

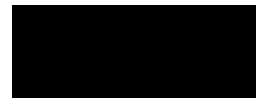
Barmouth North Promenade OBC

Welsh Government Overview Presentation

23rd January 2020



Llywodraeth Cymru
Welsh Government



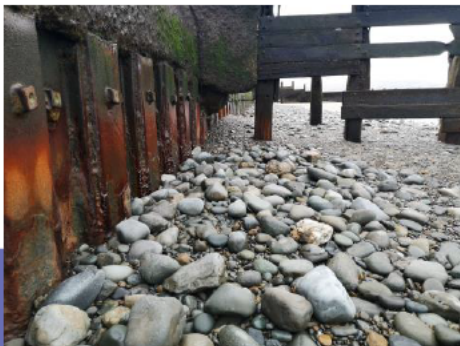
Overview

Why?

- The study area is at significant risk of coastal flooding and erosion
- Existing defences residual life <10 years - a breach is anticipated
- Vibrant coastal community at risk without appropriate safe-guarding

Recommended solution

- Managed adaptive approach
- We recommend the project is approved with a non-discounted budget for Epoch 1 and 2 capital works (excluding maintenance) of £22,559k including optimism bias of £8,307k.
- Benefit cost ratio conservatively estimated as 1:2.4



Objectives

Gwynedd Council seek a solution to:

- Reduce coastal flood and erosion risk to Barmouth North Promenade
- Improving the amenity and environmental value of this section of coastline
- Safeguard local community and tourism economy

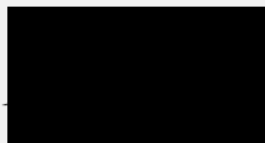
Investment Objectives

SMART	Objective description
1	To reduce the threat of coastal flood and erosion risk to people and property with due consideration of SMP2 policy to ensure the long-term resilience and vitality of the community.
2	To support, and where possible enhance, recreation and amenity value of the local area
3	To maintain, and where possible enhance, the environment.
4	To ensure marine amenity activities can continue to grow.
5	To ensure an affordable and deliverable whole life option through a partnership approach and contributions

Critical Success Factors

No	Critical Success Factor
1	Strategic Fit and Business Needs <i>How does the proposed option fit with the local flood risk strategy?</i>
2	Potential Value for Money <i>The option must represent value for money (i.e. the benefits must outweigh costs)</i>
3	Supplier Capacity and Capability <i>The option must match the capacity to deliver of potential supplies.</i>
4	Potential Affordability <i>The option must be eligible for funding from the intended Funding Organisation.</i>
5	Potential Achievability <i>The option must be physically possible to construct or deliver and the RMA must be able to maintain it in the long-term</i>

Approach



OBC Development

Project inception and start-up
Defining clients ambitions, problems and a site visit to understand the site in further detail

Strategic Case
Understand the FCERM, Environmental, Social & Economic context within which the FCERM scheme sits

Economic Case
Define and assess the longlist and shortlisted options to select and develop a preferred option

Commercial Case, Financial Case and Management Case
Led by Gwynedd Council

Finalisation of OBC
Submission to Client and WG

Supporting Studies

Shoreline Management Plan 2 (2011)

Gwynedd Council Local Flood Risk Management Strategy (2013)

Anglesey and Gwynedd Joint Local Development Plan (JLDP) (2017)

Economic Appraisal (Arup)

SMP2 Policy Context Definition (Arup)

Benefits and Opportunity Mapping (Arup)

Geotechnical Desk Study (Arup)

Existing Structure Assessment (Arup)

Stakeholder Engagement (Gwynedd, with support of Arup)

Wave and Overtopping Modelling and Coastal Processes (ABPmer)

Inundation Modelling (Arup)

Environment and Ecological Appraisal (Gwynedd)

Longlist and Shortlist Option Assessments (Arup)

