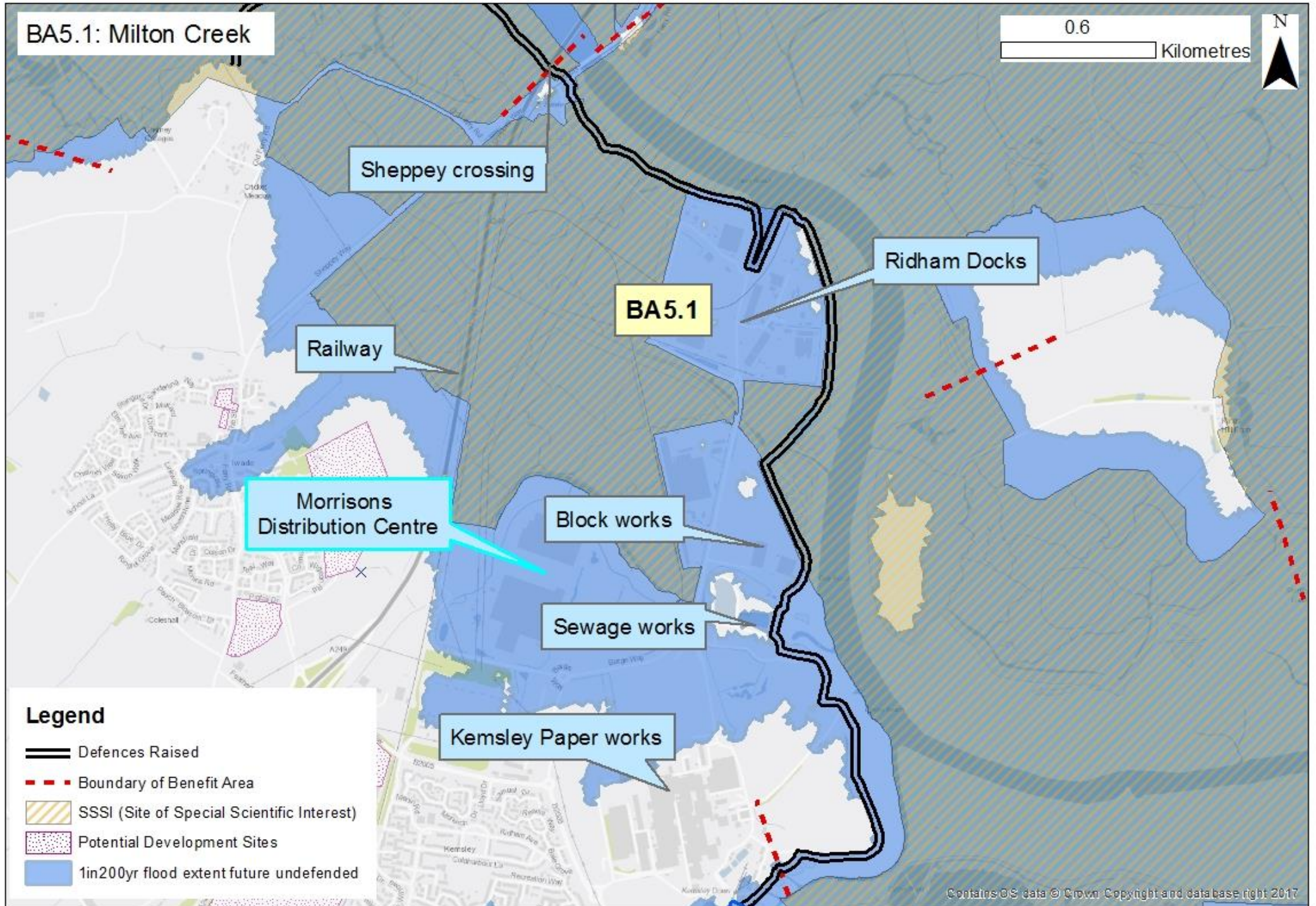


<b>Benefit Area Name</b>	5 - Milton Creek and Sittingbourne
<b>Benefit Unit Name</b>	5.1 - Kingsferry Bridge to Milton Creek
<b>Frontage Length</b>	4.7 km
<b>Defence Structure Type</b>	Embankment, high ground and wall
<b>Min Standard of Protection (AEP%)</b>	50%
<b>Residual Life (years)</b>	25

	0-20 years	20-50 years	50-100 years
<b>SMP Policy</b>	HTL	HTL	HTL
<b>Aiming to comply with policy?</b>	Yes - agree with SMP		
<b>Comment</b>	HTL for all epochs		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
<b>Residential</b>	0	0	39	83
<b>Commercial &amp; Industrial</b>	46	60	71	83
<b>Agricultural (Ha)</b>	260.2	299.2	312.9	340.2
<b>Key Infrastructure</b>	Sheppey crossing (A249 and B2231), Railway line to Isle of Sheppey, Ridham Dock, Morrisons distribution centre, Sittingbourne and Kemsley Light Railway Kemsley Marshes Historic Landfill (inert)	Sheppey crossing (A249 and B2231), Railway line to Isle of Sheppey, Ridham Dock, Morrisons distribution centre, Old Ferry Road, Block works, Sittingbourne and Kemsley Light Railway, Kemsley Mill Landfill (Industrial Waste) Kemsley Marshes Historic Landfill (inert) Kemsley Mill Historic Landfill (inert, industrial, commercial, household) North Kemsley Historic Landfill (inert)	Sheppey crossing (A249 and B2231), Railway line to Isle of Sheppey, Ridham Dock, Morrisons distribution centre, Old Ferry Road, Block works, Sittingbourne and Kemsley Light Railway, Kemsley Mill Landfill (Industrial Waste) Kemsley Marshes Historic Landfill (inert) Kemsley Mill Historic Landfill (inert, industrial, commercial, household) North Kemsley Historic Landfill (inert)	Sheppey crossing (A249 and B2231), Railway line to Isle of Sheppey, Ridham Dock, Morrisons distribution centre, Old Ferry Road, Block works, Sittingbourne and Kemsley Light Railway Sewage works, Kemsley Paper works, Kemsley Mill Landfill (Industrial Waste) Kemsley Marshes Historic Landfill (inert) Kemsley Mill Historic Landfill (inert, industrial, commercial, household) North Kemsley Historic Landfill (inert)
<b>Social and Environmental Considerations</b>	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward)	England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward)	England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward)	England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward)



