starting position of the earthwork solution.

- Stage Three: Improve the Standard of Protection (Option 5) by raising the sea wall crest level to +4.82mOD (1.62m) to provide a 2125 1 in 200-year standard of protection.

The benefits of this staged approach are as follows:

- **Immediate risk reduction:** Stage One enables essential sea wall repairs to mitigate the risk of further damage or failure while longer-term solutions are developed. Work undertaken in this stage will come at no cost to West Itchenor Parish Council, as work should be undertaken and accepted by the Environmental Agency.
- **Short-term resilience:** Stage Two (A or B) provides an important interim improvement to the standard of protection for the next 25 to 50 years.
- **Informed decision-making:** This approach allows time to review and validate sea level rise projections over the coming decades, so that any crest level adjustments beyond the next 50 years are based on robust data and deliver a 'no regrets' solution.

For Stage Two (A) a crest wall to provide either a 2050 or 2075 1 in 200-year standard of protection is likely to provide a quicker route to consent due to the reduction in footprint when compared to the earth work options and impacts whilst providing an improved standard of protection by raising the defence level up to 0.98m.

For Stage Two (B), an earthwork and crest wall solution are both technically possible but local constraints need to be considered in addition to the wider environmental, social and economic challenges. For this reason, the options available for Stage Two (B) have been divided into four sections, Figure 4-1, with different recommendations for each.

- Section 1: due to the spatial constraint with the property boundary of Orchard House abutting the sea wall, a crest wall solution is recommended. This would likely take the same alignment as the boundary fence already in place to the rear of the footpath and not encroach into the garden.
- Section 2: either a crest wall or earthworks solution, or a mixture, are suitable to raise the crest level. If Stage Two (A) is implemented, the crest wall could be raised further, or an earthwork solution could be implemented either over the crest wall or to the rear.
- Section 3: this section comprises of raising the sluice gate by year 2075 to allow continued drainage of the lake. The crest level of the sea wall above the sluice gate would still require raising in line with Section 2 and 3. An earthworks solution is recommended and the use of more vertical earthwork solutions such as FLEX MSE should be explored to minimise encroachment into the lake and allow access to the sluice gate for maintenance.
- Section 4: as per Section 1, a crest wall solution is recommended to minimise encroachment. The use of more vertical earthwork solutions should also be explored to minimise the encroachment.