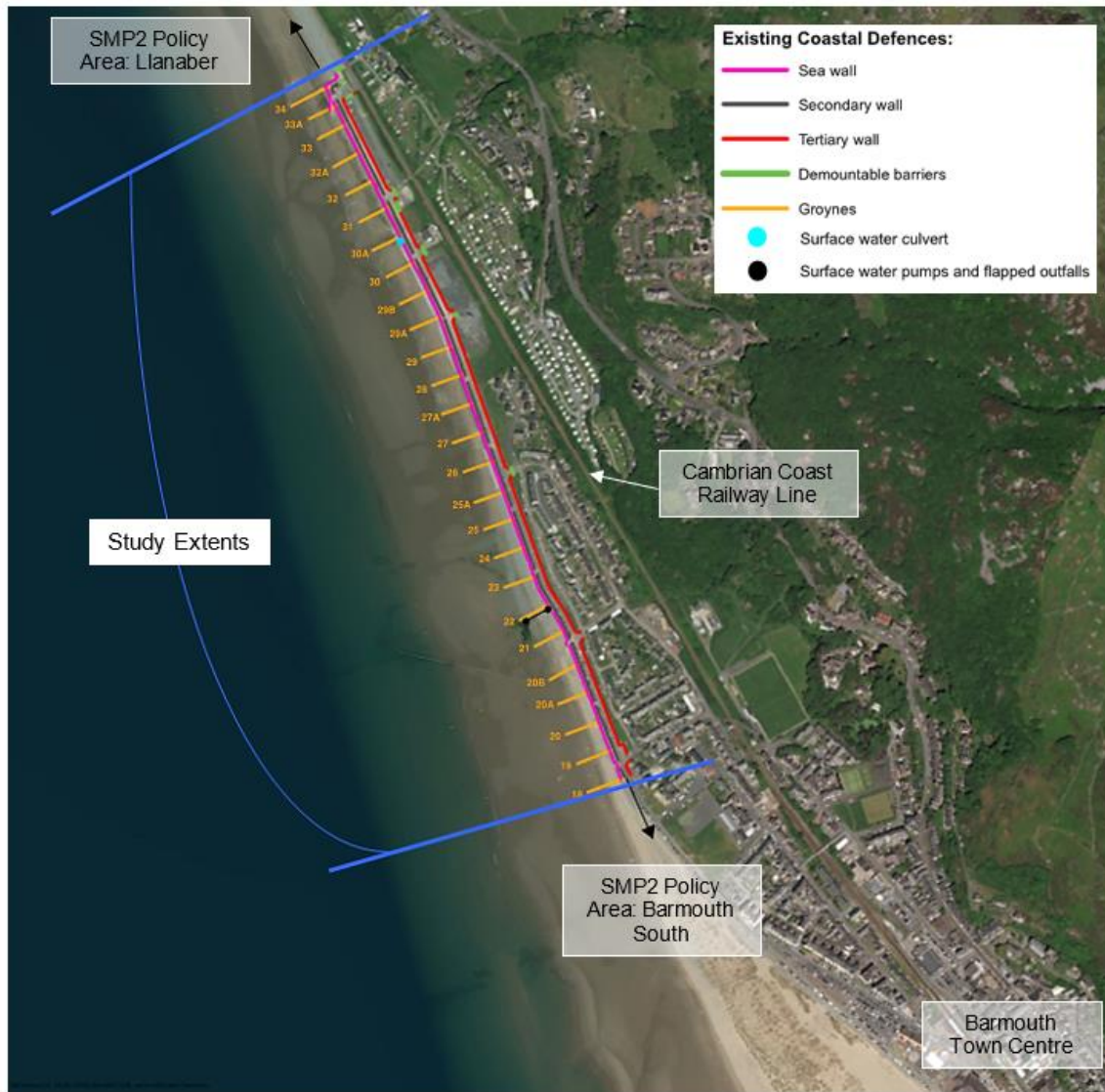
Preferred Option Drawings and Risk Register (Arup)

Overview: Strategic Case



Overtopping and coastal flooding experienced in January 2014 (images copyright: Mike Alexander)

Context



Context

FCERM strategic fit

National Strategy for Flood and Coastal Erosion Risk Management in Wales (2010)

Shoreline Management Plan 2 (2011)

MA 24 BARMOUTH: From Porth Aberamffra to Llanaber Point

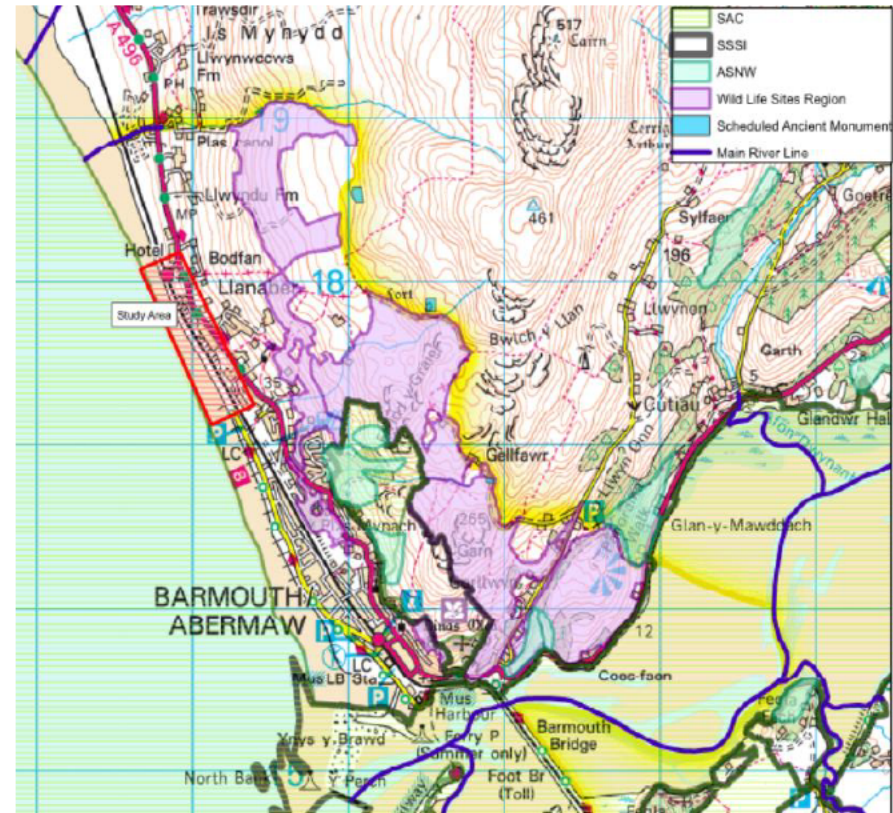
Policy Unit		Policy Plan			Comment
		2025	2055	2105	
11.14	Barmouth South	HTL	HTL	HTL	
11.15	Barmouth North	HTL	MR	MR	This may include relocation of properties
11.16	Llanaber	HTL	HTL	HTL	This needs to be considered in term of management to the above policy unit.