Long List to Short List

Potential Measures

	Measures	Selected	Reasoning
<b>Structural</b>	Construct new embankment	Y	Take forward- embankments currently present
	Maintain embankment	Y	Take forward- embankments currently present
	Raise embankment (sustain)	Y	Take forward- embankments currently present
	Raise embankment (upgrade)	Y	Take forward- embankments currently present
	Construct new wall	Y	Take forward - walls currently present
	Maintain wall	Y	Take forward - walls currently present
	Raise wall (sustain)	Y	Take forward - walls currently present
	Raise wall (upgrade)	Y	Take forward - walls currently present
	Maintain rock revetment	N	Exclude - no rock revetment currently present
	Construct rock revetment	N	Exclude - limited benefits in constructing a revetment where embankments are currently present and will not significantly reduce flood risk. Also the foreshore is mudflat/ saltmarsh so
	Install demountable defences	N	Exclude - relatively costly option which is not the most efficient use of FDGiA funding compared to sustaining existing defences. It would require significant man resources to
	Install temporary defences	N	Exclude - significant resources to implement and potentially not the most efficient use of FDGiA funding compared to sustaining existing defences. This would need to be discussed with asset owners at OBC stage.
	Beach recharge (sand or shingle)	N	Exclude - not appropriate for this location
	Construct rock groynes	N	Exclude - not appropriate for this location
	Maintain rock groynes	N	Exclude - not appropriate for this location
	Construct timber structures	N	Exclude - not appropriate for this location
	Maintain timber structures	N	Exclude - not appropriate for this location
Construct a tidal barrier	N	Exclude- likely to have significant environmental impacts, including on water quality (WFD), change in sedimentation in Estuary with wider impacts (environment, dredging, maintenance, navigation etc.). In addition likely to have significant costs.	
<b>Non-Structural</b>	Implement monitoring	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Implement flood warning system	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Land use planning	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Adaptation measures	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Development control	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Emergency response plans	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Monitoring for health and safety only	N	Not suitable as a single measure to implement the SMP policy.

Long List of Options					
	a) Do nothing	b) Ongoing maintenance of embankments and walls.	c) Maintain SOP (capital) embankments and walls.	d) Raise (sustain SOP) embankments and walls.	e) Raise (upgrade SOP) embankments and walls.
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	N	N	N	N	N
3- Reduce maintenance	N	N	N	N	N
4 - WFD	N	Y	Y	Y	Y
5 - Local Plans	N	Y	Y	Y	Y
<b>Comment and decision on whether taken forward to shortlist</b>	Y= baseline for the economic assessment.	Y= as baseline. Following year 25 a Do nothing scenario would occur due to the failure of the defences.	Y= SOP of defences is very low and residual life of defences is low. Capital maintenance required.	Y= Existing defence SOP very low so could be increased with sea level rise. Significant assets at risk to warrant sustaining the SOP.	Y = Existing defence SOP very low so could be increased with sea level rise. Significant assets at risk to warrant upgrading the SOP.

\* no Natura 2000 sites present

Short List of Options	
a) Do nothing	
b) Do minimum	
c) Maintain (capital) embankments and walls.	
d) Raise (sustain) embankments and walls.	
e) Raise (upgrade) embankments and walls.	

Assessment of Short List			
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls.
Description	Used as an economic baseline to compare the other options against.	Used as an economic baseline to compare the other options against.	Capital works are undertaken to maintain the current defences.
Technical Issue	<p>Defences have 25 years residual life.</p> <p>Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.</p> <p>Designated habitat and therefore compensatory habitat is required.</p> <p>Kemsley Mill Landfill (Industrial Waste), Kemsley Marshes Historic Landfill (inert), Kemsley Mill Historic Landfill (inert, industrial, commercial, household) and North Kemsley Historic Landfill (inert) potentially at risk.</p>	<p>Defences have 25 years residual life.</p> <p>Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.</p> <p>Designated habitat and therefore compensatory habitat is required.</p> <p>Kemsley Mill Landfill (Industrial Waste), Kemsley Marshes Historic Landfill (inert), Kemsley Mill Historic Landfill (inert, industrial, commercial, household) and North Kemsley Historic Landfill (inert) potentially at risk.</p>	<p>Current defences have 25 years residual life.</p> <p>Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.</p> <p>Designated habitat and therefore compensatory habitat is required.</p> <p>Kemsley Mill Landfill (Industrial Waste), Kemsley Marshes Historic Landfill (inert), Kemsley Mill Historic Landfill (inert, industrial, commercial, household) and North Kemsley Historic Landfill (inert) potentially at risk over time.</p>
Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 30.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.
SOP Provided (% AEP)	>50%	>50%	50%
<b>Value of Economics</b>			
PV Capital Costs	£ -	£ -	£ 2,520,246
PV Maintenance Costs	£ -	£ 186,250	£ 284,749
PV Other Costs	£ -	£ -	£ 212,228
Total Cost (including Optimism Bias) (PV)	£ -	£ 298,000	£ 4,827,556
Value of Benefits	£ -	£ 11,023,000	£ 63,475,943
Benefit Cost Ratio (BCR)	0.0	37.0	13.1
PF Score	0%	205%	73%
Further funding required to achieve 100% PF Score	£ -	£ -	£ 1,301,115

Assessment of Short List			
Option	d) Raise (sustain) embankments and walls.		e) Raise (upgrade) embankments and walls.
Description	Capital works are undertaken to maintain the current defences.		Capital works are undertaken to maintain the current defences.
Technical Issue	<p>Current defences have 25 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Designated habitat and therefore compensatory habitat is required. Kemsley Mill Landfill (Industrial Waste), Kemsley Marshes Historic Landfill (inert), Kemsley Mill Historic Landfill (inert, industrial, commercial, household) and North Kemsley Historic Landfill (inert) potentially at risk over time.</p>		<p>Current defences have 25 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Designated habitat and therefore compensatory habitat is required. Kemsley Mill Landfill (Industrial Waste), Kemsley Marshes Historic Landfill (inert), Kemsley Mill Historic Landfill (inert, industrial, commercial, household) and North Kemsley Historic Landfill (inert) potentially at risk over time.</p>
Assumptions/ Uncertainties	<p>The SOP provided by the defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This option will maintain the required SOP provided by the defences by keeping pace with sea level rise.</p>		<p>The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.</p>
SOP Provided (% AEP)		0.1%	0.1%
<b>Value of Economics</b>			
PV Capital Costs		£ 6,257,806	£ 8,303,415
PV Maintenance Costs		£ 285,351	£ 304,237
PV Other Costs		£ 509,373	£ 583,092
Total Cost (including Optimism Bias) (PV)		£ 11,284,048	£ 14,705,191
Value of Benefits		£ 67,585,341	£ 67,585,341
Benefit Cost Ratio (BCR)		6.0	4.6
PF Score		33%	26%
Further funding required to achieve 100% PF Score		£ 7,529,306	£ 10,950,450