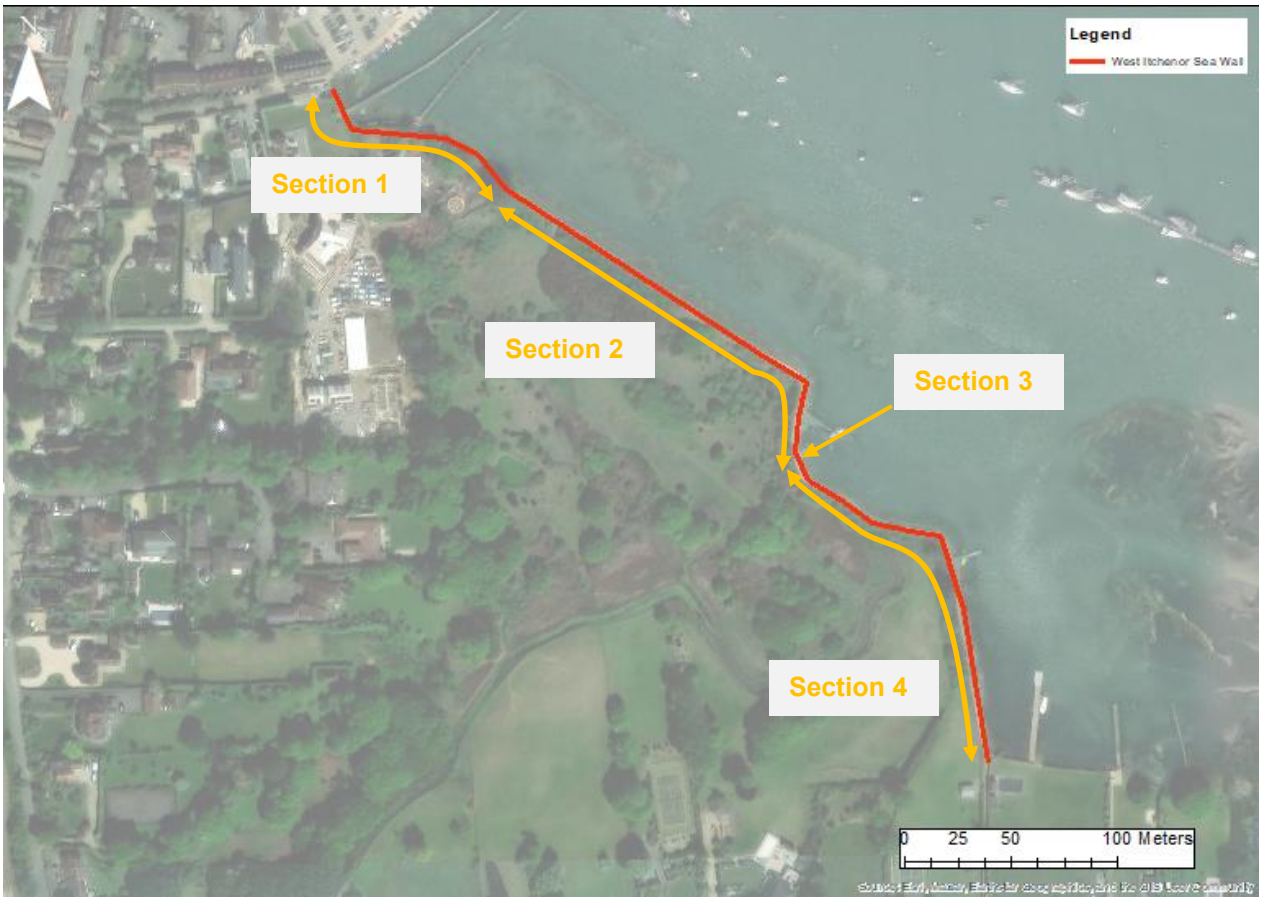


Figure 4-1: Stage Two (B) - Sections

A1 West Itchenor Sea Wall - Background

A2 Maintenance and Reinforcement of West Itchenor Sea Wall Terms of Reference for Consultants

A3 Additional Predicted Extreme Water Levels

Table A3.1: Predicted extreme water levels within Chichester Harbour (output point 4604_3) – (UKCP18 RCP8.5 70th percentile)

Return Period	Total water level (mOD)				
	2025 (present day)	2050 (+25yrs)	2075 (+50yrs)	2100 (+75yrs)	2125 (+100yr)
T1	2.91	3.09	3.34	3.65	3.98
T5	3.08	3.26	3.51	3.82	4.15
T10	3.15	3.33	3.58	3.89	4.22
T20	3.22	3.40	3.65	3.96	4.29
T50	3.31	3.49	3.74	4.05	4.38
T75	3.35	3.53	3.78	4.09	4.42
T100	3.38	3.56	3.81	4.12	4.45
T200	3.45	3.63	3.88	4.19	4.52
T500	3.55	3.73	3.98	4.29	4.62
T1000	3.62	3.80	4.05	4.36	4.69

Table A3.2: Predicted extreme water levels along the open coast (output point 4602) – (UKCP18 RCP8.5 70th percentile)

Return Period	Total water level (mOD)				
	2025 (present day)	2050 (+25yrs)	2075 (+50yrs)	2100 (+75yrs)	2125 (+100yr)
T1	2.77	2.95	3.20	3.51	3.84
T5	2.93	3.11	3.36	3.67	4.00
T10	3.00	3.18	3.43	3.74	4.07
T20	3.07	3.25	3.50	3.81	4.14
T50	3.16	3.34	3.59	3.90	4.23
T75	3.20	3.38	3.63	3.94	4.27
T100	3.23	3.41	3.66	3.97	4.30
T200	3.30	3.48	3.73	4.04	4.37
T500	3.40	3.58	3.83	4.14	4.47
T1000	3.47	3.65	3.90	4.21	4.54

Table A3.3: Predicted extreme water levels within Chichester Harbour (output point 4604_3) – (UKCP18 RCP8.5 95th percentile)

	Total water level (mOD)				
	2025 (present day)	2050 (+25yrs)	2075 (+50yrs)	2100 (+75yrs)	2125 (+100yr)
T1	2.91	3.15	3.48	3.90	4.36
T5	3.08	3.32	3.65	4.07	4.53
T10	3.15	3.39	3.72	4.14	4.60
T20	3.22	3.46	3.79	4.21	4.67
T50	3.31	3.55	3.88	4.30	4.76
T75	3.35	3.59	3.92	4.34	4.80
T100	3.38	3.62	3.95	4.37	4.83
T200	3.45	3.69	4.02	4.44	4.90
T500	3.55	3.79	4.12	4.54	5.00
T1000	3.62	3.86	4.19	4.61	5.07

Table A3.4: Predicted extreme water levels along the open coast (output point 4602) – (UKCP18 RCP8.5 95th percentile)

Return Period	Total water level (mOD)				
	2025 (present day)	2050 (+25yrs)	2075 (+50yrs)	2100 (+75yrs)	2125 (+100yr)
T1	2.77	3.01	3.34	3.76	4.22
T5	2.93	3.17	3.50	3.92	4.38
T10	3.00	3.24	3.57	3.99	4.45
T20	3.07	3.31	3.64	4.06	4.52
T50	3.16	3.40	3.73	4.15	4.61
T75	3.20	3.44	3.77	4.19	4.65
T100	3.23	3.47	3.80	4.22	4.68
T200	3.30	3.54	3.87	4.29	4.75
T500	3.40	3.64	3.97	4.39	4.85
T1000	3.47	3.71	4.04	4.46	4.92

A4 West Itchenor Drains

A5 Preliminary Ecological Appraisal Report