Key: HTL - Hold the Line, A - Advance the Line, NAI - No Active Intervention
MR - Managed Realignment

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day	Maintain existing defences.
Medium term	Develop strategy to look at opportunities for MR at north Barmouth.
Long term	Maintain defences.

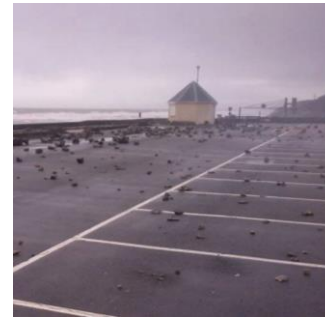
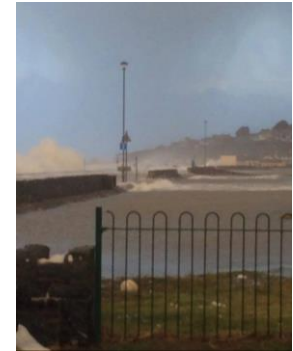
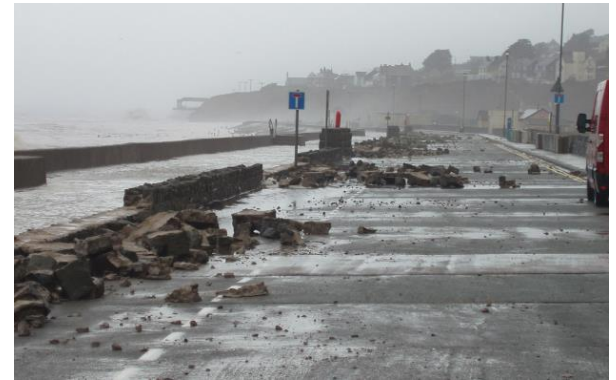
Sustainability and well-being strategic fit



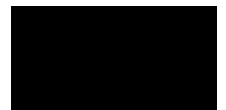
Environmental Appraisal

- Pen Llyn a'r Sarnau SAC - 171m south-west
- Two local watercourses are a Welsh Priority Habitat and River Corridors have a Gwynedd council Biodiversity Habitat Action Plan

The flood or erosion problems



- Failing assets
- Risk to life
- High flood risk
- Un-safe beach structures



Overview: Economic Case



Overtopping of promenade at Barmouth in
10th December 2014



Wave overtopping at North Barmouth
during Storm Brian (21st October 2017)



Approach to options assessment

1. Options Framework Filter to identify the long-list
 - Should be applied to identify reasonable limits of the long-list
2. Identify measures to deliver the long-list
 - Using the Options Framework Filter, a range of potential measures should be identifies (including natural processes)
 - Consider 'source-pathway-receptor' concept
 - Consider multiple benefits
3. Screen the performance of each measure to inform shortlist
 - *Screen performance to reduce list of potential measures to a shorter list*
 - Following an objective-led appraisal approach
4. Access the performance of each measure to inform selection of preferred option
 - Engineering performance
 - Sustainability and well-being performance
 - Economic performance
 - Financial Performance



Baseline Definition: Overtopping Results

Table 8. Profile 1 Base Case: Overtopping rates for Barmouth North Promenade Northern Section

Return Period	AEP (%)	Overtopping Rate (l/s/m)		
		Epoch 2019	Epoch 2069	Epoch 2119
1:1	100	29	38	121
1:10	10	88	124	null
1:50	2	126	180	null
1:100	1	145	207	null
1:200	0.5	163	246	null
1:1000	0.1	219	null	null

Hazard Type and Reason	Mean Discharge Q (l/s/m)
No damage to embankment/seawall if crest and rear slope are well protected.	50 – 200
No damage to embankment/seawall crest and rear face of grass covered embankment of clay.	1 – 10
Damage to paved or armoured promenade behind a seawall.	200
Damage to grassed or lightly protected promenade.	50