<b>Flood/ erosion impacts</b>			
Number of Residential Properties at risk under 0.1% AEP	84	84	82
Number of Commercial properties at risk under 0.1% AEP	86	86	85
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 66,621,328	£ 55,798,867	£ 4,030,357
Critical Infrastructure	Ridham Dock, Morrisons distribution centre, Old Ferry Road, Block works, Sittingbourne and Kemsley Light Railway, Sewage works, and Kemsley Paper works at risk	Ridham Dock, Morrisons distribution centre, Old Ferry Road, Block works, Sittingbourne and Kemsley Light Railway, Sewage works, and Kemsley Paper works at risk	Ridham Dock, Morrisons distribution centre, Old Ferry Road, Block works, Sittingbourne and Kemsley Light Railway, Sewage works, and Kemsley Paper works at risk
PV Value of Impacts on road and rail	£813,384 Road: A249 Rail: Kemsley to Isle of Sheppey	£665,827 Road: A249 Rail: Kemsley to Isle of Sheppey	£73,621 Road: A249 Rail: Kemsley to Isle of Sheppey
PV Value of Tourism and Recreation Impacts	-	-	-
PV Value of Agriculture Impacts	£157,418 Worst case scenario 12.77ha Grade 1 agricultural land flooded and 11.67ha Grade 3 flooded 333.15ha Grade 4 flooded	£134,892 Worst case scenario 12.77ha Grade 1 agricultural land flooded and 11.67ha Grade 3 flooded 333.15ha Grade 4 flooded	£12,209 Worst case scenario 11ha Grade 1 agricultural land flooded and 8ha Grade 3 flooded 324.5ha Grade 4 flooded
<b>Stakeholders Feedback</b>			
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments
Landowners	No specific comments	No specific comments	No specific comments
<b>Technical Feasibility</b>			
Site Specific	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a
<b>WFD (Water Framework Directive)</b>			
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	1 HMWB maintained
<b>HRA (Habitats Regulation Assessment)</b>			
Impact on SPA/ Ramsar qualifying features	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat until at least yr. 25 when failing defences will allow estuarine habitats to begin to form. At this point, there will be impacts on the designated freshwater habitats and qualifying feature species.	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat until at least yr. 30 when failing defences will allow estuarine habitats to begin to form. At this point, there will be impacts on the designated freshwater habitats and qualifying feature species.	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat. However with sea level rise the defences will become overtopped and there will be impacts on the designated freshwater habitats and those qualifying feature species that use it.

Flood/ erosion impacts		
Number of Residential Properties at risk under 0.1% AEP	0	0
Number of Commercial properties at risk under 0.1% AEP	1	1
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 166	£ 166
Critical Infrastructure	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	-	-
PV Value of Tourism and Recreation Impacts	-	-
PV Value of Agriculture Impacts	£6,623 Worst case scenario 6.6ha Grade 4 agricultural land flooded	£6,623 Worst case scenario 6.6ha Grade 4 agricultural land flooded
Stakeholders Feedback		
Statutory Stakeholders/ SEG	No specific comments	No specific comments
Landowners	No specific comments	No specific comments
Technical Feasibility		
Site Specific	n/a	n/a
Strategy Wide	n/a	n/a
WFD (Water Framework Directive)		
Compliance assessment outcome	1 HMWB maintained	1 HMWB maintained
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat.	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat.



Impacts on freshwater habitats	<p>1</p> <p>Yes. Following the failure of defences there will be inundation of the freshwater habitats. Compensatory habitat would be required in advance of failure of the defence to compensate for the loss of freshwater grazing marsh.</p>	<p>1</p> <p>Yes. Following the failure of defences there will be inundation of the freshwater habitats. Compensatory habitat would be required in advance of failure of the defence to compensate for the loss of freshwater grazing marsh.</p>	<p>1</p> <p>Yes. With sea level rise the risk of overtopping and inundation of the defences will increase. Compensatory habitat would be required in advance of overtopping of the defence, to compensate for the loss of freshwater grazing marsh. Likely to be later than the Do Nothing option.</p>
Impacts on intertidal habitats	<p>2</p> <p>Yes, until defences fail (from year 25). Once the defences have failed intertidal habitats will start to develop.</p> <p>Although new saltmarsh and mudflat habitat would potentially develop, the rate, area and quality would effectively be unmanaged, so this would not be a favourable means of mitigating for coastal squeeze.</p>	<p>2</p> <p>Yes, until defences fail (from year 30). Once the defences have failed intertidal habitats will start to develop.</p> <p>Although new saltmarsh and mudflat habitat would potentially develop, the rate, area and quality would effectively be unmanaged, so this would not be a favourable means of mitigating for coastal squeeze.</p>	<p>1</p> <p>Yes, until overtopping happens regularly enough that tidal habitats develop in place of the freshwater grazing marsh.</p> <p>Although new saltmarsh and mudflat habitat would potentially develop, the rate, area and quality would effectively be unmanaged, so this would not be a favourable means of mitigating for coastal squeeze.</p>
Habitat Connectivity	<p>2</p> <p>Slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before defences fail. Loss of linear freshwater grazing marsh habitat along the Swale once defences fail, although estuarine habitat connectivity should begin to open up again.</p>	<p>2</p> <p>Slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before defences fail. Loss of linear freshwater grazing marsh habitat along the Swale once defences fail, although estuarine habitat connectivity should begin to open up again.</p>	<p>2</p> <p>Slight negative impact on connectivity due to loss of habitat from coastal squeeze. Loss of linear freshwater grazing marsh habitat along the Swale once defences overtop, although estuarine habitat connectivity should begin to open up again.</p>
<b>SEA (Strategic Environmental Assessment)</b>			
Historic Environment	<p>3</p> <p>No observable historic assets at risk</p>	<p>3</p> <p>No observable historic assets at risk</p>	<p>3</p> <p>No observable historic assets at risk</p>
Effects on population	<p>1</p> <p>Coastal access and livelihoods at risk following the defences failure in year 25. The area is a key industrial area.</p>	<p>1</p> <p>Coastal access and livelihoods at risk following the defences failure in year 30. The area is a key industrial area.</p>	<p>2</p> <p>Coastal access and livelihoods at risk over time with increased risk of overtopping due to sea level rise. The area is a key industrial area.</p>
Impact on plans/ programmes	<p>1</p> <p>Potential risk of inundation of proposed development sites</p>	<p>1</p> <p>Potential risk of inundation of proposed development sites</p>	<p>2</p> <p>Proposed development sites at risk of inundation overtime as the risk of overtopping increases with sea level rise</p>
Freshwater Biodiversity	<p>1</p> <p>Landward SSSI at risk following the failure of the defences. The area is industrial but does have freshwater wetland habitat and grazing marshes.</p>	<p>1</p> <p>Landward SSSI at risk following the failure of the defences. The area is industrial but does have freshwater wetland habitat and grazing marshes.</p>	<p>2</p> <p>Landward SSSI at risk from overtopping with increased risk of overtopping due to sea level rise</p>

