

Appraisal Summary Table – PAR Options					
Project Name	Sandsend Coast Protection Scheme – Revetment Options				
Description of Key Problems	<p>Summary:</p> <p>Key Problems:</p> <ul style="list-style-type: none"> • Outflanking of eastern end of concrete revetment. • Instability/erosion of slope directly above revetment. • Variable beach levels. • Residual life of revetment. 				
Option	Option 1: Baseline (Do Nothing)	Option 2 (Do Minimum)	Option A: Major upgrade/refurbishment of existing structure	Option B: Rock Armour Revetment	Option C: Concrete Stepped Revetment
Overview Description	<p>Do Nothing: no further maintenance or capital works are carried out.</p> <p>Without maintenance the existing concrete revetment will continue to fail in large sections leading to total failure of the asset and commencement of coastal erosion. The A174 road would be lost to coastal erosion by year 20.</p>	<p>Revetment continues to be patched up on an annual basis at increasing expense, to prolong its residual life.</p> <p>However due to rapid deterioration, multiple methods of failure and overall poor condition of the asset it will not be possible to prolong the life of the asset by much; the residual life of the asset with maintenance is estimated at 5 years.</p> <p>Once the residual life of the asset is over the revetment will fail as under Do Nothing, and erosion commence leading to loss of the A174 road.</p> <p>No capital works would be carried out to delay the erosion at the sections in MU6 and MU7A where the coastal defence assets are virtually obsolete. Therefore erosion and road loss would be as under Do Nothing scenario; Year 20.</p>	<p>Major upgrading and refurbishment of existing structures with rock armour at eastern end of scheme (as proposed in the original 2002 Whitby Coastal Strategy): phased approach, progressively refurbishing the revetment and addressing priority areas first.</p> <p>Works would include measures to protect toe from undercutting, measures to protect top of slope to prevent wash out, and install measures to minimise force of wave attack and run-up</p>	<p>A rock armour revetment would be constructed on top of the existing revetment, after the concrete surface had been broken out. The revetment would be constructed to approximately the same height as the existing revetment and would continue across the front of Raithwaite Ravine (either in-filled with new fill material or excavated material from slope Option AC), and into MU7 to provide a transition from the scheme into the area of No Active Intervention and prevent outflanking.</p> <p>The bedrock would be excavated to a depth of approximately 2m and the toe of the rock armour revetment tied in to prevent undercutting.</p> <p>Improvements to drainage outfalls from the road gullies would be made, and new outfalls incorporated for Newholme Beck at Raithwaite Ravine and the unnamed watercourse close to Raven Hill Farm.</p>	<p>A reinforced concrete stepped revetment would be constructed on top of the existing revetment, after the concrete surface had been broken out and the fill material reprofiled to a suitable profile. The revetment would be constructed to approximately the same height as the existing revetment.</p> <p>The concrete revetment would end at the edge of Raithwaite Ravine and tie into a new rock armour revetment across the front of the fill material placed in Raithwaite Ravine (either in-filled with new fill material or excavated material from slope Option AC). The rock armour revetment would continue into MU7 to provide a transition from the scheme into the area of No Active Intervention and prevent outflanking.</p> <p>The bedrock would be excavated to a depth of approximately 2m and the toe of the concrete revetment tied in to prevent undercutting.</p> <p>Improvements to drainage outfalls from the road gullies would be made, and new outfalls incorporated for Newholme Beck at Raithwaite Ravine and the unnamed watercourse close to Raven Hill Farm. Additional drainage through the concrete revetment would be installed to allow discharge of ground water and ingressed seawater without damaging the revetment.</p>
Technical Issues	<p>As the revetment fails there will be health and safety issues for beach users, with potential for sections of revetment to collapse onto members of the public. Similarly, once the road starts to be eroded there is potential for large sections of the road to fall onto the beach from height, posing a risk to members of the public using the beach below.</p>	<p>The condition of the revetments is such that routine maintenance consists of emergency repairs to the revetment in response to partial collapses to the toe and upper slopes of the revetment. The frequency and extent of these patch repairs are increasing and so to the costs.</p>	<p>A progressive approach to upgrading the revetment would present technical difficulties in creating a coherent revetment without weak points in the continuity of the surfacing, e.g. at the joints between the upgraded sections.</p> <p>The residual life of the asset is estimated at 5 years with maintenance, therefore the rolling programme of works would have to be carried out within this timescale to prevent large scale failure and onset of erosion in any sections that the progressive upgrade works have not yet reached.</p>		