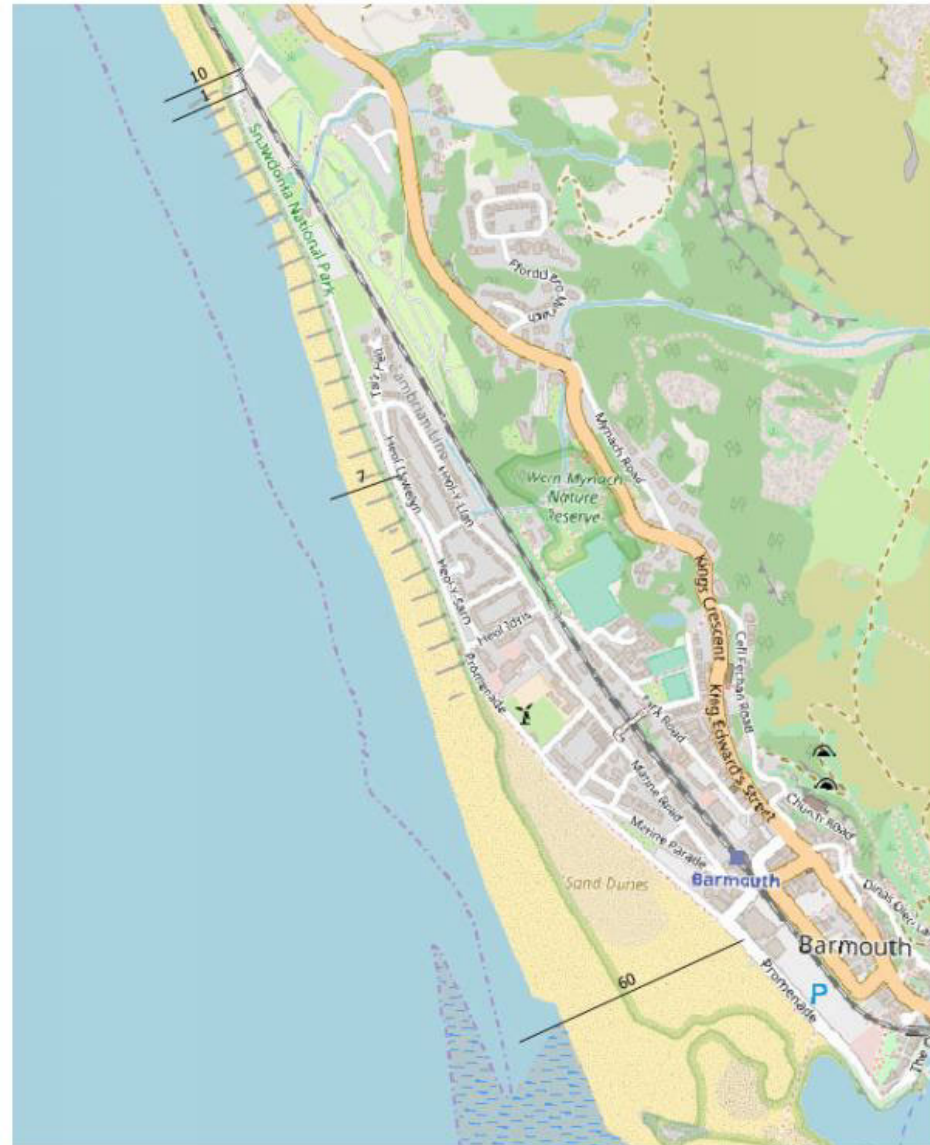
Source: EurOtop, 2007

Table 9. Profile 7 Base Case: Associated Overtopping rates for Barmouth North Promenade Southern Section

Return Period	AEP (%)	Associated Overtopping Rate (l/s/m)		
Event from Northern Section of North Promenade (Profile 1)		Epoch 2019	Epoch 2069	Epoch 2119
1:1	100	10	16	49
1:10	10	22	38	no associated event available
1:50	2	31	66	no associated event available
1:100	1	48	72	no associated event available
1:200	0.5	46	101	no associated event available
1:1000	0.1	59	no associated event available	no associated event available