Impacts on freshwater habitats	3 No. Defences will remain in place so there is limited impact on the designated freshwater habitat.	3 No. Defences will remain in place so there is limited impact on the designated freshwater habitat.
Impacts on intertidal habitats	1 Yes the maintenance of the defences means that coastal squeeze will occur as the sea levels rise.	1 Yes the maintenance of the defences means that coastal squeeze will occur as the sea levels rise.
Habitat Connectivity	1 Negative impact on connectivity due to loss of habitat from coastal squeeze.	1 Negative impact on connectivity due to loss of habitat from coastal squeeze.
<b>SEA (Strategic Environmental Assessment)</b>		
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk
Effects on population	4 Coastal access and livelihoods at reduced risk from flooding	5 Coastal access and livelihoods at reduced risk from flooding
Impact on plans/ programmes	4 Proposed development sites protected	4 Proposed development site protected
Freshwater Biodiversity	5 Landward SSSI at reduced risk from overtopping	5 Landward SSSI at reduced risk from overtopping

Saline Biodiversity	2 Seaward SPA at risk due to coastal squeeze until defences fail	2 Seaward SPA at risk due to coastal squeeze until defences fail	2 Seaward SPA at risk due to coastal squeeze, although with sea level rise there may be overtopping of the defences and development of intertidal habitat behind.
Soil	1 Degradation of soils from saline intrusion following failure of defences	1 Degradation of soils from saline intrusion following failure of defences	2 Degradation of soils from saline intrusion over time with increased risk of overtopping due to sea level rise
Groundwater	1 Potential risk of pollutant mobilisation from the landfill sites once the defences fail.	1 Potential risk of pollutant mobilisation from the landfill sites once the defences fail.	2 Potential risk of pollutant mobilisation from the landfill sites overtime as the risk of overtopping is increased.
Landscape (visual impact)	1 Change to landscape once the defences fail in year 25.	1 Change to landscape once the defences fail in year 30.	2 Gradual changes to landscape from overtopping
Carbon Storage	2 Loss of carbon storage in saltmarsh due to coastal squeeze and freshwater grazing marsh overtopping	2 Loss of carbon storage in saltmarsh due to coastal squeeze and freshwater grazing marsh overtopping	2 Gradual loss of carbon storage in saltmarsh due to coastal squeeze and freshwater grazing marsh overtopping
<b>Ecosystem Services</b>			
Qualitative Score from Ecosystem Services Assessment	-42	-42	-30
Comments	Major degradation in various ES (e.g. food provision, natural hazard regulation, recreation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in various ES (e.g. food provision, natural hazard regulation, recreation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in various ES (e.g. food provision, natural hazard regulation, recreation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)
<b>To what extent does the option meet the objectives?</b>			
1- Reduce Flood Risk	N	N	Y
2 - Natura 2000 sites	N	N	N
3- Reduce maintenance	N	N	Y
4 - WFD	N	N	N
5 - Local Plans	Y	Y	Y

Saline Biodiversity	1 Seaward SPA at risk due to coastal squeeze	1 Seaward SPA at risk due to coastal squeeze
Soil	4 Soils at reduced risk from saline intrusion	4 Soils at reduced risk from saline intrusion
Groundwater	3 No impacts predicted, landfill sites protected against overtopping	3 No impacts predicted, landfill sites protected against overtopping
Landscape (visual impact)	2 Incremental change to visual impact as defence heights increase	1 Significant change to visual impact with defence height increase
Carbon Storage	1 Loss of carbon storage coastal squeeze and generated carbon cost from construction activities	1 Loss of carbon storage coastal squeeze and generated carbon cost from construction activities
<b>Ecosystem Services</b>		
Qualitative Score from Ecosystem Services Assessment	-5	-7
Comments	Degradation in various ES (e.g. aesthetic value, conversation habitat, fisheries habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation and erosion regulation)	Degradation in various ES (e.g. aesthetic value, conversation habitat, fisheries habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation and erosion regulation)
<b>To what extent does the option meet the objectives?</b>		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	N	N
3- Reduce maintenance	Y	Y
4 - WFD	N	N
5 - Local Plans	Y	Y



Environmental Scores			
100 = best option, 0 = worst option			
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls.
<b>WFD (Water Framework Directive)</b>			
Compliance assessment outcome	25	25	0
<b>HRA (Habitats Regulation Assessment)</b>			
Impact on SPA/ Ramsar qualifying features	0	0	0
Impacts on freshwater habitats	0	0	0
Impacts on intertidal habitats	25	25	0
Habitat Connectivity	25	25	25
<b>SEA (Strategic Environmental Assessment)</b>			
Historic Environment	50	50	50
Effects on population	0	0	25
Impact on plans/ programmes	0	0	25
Freshwater Biodiversity	0	0	25
Saline Biodiversity	25	25	25
Soil	0	0	25
Groundwater	0	0	25
Landscape (visual impact)	0	0	25
Carbon Storage	25	25	25
<b>Total</b>	<b>175</b>	<b>175</b>	<b>275</b>