Assumptions/Uncertainties	<p>Road will be lost in Year 20.</p>	<p>It has been assumed that the revetment can only be patched up for another 5 years due to the increasing degradation of the assets and extent of emergency works required.</p> <p>The patch up works for the revetment will not delay the loss of the Road, as erosion in MU's 6 & 7 where the defences are virtually obsolete will result in the loss of the Road (at the pinch point and Raithwaite Ravine) in Year 20.</p>	<p>There are larger uncertainties associated with this progressive approach regarding providing a robust defence asset that will provide the design life that is being aimed for. Present experience of maintaining and patch repairing the revetment shows that subsequent deterioration of the revetment can focus on sections adjacent to the recent repairs.</p>	<p>Maintenance for this option would include replacement of rocks and maintenance of the profile of the revetment following storms, and maintenance of the drainage systems.</p>	<p>Maintenance for this option would include concrete repairs following storms, maintenance of the drainage systems and joints. Additionally for the rock armour section maintenance would be required including replacement of rocks and maintenance of the profile of the revetment following storms.</p>
Approaches to adaptation	None	None			
Category	Description and Quantification of Impacts	Description and Quantification of Impacts	Description and Quantification of Impacts	Description and Quantification of Impacts	Description and Quantification of Impacts
Economic Impacts					
Properties	Based on SMP erosion lines 1 property (doctor's surgery) would	Property would become at risk after assets have	Do Nothing damages avoided; properties would	Do Nothing damages avoided; properties would	Do Nothing damages avoided; properties would

	be lost by Year 50, and additional 15 by year 100. In total 10 residential and 6 commercial properties would be at risk. PVd = £111k	failed, however the losses would be delayed by ~5 years compared to the Do Nothing. Therefore some properties would no longer be at risk until after the end of the 100 year appraisal period. PVd = £13k	continue to be protected	continue to be protected	continue to be protected
Emergency Costs	Emergency services (police and ambulance) will be forced to use longer route (22km diversion), resulting in longer response times. Therefore increased risk to life for patients.	Although Do Minimum would prolong life of asset by 5 years through maintenance, the A174 would still be lost by year 20 as under the Do Nothing scenario in MUs 6 & 7 where the defences are virtually obsolete and therefore damages across the full A174 length (MUs 2-7) would occur as under Do Nothing.	Do Nothing damages avoided; road would continue to be protected	Do Nothing damages avoided; road would continue to be protected	Do Nothing damages avoided; road would continue to be protected
Infrastructure	2583m BT, 1360m Transco services, 1503m Yorkshire Water, and 493m of Northern Electric services. PVd = £828k	Do Nothing impacts would be delayed by ~5 years in MU4CD and MU5 due to maintenance of revetment, however no delay in MU6 and MU7A where the defences are virtually obsolete. PVd = £742k	Do Nothing damages avoided; road and services within it would continue to be protected	Do Nothing damages avoided; road and services within it would continue to be protected	Do Nothing damages avoided; road and services within it would continue to be protected
Transport	1150m of A174 main road would be lost, resulting in major traffic diversions of 22km. PVd = £100,731k	A174 would be lost as under the Do Nothing scenario in MUs 6 & 7 where the defences are virtually obsolete and therefore damages across the full A174 length (MUs 2-7) would occur as under Do Nothing. PVd = £100,731k	Do Nothing damages avoided; road would continue to be protected. However increased congestion during construction period, which would occur repeatedly as the works are carried out progressively over consecutive years, leading to prolonged disruption.	Do Nothing damages avoided; road would continue to be protected. However increased congestion during construction period	Do Nothing damages avoided; road would continue to be protected. However increased congestion during construction period
Agriculture	Limited impact – some loss of land from edge of fields at top of coastal slope, as the slope retreats due to coastal erosion. Approximately 50m retreat over 100 years. Damages would not be significant and therefore have not been valued.	Although Do Minimum would prolong life of asset by 5 years through maintenance, the A174 would still be lost by year 20 as under the Do Nothing scenario in MUs 6 & 7 where the defences are virtually obsolete and therefore damages across the full A174 length (MUs 2-7) would occur as under Do Nothing.	Do Nothing impacts avoided, erosion will be prevented.	Do Nothing impacts avoided, erosion will be prevented.	Do Nothing impacts avoided, erosion will be prevented.
Tourism	Loss of road would turn Sandsend from the tourist destination on the coastal through route to a dead-end destination. Large impact on tourism potential of the village is expected.		Do Nothing impacts avoided.	Do Nothing impacts avoided.	Do Nothing impacts avoided.
Indirect effects on business	Loss of the A174 is likely to impact on the businesses in Sandsend that rely on the tourist trade. Sandsend would no longer be a through route on the coastal road and would no longer be easily accessible from Whitby by vehicle. Therefore it is likely that tourist numbers would fall.		However during construction there will be some disruption due to increased traffic on the road and closure of the beach in the vicinity of the works. As the works are progressive and construction will be spread over several years this will be a prolonged period of disruption, which may impact on repeat tourist visits to the area.	However during construction there will be some disruption due to increased traffic on the road and closure of the beach in the vicinity of the works.	However during construction there will be some disruption due to increased traffic on the road and closure of the beach in the vicinity of the works.