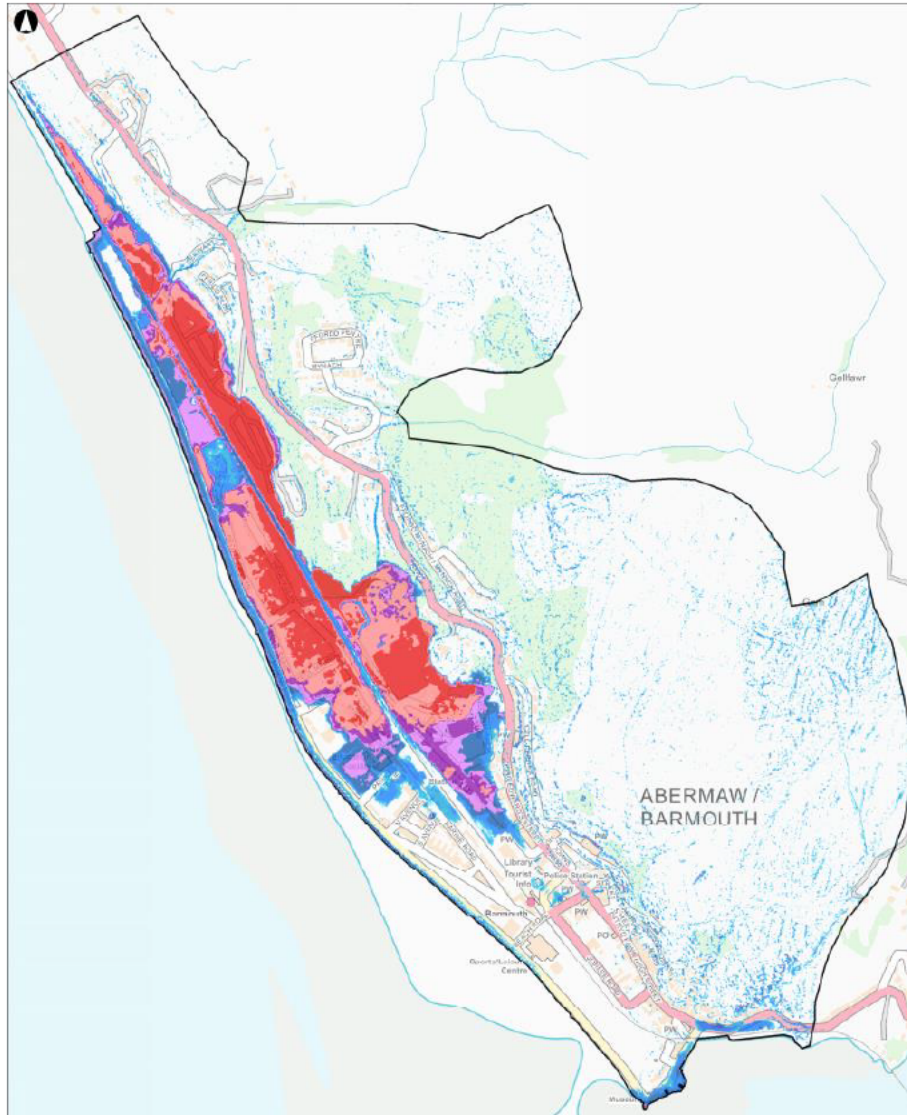
Table 10. Profile 10 Base Case: Associated Overtopping rates for shingle ridge

Return Period	AEP (%)	Associated Overtopping Rate (l/s/m)		
Event from Northern Section of North Promenade (Profile 1)		Epoch 2019	Epoch 2069	Epoch 2119
1:1	100	6	9	17
1:10	10	12	16	no associated event available
1:50	2	14	27	no associated event available
1:100	1	27	33	no associated event available
1:200	0.5	24	56	no associated event available
1:1000	0.1	26	no associated event available	no associated event available



Baseline Definition: Flooding and Coastal Erosion

Baseline: 2019 Coastal (200yr) Rainfall (2 yr)



SMP2: 100 year Erosion Range (Indicative)