Environmental Scores		
100 = best option, 0 = worst option		
Option	d) Raise (sustain) embankments and walls.	e) Raise (upgrade) embankments and walls.
<b>WFD (Water Framework Directive)</b>		
Compliance assessment outcome	0	0
<b>HRA (Habitats Regulation Assessment)</b>		
Impact on SPA/ Ramsar qualifying features	0	0
Impacts on freshwater habitats	50	50
Impacts on intertidal habitats	0	0
Habitat Connectivity	0	0
<b>SEA (Strategic Environmental Assessment)</b>		
Historic Environment	50	50
Effects on population	75	100
Impact on plans/ programmes	75	75
Freshwater Biodiversity	100	100
Saline Biodiversity	0	0
Soil	75	75
Groundwater	50	50
Landscape (visual impact)	25	0
Carbon Storage	0	0
<b>Total</b>	<b>500</b>	<b>500</b>

Summary of Results			
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls.
Costs	£ -	£ 298,000	£ 4,827,556
Benefits	£ -	£ 11,023,000	£ 63,475,943
NPV	£ -	£ 10,725,000	£ 58,648,386
BCR	0.0	37.0	13.1
Environmental Scoring	175	175	275

Summary of Results		
Option	d) Raise (sustain) embankments and walls.	e) Raise (upgrade) embankments and walls.
Costs	£ 11,284,048	£ 14,705,191
Benefits	£ 67,585,341	£ 67,585,341
NPV	£ 56,301,293	£ 52,880,150
BCR	6.0	4.6
Environmental Scoring	500	500

Preferred Option Decision Making		
DLO	Leading Option at DLO Stage	Justification for Leading Option
DLO1 - Economic Assessment	Maintain (capital) embankments and walls.	This option has the highest BCR.
DLO2 - Economic Sensitivities	Maintain defences until year 20. Raise (sustain) embankments and walls from year 20.	Delayed sustain option has highest BCR and better environmental scoring compared to the Maintain option.
DLO3 - Review of Compensatory Intertidal Habitat Requirements		
DLO4 - Review of Compensatory Freshwater Habitat Requirements		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name
Maintain defences until year 20. Raise (sustain) embankments and walls from year 20.

Preferred Option
Maintenance of the current defences (embankment, seawall and rock revetment) for the first 5 years. Following this the defences will be raised to 5.2m AOD and then raised again in year 50 to 6.5m AOD to ensure a 0.1% SoP with sea level rise.

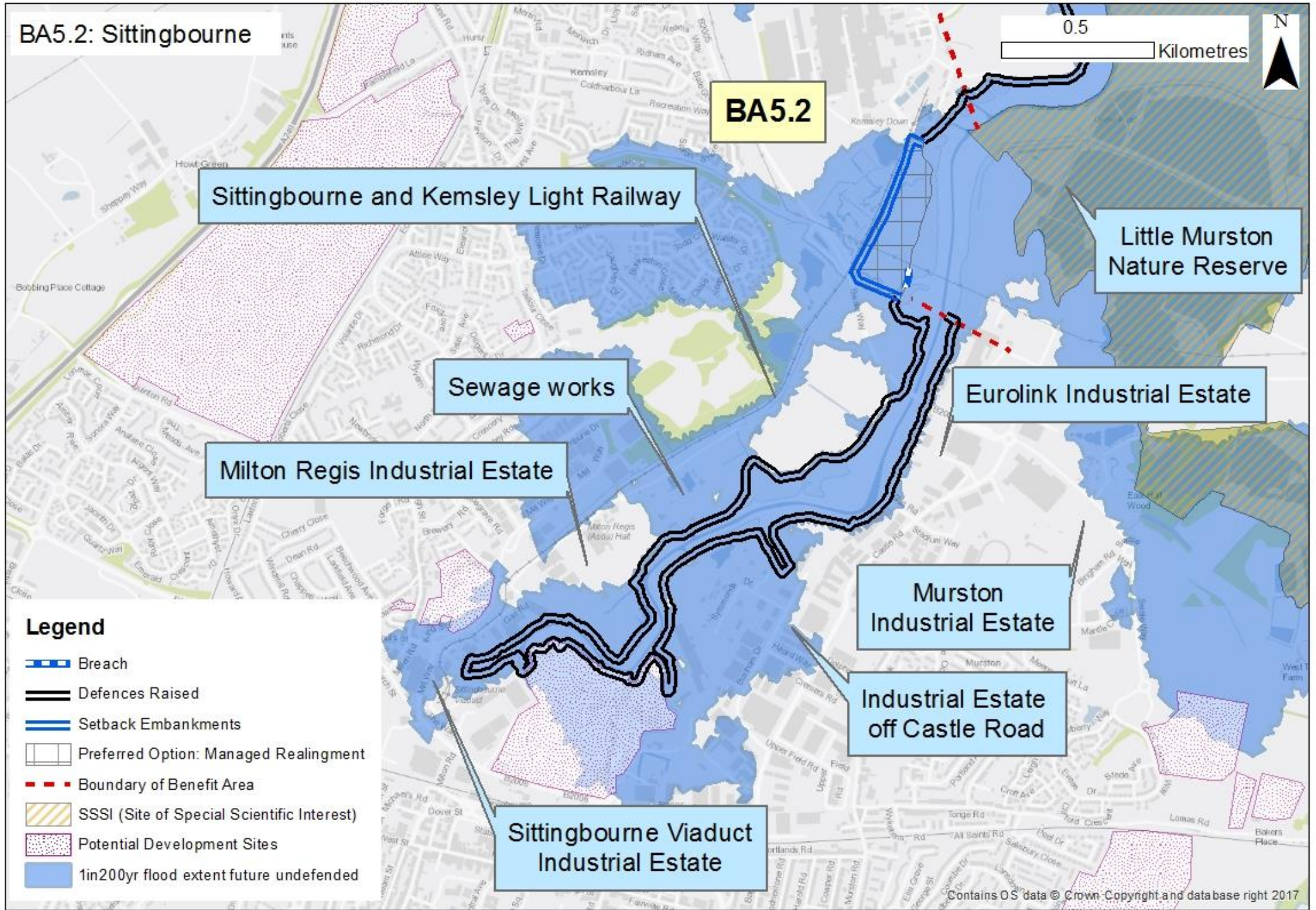
Justification
Maintain (capital) option has the highest benefits following the Do Minimum and an incremental BCR greater than 1. However, the Sustain option protects over 160 additional properties and therefore much better meets the Strategy objectives. Under local choices, the Sustain Option will be preferred and would require and additional £2.1m funding over 100 years.