Environmental Impacts					
Geology & Coastal Processes	Asset would fail, and then coastal erosion processes would commence, resulting in cliff top recession.		Do Nothing impacts would be avoided. However there is a greater risk of damage/failure of asset at join between sections of upgraded revetment due to issues with continuity in asset.	Do Nothing impacts would be avoided	Do Nothing impacts would be avoided
Ecosystem Services	The option would result in the loss of a large section of Upgang to Sandsend coastal slope SINC and Maritime Cliff and Slope BAP habitat as the coastline retreats.	Do Nothing impacts would be delayed by ~5 years in MU4CD and MU5 due to maintenance of revetment, however no delay in MU6 and MU7A where the defences are virtually obsolete.	Do Nothing impacts would be avoided	Do Nothing impacts would be avoided	Do Nothing impacts would be avoided
Change in Status under WFD	Water quality in the coastal waterbody would likely be reduced due to the release soils within the coastal slope as slope fails. This could potentially affect the chemical and physico chemical quality elements of the waterbody depending on the potential presence of contaminants. There are likely to be impacts on the biological quality elements of due to smothering of benthic communities from increased fines entering the system.		Do Nothing impacts would be avoided	Do Nothing impacts would be avoided	Do Nothing impacts would be avoided
Historic Environment	3 listed buildings, 22 Cultural Heritage Sites, 3 Archaeological Event Sites, and 11 Defence of Britain Site at risk from coastal erosion. Pvd = £3.1k	Do Nothing impacts would be delayed by ~5 years in MU4CD and MU5 due to maintenance of revetment, however no delay in MU6 and MU7A where the defences are virtually obsolete. PVd = £2.9k	Do Nothing impacts would be avoided	Do Nothing impacts would be avoided. A number of archaeological sites are present within Raithwaite Ravine. The deposition of material from the coastal slope onto these features would allow for the <i>in-situ</i> preservation of such features and sites.	Do Nothing impacts would be avoided. A number of archaeological sites are present within Raithwaite Ravine. The deposition of material from the coastal slope onto these features would allow for the <i>in-situ</i> preservation of such features and sites.
Landscape	Landscape and seascape would deteriorate due to collapse of the existing defences, followed by sections of the road, leaving debris on the beach. In the long term a more natural coastline may develop.	Do Nothing impacts would be delayed by ~5 years in MU4CD and MU5 due to maintenance of revetment, however no delay in MU6 and MU7A where the defences are virtually obsolete.	Do Nothing impacts would be avoided. Appearance of asset would not be dissimilar to existing; however improved condition of the asset would be an improvement.	Do Nothing impacts would be avoided. There would be an impact on the landscape as there are no local precedents (in immediate Sandsend vicinity, rock is present at Whitby) for rock revetments, it would be a deviation from the type of assets locally present.	Do Nothing impacts would be avoided. There would be limited impact on the landscape as the existing revetment is already concrete. The new revetment would be an improvement in appearance due to improved condition, consistent appearance and improved amenity features.

Social Impacts					
Way of Life	Loss of the A174 would have a significant impact on the way of life for residents of Sandsend, with the village becoming more isolated and services harder to access. Longer journey times would impact on travel to Whitby for jobs, leisure, health and social reasons. In addition the nature of the village as a tourist destination would be affected.	Although Do Minimum would prolong life of asset by 5 years through maintenance, the A174 would still be lost by year 20 as under the Do Nothing scenario in MUs 6 & 7 where the defences are virtually obsolete and therefore damages across the full A174 length (MUs 2-7) would occur as under Do Nothing.	Do Nothing impacts would be avoided.	Do Nothing impacts would be avoided.	Do Nothing impacts would be avoided.
Community	Sendsend is a small village, with the majority of its services based in Whitby, including schools, hospital, supermarkets, employment etc. Currently it takes ~5mins to drive to centre of Whitby (4km); loss of road would increase this to ~25mins (26km). Loss of A174 would isolate the village, making it a dead-end destination rather than a through route. This could result in loss of trade for businesses reliant on tourist/recreation trade, which could result in the loss of businesses affecting locally job market and range of services available locally for residents.				
Culture	Limited impact from loss of historic environment				
Health & well being	The doctor's surgery is one of the properties at risk. Increased distance and journey time for emergency services would increase risk to life for patients. Could be considerable stress impacts from loss of road leading to feeling of isolation and blight on property values.				
Fears & Aspirations	Affected residents may feel isolated and abandoned, and suffer stress from blight on property values and concerns regarding ongoing viability of properties/community.				
			There may be concerns that the solution is not 'robust' and will be reviewed as another repair job which is unlikely to last in the long term.	There may be concerns that the appearance of rock will be unattractive which will affect the attractiveness of the area to tourists which will affect the businesses which rely on the trade.	Do Nothing impacts would be avoided. Improved condition and appearance, plus the additional amenity value of the design may increase the attractiveness of the area to tourists.