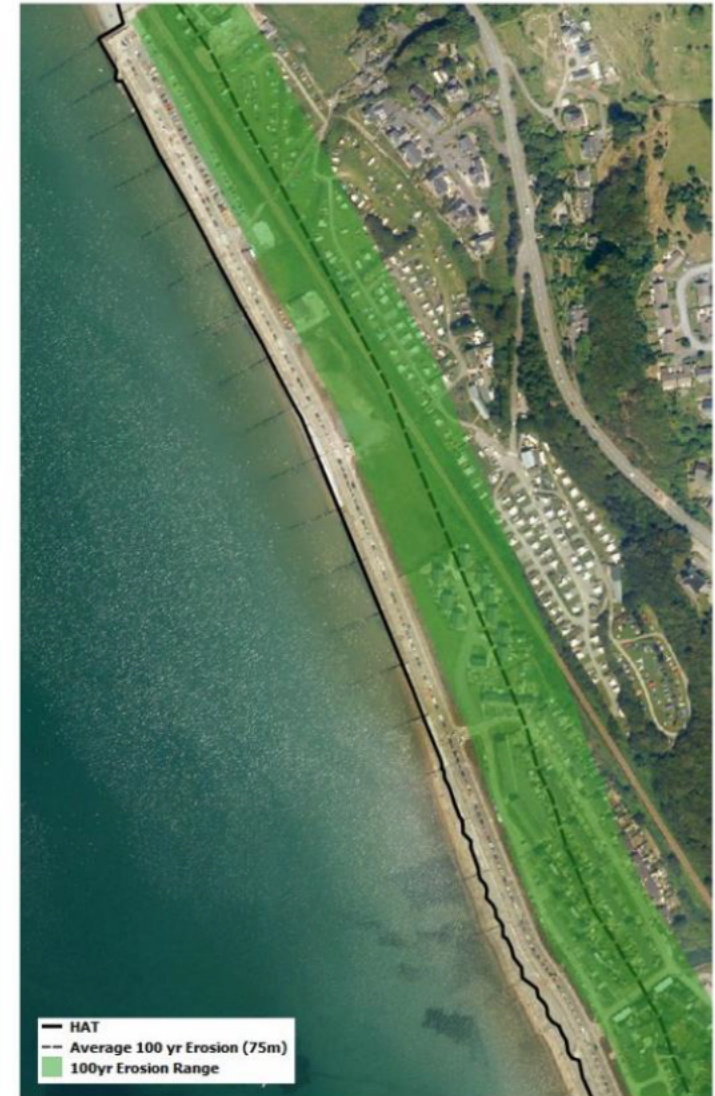


Figure 27 Potential erosion over 100 year period based on SMP2 NAI scenario

Longlist and shortlist screening

	Option	Overview / Description	Life-Span				Engineering Performance	Economic Performance	Environmental Performance	Social & Well-Being Performance	Financial Performance
			Epoch 1 0-20 yrs	Epoch 2 20-50 yrs	Epoch 3 50-100 yrs	Epoch 4 +100 yrs					
1	Baseline - Walkaway & Business As Usual	Residual life of the sea wall and revetment is considered to be <10 years and <20 years for the Walkaway and BAU					Unacceptable level of risk to community.	Significant damages, regular monitoring, H&S risks	Impacts on the Pen Llyn ar Sarnau SAC		Significant risks to property, life and the wider tourist town
2	Extending lifespan and improve existing defences	Option involves: • Extending the life • Improve and secondary tertiary flood wall,					Beyond Epoch 2 an increased level of risk.	Protection to properties (up to 2069)	Limited	Protects Barmouth North Promenade	Least, but significant cost
3	Improved beach management, supported by stabilising structures such as breakwaters or groynes.	Combination of groynes and offshore breakwater options to stabilise beach material.					1 in 200 year SOP up to 2119 - practicality and amenity constraints may limit	Of significant cost to achieve benefits	Direct loss of beach habitat directly adjacent to the Pen Llyn ar Sarnau SAC	Protects Barmouth North Promenade. May impact on access and amenity.	Option is of significant cost – unable to fund
4	Managed Realignment	New line of defence to protect the railway line					Long-term sustainable FCERM scheme	Of significant cost and associated risks,	Promote habitat creation (limited)	Potential negative implications on local residents and businesses, opportunity to create further amenity	High capital and decommissioning costs. require government support and funding.

Stakeholder Engagement: 25th March



Morning information session:

Public service organisations - Network Rail, Local Councillors, NRW etc

Feedback: All participants recognised the need to sustain and improve the defences and gave their support

Afternoon public drop in event:

45+ local residents

Feedback:

- Public support the need to improve the defences at Barmouth North Promenade.
- Historical and present-day observations supporting inundation modelling
- Residents recognised vulnerability of existing defences and concerned about of long timescales for action
- Asset valued by the general public (amenity, recreation and health benefits)
- Option 2 (Betterment of Existing Defences) preferred option

Economics – Benefit Summary

Property count for the epochs including climate change (worst case) for Baseline option

Return Period	NCC (Present day, no climate change (CC))						CC2069						CC2119					
	1	10	50	100	200	1000	1	10	50	100	200	1000	1	10	50	100	200	1000
Baseline	14	300	322	757	760	761	261	>261	>538	>757	>760	>761	>261	>261	>538	>757	>760	>761

Component	(£k) Present Value Damages	Key areas of uncertainty
Flood Related Damages		
Flood damages avoided	£99,767	Extents and severity of flooding. Defence failure/breach due to defects such as voiding.
Erosion Related Damages		
Loss of properties	[Excluded – up to 60 properties affected]	High level of uncertainty
Cambrian Coastal Railway	[Excluded - benefits of protecting asset are +£m's and safe-guarding is imperative]	Significant cost uncertainties, benefits are considered qualitatively.
Recreational Benefits	[Excluded - may reduce the appeal of Barmouth]	Insufficient data to consider Barmouth North and South separately
Damage to utilities infrastructure (services replacement)	£100	Cost of diversion works & replacement services.
Total	£99,867	
• A precautionary and conservative approach • Predicted rates of overtopping exceeded industry analytical methods - modelling is only available for 2019 and 2069 • Significant potential damages are excluded due to uncertainties		

Adaptive Pathways

- Delivering resilient solutions in the face of changing uncertainty
- Managed adaptive approach involves investing now in actions that manage today's risks, monitoring the change in risk over time and managing these changes.
- Involves planning for multiple interventions and investments in the future, although the future choices and the timing of these interventions will be uncertain
- Adaptive planning provides an approach to support the incorporation of uncertainty into investment decision making



Economics: Options

	Option 2	Option 3	Option 4a	Option 4b	Comments
OBC to construction (£k):					
Subtotal	£899	£2,516	£8,029	£5,983	30% Optimism Bias
Construction (£k):					
Subtotal	£16,055	£56,492	£47,257	£31,539	60% Optimism Bias
Future costs (scheme implemented at Year 0):					
Subtotal	£62	£2,864	£72	£72	60% Optimism Bias applied
Total	£17,016	£61,872	£55,359	£37,594	