Preferred Option Costs				
	<b>Cost</b>	<b>Benefits</b>	<b>BCR</b>	<b>PF Score</b>
	£ 8,920,207	£ 67,407,973	7.56	42%



<b>Benefit Area Name</b>	5 - Milton Creek and Sittingbourne
<b>Benefit Unit Name</b>	5.2 - Milton Creek - MR site at the Northern end of Milton Creek (site 22)
<b>Frontage Length</b>	5.7 km
<b>Defence Structure Type</b>	Embankment and High ground
<b>Min Standard of Protection (AEP%)</b>	50%
<b>Residual Life (years)</b>	20

	<b>0-20 years</b>	<b>20-50 years</b>	<b>50-100 years</b>
<b>SMP Policy</b>	HTL	HTL	HTL
<b>Aiming to comply with policy?</b>	Agree with SMP		
<b>Comment</b>	HTL for all epochs		





Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
<b>Residential</b>	1	527	684	1068
<b>Commercial &amp; Industrial</b>	8	57	80	202
<b>Agricultural (Ha)</b>	18.7	43	47.5	60.7
<b>Key Infrastructure</b>	Sittingbourne and Kemsley Light Railway, Sewage works, Swale Way, Church Marshes Historic Landfill (inert, industrial, commercial, household) Gypsy Site Historic Landfill (inert)	Sittingbourne and Kemsley Light Railway, Sewage works, Swale Way, Church Marshes Historic Landfill (inert, industrial, commercial, household) Gypsy Site Historic Landfill (inert) North Murston Historic Landfill Gas Lane Historic Landfill (inert)	Sittingbourne and Kemsley Light Railway, Sewage works, Swale Way, B2006, Church Marshes Historic Landfill (inert, industrial, commercial, household) Gypsy Site Historic Landfill (inert) North Murston Historic Landfill Gas Lane Historic Landfill (inert)	Sittingbourne and Kemsley Light Railway, Sewage works, Swale Way, B2006, Church Marshes Historic Landfill (inert, industrial, commercial, household) Gypsy Site Historic Landfill (inert) North Murston Historic Landfill Gas Lane Historic Landfill (inert)
<b>Social and Environmental Considerations</b>	Natural England Coastal Path (Saxon Shore Way)	Natural England Coastal Path (Saxon Shore Way)	Murston B G Historic Landfill Natural England Coastal Path (Saxon Shore Way)	Murston B G Historic Landfill Mill Way Historic Landfill Natural England Coastal Path (Saxon Shore Way)

Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
<b>Structural</b>	Construct new embankment	Y	Take forward- embankments currently present
	Maintain embankment	Y	Take forward- embankments currently present
	Raise embankment (sustain)	Y	Take forward- embankments currently present
	Raise embankment (upgrade)	Y	Take forward- embankments currently present
	Construct new wall	Y	Take forward - walls currently present
	Maintain wall	Y	Take forward - walls currently present
	Raise wall (sustain)	Y	Take forward - walls currently present
	Raise wall (upgrade)	Y	Take forward - walls currently present
	Maintain rock revetment	N	Exclude - no rock revetment currently present
	Construct rock revetment	N	Exclude - limited benefits in constructing a revetment where embankments are currently present and will not significantly reduce flood risk. Also the foreshore is mudflat/ saltmarsh so potentially environmentally damaging in SPA habitat
	Install demountable defences	N	Exclude - relatively costly option which is not the most efficient use of FDGiA funding compared to sustaining existing defences. It would require significant man resources to implement during a flood event. This would need to be discussed with Asset Owners at OBC stage.
	Install temporary defences	N	Exclude - significant resources to implement and potentially not the most efficient use of FDGiA funding compared to sustaining existing defences. This would need to be discussed with asset owners at OBC stage.
	Beach recharge (sand or shingle)	N	Exclude - not appropriate for this location
	Construct rock groynes	N	Exclude - not appropriate for this location
	Maintain rock groynes	N	Exclude - not appropriate for this location
Construct timber structures	N	Exclude - not appropriate for this location	
Maintain timber structures	N	Exclude - not appropriate for this location	
Construct a tidal barrier	N	Exclude- likely to have significant environmental impacts, including on water quality (WFD), change in sedimentation in Estuary with wider impacts (environment, dredging, maintenance, navigation etc.). In addition likely to have significant costs.	
<b>Non-Structural</b>	Implement monitoring	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Implement flood warning system	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Land use planning	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Adaptation measures	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Development control	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Emergency response plans	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Monitoring for health and safety only	N	Not suitable as a single measure to implement the SMP policy.

Long List of Options					
	a) Do nothing	b) Ongoing maintenance of embankments and walls.	c) Maintain (capital) embankments and walls.	d) Raise (sustain) embankments and walls.	e) Raise (upgrade) embankments and walls.
<b>To what extent does the option meet the objectives?</b>					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	N	N	N	N	N
3- Reduce maintenance	N	N	N	N	N
4 - WFD	N	Y	Y	Y	Y
5 - Local Plans	N	Y	Y	Y	Y
<b>Comment and decision on whether taken forward to shortlist</b>	Y= baseline	Y = as baseline. Following year 25 a Do nothing scenario would occur due to failure of the defences.	Y= SOP and residual life of defences is very low. Capital maintenance required. Do minimum	Y= Existing defence SOP variable but could be increased with sea level rise.	Y= Existing defence SOP variable but could be increased with sea level rise.