	Epoch 1 0-20 years	Epoch 2 20-50 years	Epoch 3 50-100 years
Pathway A	Option 2: Betterment of defences Precautionary SOP reducing to 1 in 50 by 2069		Option 4: Managed Realignment (SMP2) Adaptive SOP 1 in 200
Pathway B	Option 2: Betterment of defences SOP 1 in 200 in 2019	Option 4: Managed Realignment (SMP2) Adaptive SOP 1 in 200	
Pathway C	Option 2: Betterment of defences Precautionary SOP reducing to 1 in 50 by 2069		Option 3: Beach Management Adaptive SOP 1 in 200
Pathway D	Option 2: Betterment of defences SOP 1 in 200 in 2019	Option 3: Beach Management Adaptive SOP 1 in 200	
Pathway E	Option 3: Beach Management Adaptive SOP 1 in 200		
Pathway F	Option 2 + Option 3 Adaptive SOP 1 in 200		
Pathway G	Option 2: Betterment of defences Precautionary SOP reducing to 1 in 50 by 2069		Option 4b: Managed Realignment (North) Adaptive SOP 1 in 200
Pathway H	Option 2: Betterment of defences SOP 1 in 200 in 2019	Option 4b: Managed Realignment (North Only) Adaptive SOP 1 in 200	

Pathway	PV Flood Damages (£k)	PV Flood Benefits (£k)	PV Costs (£k)	Benefit Cost Ratio	Incremental Benefit Cost Ratio
Baseline	£99,867	£0			
Pathway G	£29,221	£70,304	£26,395	2.7	

Preferred Option

	Epoch 1 0-20 years	Epoch 2 20-50 years	Epoch 3 50-100 years
Pathway G	Option 2: Betterment of defences Precautionary SOP reducing to 1 in 50 by 2069		Option 4b: Managed Realignment (North) Adaptive SOP 1 in 200

Economic Summary

Total PV Benefits (£k) (1 in 50 year – 2069)

£70,304

PV Cost

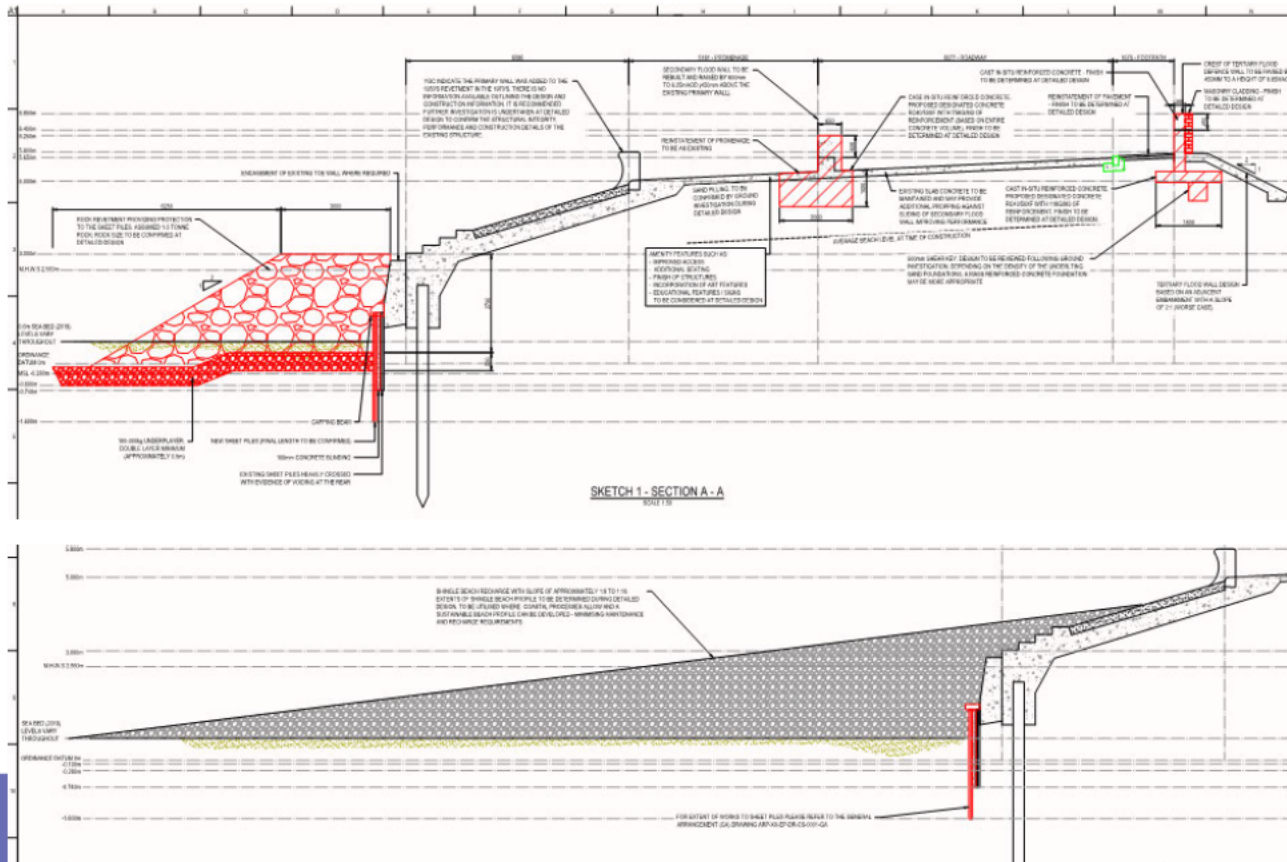
Option 2: £22,717
Combined: £29,428

Benefit Cost Ratio (Option 2)

3.1

Benefit Cost Ratio (Option 2 and Option 4a in Epoch 3)

2.4



Preferred Option

Proposed Scheme	PV Costs (£k)	Non Discounted Costs (£k)	Comments
Gwynedd Council staff costs	£145	£145	Gwynedd Council Costs (2019) weekly rate based on construction period
Consultant fees	£481	£481	Assume 5% of construction cost for detailed design stage. Costs to include further detailed modelling so support the detailed design analysis.
Cost consultant fees	£19	£19	1 day/week for 45 weeks for £55/hr
Site investigation/survey	£77	£77	- o Trial pits along the promenade for the proposed secondary/ tertiary wall and at existing sheet pile - o Structural coring of the existing wall to inform the design - o Windowless sampling along the beach, supplemented with a small number of boreholes, to inform the settlement analysis and foundation details of the proposed rock armour. This will also inform the temporary works design for the sheet pile refurbishment. Includes 10% contingency.
Utility Diversions	£0	£0	No diversions anticipated as part of the scheme, based on initial review
Early Contractor Involvement	£25	£25	One off cost to include drawings review, based on previous project experience.
Other	£32	£32	Marine licencing and stakeholder engagement
Optimism bias	£224	£224	30% applied to 'OBC to Construction' costs due to uncertainty pending ongoing study and further survey.
<i>OBC to Construction Subtotal</i>	<i>£1,004</i>	<i>£1,004</i>	<i>Assumed to occur in Year 0.</i>
Construction and Construction Support	£13,472	£13,472	PV Capital cost, based on estimate from Gwynedd Council Twynn Scheme. Includes: - Preliminaries, overheads and profit: 25% - Contingency (including inflation): 15% Construction Period: Year 2 – March 2021 – June 2021 7wks +4wks de/re-mob Year 2 – Sept 2021 – Oct 2021 17wks+4wks de/re-mob Year 3 – March 2022- June 2022 7wks +4wks de/re-mob Year 3 – Sept 2022 – Oct 2022 17wks+4wks de/re-mob
Optimism bias	£8,083	£8,083	60% applied to 'OBC to Construction' and 'Construction' costs due to uncertainty pending ongoing study and further survey. Nominal allowance for Network Rail BAPA and reinstatement/replacement of street furniture, signposting, and amenity features included as Optimism Bias.
<i>Subtotal</i>	<i>£22,559</i>	<i>£22,559</i>	
Future costs (maintenance)	£158	£363	PV Maintenance cost to include minor concrete repair works to sea wall, promenade and reseating of the rock armour and reinstatement of shingle.
Optimism bias	£95	£218	60% applied to 'OBC to Construction' and 'Construction' costs due to uncertainty pending ongoing study and further survey.
Total	£22,717	£23,139	

Preferred Option Costs were also calculated utilising the EA Long-term Costing Tool and Gwynedd Council In-house quantity surveyor (2019). Each assessment indicated similar capital construction costs (ie between £8 – 10million) with an additional 25% preliminaries and 10% contingency (including inflation). Note, that costs have increased slightly from shortlisting stage.

Risks

	Key Risks	H/M/ L	Owner	Mitigation
1.	Funding – the ability of GC to realise match funding requirements for the construction phase	M	Gwynedd / WG	Early Contractor Involvement Continued dialog between GC and WG
2.	Condition and performance of existing defences	H	Gwynedd	Structural investigation and surveys to confirm structural integrity, performance and construction
3.	Design of preferred option based on assumed wave loading. There is no empirical method to calculate wave loads for this geometry	H	Gwynedd	Physical coastal modelling required at detailed design to define wave loading.
4.	Statutory – delay in obtaining planning permission / marine licence	M	Gwynedd	Early pre-application consultation with the LPA (GC) and NRW.
5.	Delivery of project within current WG funding cycle.	L	Gwynedd / WG	Ensure that all other risk are mitigated as far as possible and that continued dialog
6.	Acceptability of the project by local residents and local businesses	L	Gwynedd	Early consultation with residents and business owners
67.	Environmental – delay in obtaining environmental consents and acceptance of scheme by SEBs	L	Gwynedd	Early environmental screening and assessment and consultation with statutory environmental bodies.

Thank you for your time,

Discussion