\* Assumed that the MR sites will have natural topography

Long List of Options			
	f) Construct new setback embankments at identified managed realignment sites. Maintain embankments and walls along the rest of the section.	g) Construct new setback embankments at identified managed realignment sites. Sustain embankments and walls along the rest of the section.	h) Construct new setback embankments identified managed realignment sites. Upgrade embankments and walls along the rest of the section.
<b>To what extent does the option meet the objectives?</b>			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	Y	Y	Y
3- Reduce maintenance	Y*	Y*	Y*
4 - WFD	TBC	TBC	TBC
5 - Local Plans	TBC	TBC	TBC
<b>Comment and decision on whether taken forward to shortlist</b>	N = MR with maintain removed as the flood risk to the surrounding area would not likely be reduced over 100 years.	Y = Significant assets at risk that would require defences to be sustained over time.	Y= Significant assets at risk that would require upgrade of defences in time.

Short List of Options
a) Do nothing
b) Do minimum
c) Maintain (capital) embankments and walls.
d) Raise (sustain) embankments and walls.
e) Raise (upgrade) embankments and walls.
f) Construct new setback embankments at identified managed realignment sites. Sustain embankments and walls along the rest of the section.
g) Construct new setback embankments identified managed realignment sites. Upgrade embankments and walls along the rest of the section.

Assessment of Short List				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls.	d) Raise (sustain) embankments and walls.
Description	Used as an economic baseline to compare the other options against.	Used as an economic baseline to compare the other options against.	Capital works are undertaken to maintain the current defences	Capital works are undertaken to improve the current defences
Technical Issue	Defences have 20 years residual life. Church Marshes Historic Landfill (inert, industrial, commercial, household), Gypsy Site Historic Landfill (inert), North Murston Historic Landfill, Gas Lane Historic Landfill (inert) and Murston B G Historic Landfill potentially at risk.	Defences have 20 years residual life. Church Marshes Historic Landfill (inert, industrial, commercial, household), Gypsy Site Historic Landfill (inert), North Murston Historic Landfill, Gas Lane Historic Landfill (inert) and Murston B G Historic Landfill potentially at risk.	Current defences have 20 years residual life. Church Marshes Historic Landfill (inert, industrial, commercial, household), Gypsy Site Historic Landfill (inert), North Murston Historic Landfill, Gas Lane Historic Landfill (inert) and Murston B G Historic Landfill potentially at risk over time.	Current defences have 20 years residual life. Church Marshes Historic Landfill (inert, industrial, commercial, household), Gypsy Site Historic Landfill (inert), North Murston Historic Landfill, Gas Lane Historic Landfill (inert) and Murston B G Historic Landfill potentially at risk over time.
Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 25.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.	The SOP provided by the defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This option will maintain the required SOP provided by the defences by keeping pace with sea level rise.
SOP Provided (% AEP)	>50%	>50%	50%	0.5%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 1,560,229	£ 4,523,940
PV Maintenance Costs	£ -	£ 223,750	£ 388,798	£ 387,518
PV Other Costs	£ -	£ -	£ 158,668	£ 401,672
Total Cost (including Optimism Bias) (PV)	£ -	£ 358,000	£ 3,372,313	£ 8,501,007
Value of Benefits	£ -	£ 4,390,000	£ 55,254,449	£ 67,427,790
Benefit Cost Ratio (BCR)	0.0	12.2	16.4	7.9
PF Score	0%	68%	254%	109%



Assessment of Short List			
Option	e) Raise (upgrade) embankments and walls.	f) Construct new setback embankments at identified managed realignment sites. Sustain embankments and walls along the rest of the section. MR site at the Northern end of Milton Creek (site 22)	g) Construct new setback embankments identified managed realignment sites. Upgrade embankments and walls along the rest of the section. MR site at the Northern end of Milton Creek (site 22)
Description	Capital works are undertaken to improve the current defences	Development of MR site. Capital works undertaken to improve the remaining defences	Development of MR site. Capital works undertaken to improve the remaining defences
Technical Issue	Current defences have 20 years residual life. Church Marshes Historic Landfill (inert, industrial, commercial, household), Gypsy Site Historic Landfill (inert), North Murston Historic Landfill, Gas Lane Historic Landfill (inert) and Murston B G Historic Landfill potentially at risk over time.	Defences have 20 years residual life. Potential increase in defence line due to construction of setback defences. Based on current sea levels the MR site would create 5.8ha of saltmarsh and 0.4ha of mudflat. With 100 years sea level rise there could be 1.2ha of saltmarsh and 5.1ha of mudflat. The site is not internationally designated so no compensatory habitat legally required. Impacts on historic landfills (inert) will need to be considered at the next stage.	Defences have 20 years residual life. Potential increase in defence line due to construction of setback defences. Based on current sea levels the MR site would create 5.8ha of saltmarsh and 0.4ha of mudflat. With 100 years sea level rise there could be 1.2ha of saltmarsh and 5.1ha of mudflat. The site is not internationally designated so no compensatory habitat legally required. Impacts on historic landfills (inert) will need to be considered at the next stage.
Assumptions/ Uncertainties	The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.	MR site to provide at least 5% AEP SOP to protect property etc. directly behind. The SOP provided by the remaining defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This will maintain the required SOP provided by the defences by keeping pace with sea level rise.	MR site to provide at least 5% AEP SOP to protect property etc. directly behind. The SOP provided by the remaining defences is increased. The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.
SOP Provided (% AEP)	0.5%	5% MR site, elsewhere 0.5%	5% MR site, elsewhere 0.5%
<b>Value of Economics</b>			
PV Capital Costs	£ 6,918,484	£ 4,661,632	£ 6,737,882
PV Maintenance Costs	£ 386,447	£ 369,637	£ 374,020
PV Other Costs	£ 529,638	£ 458,164	£ 566,339
Total Cost (including Optimism Bias) (PV)	£ 12,535,311	£ 8,783,094	£ 12,285,185
Value of Benefits	£ 67,490,727	£ 67,428,138	£ 67,491,044
Benefit Cost Ratio (BCR)	5.4	7.7	5.5
PF Score	74%	109%	78%

Further funding required to achieve 100% PF Score	£ -	£ 114,000	£ -	£ -
<b>Flood/ erosion impacts</b>				
Number of Residential Properties at risk under 0.1% AEP	1235	1235	105	0
Number of Commercial properties at risk under 0.1% AEP	274	274	204	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 65,545,106	£ 62,337,781	£ 11,621,323	£ 61,120.10
Critical Infrastructure	Sewage works Industry area along creek	Sewage works Industry area along creek	Sewage works Industry area along creek	No impact
PV Value of Impacts on road and rail	£20,540 Road: B2005	£17,943 Road: B2005	£2,715 Road: B2005	£1,786 Road: B2005
PV Value of Tourism and Recreation Impacts	£1,780,297 Milton Creek Country Park	£610,738 Milton Creek Country Park	£610,738 Milton Creek Country Park	-
PV Value of Agriculture Impacts	£145,101 Worst case scenario 34.54ha Grade 1 agriculture land flooded and 1.90ha Grade 3 flooded 34.78ha Grade 4 flooded	£134,312 Worst case scenario 34.54ha Grade 1 agriculture land flooded and 1.90ha Grade 3 flooded 34.78ha Grade 4 flooded	£3,604 Worst case scenario 0.4ha Grade 1 agriculture land flooded and 26ha Grade 4 flooded	£349 Worst case scenario 6.51ha Grade 4 agriculture land flooded
<b>Stakeholders Feedback</b>				
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments	No specific comments
Landowners	No specific comments	No specific comments	No specific comments	No specific comments
<b>Technical Feasibility</b>				
Site Specific	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a
<b>WFD (Water Framework Directive)</b>				
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	1 Heavily Modified Water Body (HMWB) maintained	1 HMWB maintained
<b>HRA (Habitats Regulation Assessment)</b>				
Impact on SPA/ Ramsar qualifying features	3 These options are not likely to have significant effects on any Natura 2000 sites and their constituent qualifying features.	3 These options are not likely to have significant effects on any Natura 2000 sites and their constituent qualifying features.	3 These options are not likely to have significant effects on any Natura 2000 sites and their constituent qualifying features.	3 These options are not likely to have significant effects on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA

Further funding required to achieve 100% PF Score	£ 3,287,184	£ -	£ 2,734,819
<b>Flood/ erosion impacts</b>			
Number of Residential Properties at risk under 0.1% AEP	0	5	0
Number of Commercial properties at risk under 0.1% AEP	0	29	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ -	£ -	£ -
Critical Infrastructure	No assets at risk	No impact	No assets at risk
PV Value of Impacts on road and rail	-	£1786 Road: B2005	-
PV Value of Tourism and Recreation Impacts	-	-	-
PV Value of Agriculture Impacts	£317 Worst case scenario 0.4ha Grade 4 agriculture land flooded	-	-
<b>Stakeholders Feedback</b>			
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments
Landowners	No specific comments	No specific comments	No specific comments
<b>Technical Feasibility</b>			
Site Specific	n/a	Site not flooded during the modelled Spring tide. Potential 158m increase in defence line due to construction of setback defences MR site would create 5.8ha of saltmarsh and 0.4ha of mudflat. With 100 years sea level rise there could be 1.2ha of saltmarsh and 5.1ha of mudflat.	Site not flooded during the modelled Spring tide. Potential 158m increase in defence line due to construction of setback defences. MR site would create 5.8ha of saltmarsh and 0.4ha of mudflat. With 100 years sea level rise there could be 1.2ha of saltmarsh and 5.1ha of mudflat.
Strategy Wide	n/a	Sites are completely flooded during extreme events. An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.	Sites are completely flooded during extreme events. An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.
<b>WFD (Water Framework Directive)</b>			
Compliance assessment outcome	1 HMWB maintained	4 Controlled return to a degree of natural process	4 Controlled return to a degree of natural process
<b>HRA (Habitats Regulation Assessment)</b>			
Impact on SPA/ Ramsar qualifying features	3 These options are not likely to have significant effects on any Natura 2000 sites and their constituent qualifying features.	3 These options are not likely to have adverse effects on the Swale SPA.	3 These options are not likely to have adverse effects on the Swale SPA.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.

Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
<b>SEA (Strategic Environmental Assessment)</b>				
Historic Environment	1 Risk to listed buildings, scheduled monuments following the failure of the defences in year 20	1 Risk to listed buildings, scheduled monuments following the failure of the defences in year 25	2 Listed buildings, scheduled monuments at risk over time with increased risk of overtopping due to sea level rise	5 Listed buildings, scheduled monuments at reduced risk of flooding
Effects on population	1 Coastal access at risk, livelihoods and homes at risk once the defences fail. Loss of agricultural livelihoods once the defences fail.	1 Coastal access at risk, livelihoods and homes at risk once the defences fail. Loss of agricultural livelihoods once the defences fail.	2 Coastal access at risk, livelihoods and homes at risk over time with increased risk of overtopping due to sea level rise. Loss of agricultural livelihoods over time.	5 Coastal access, livelihoods and homes at reduced risk. Reduced risk to loss of agricultural livelihoods over time
Impact on plans/ programmes	1 Proposed development site at risk from flooding following the failure of the defences in year 20	1 Proposed development site at risk from flooding following the failure of the defences in year 25	2 Proposed development site at risk from flooding over time with increased risk of overtopping due to sea level rise.	5 Proposed development site at reduced risk from flooding
Freshwater Biodiversity	3 Overtopping during storm events however area is fairly disturbed and biodiversity is limited.	3 Overtopping during storm events however area is fairly disturbed and biodiversity is limited.	3 Increased risk of overtopping overtime	5 Protected
Saline Biodiversity	2 Loss of habitat due to coastal squeeze until failure of the defences	2 Loss of habitat due to coastal squeeze until failure of the defences	1 Gradual loss of habitat due to coastal squeeze	1 Loss of habitat due to coastal squeeze
Soil	1 Degradation of soil following the failure of the defences	1 Degradation of soil following the failure of the defences	2 Gradual degradation overtime with the increased risk of overtopping.	3 Protected
Groundwater	1 Risk to groundwater once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	1 Risk to groundwater once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	2 Potential impacts over time as risk of overtopping increases with sea level rise.	3 Reduced risks to groundwater
Landscape (visual impact)	4 Change but giving back to natural processes	4 Change but giving back to natural processes	3 Gradual change but giving back to natural processes	2 Incremental change to visual impact as defence height increases



Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	4 Creation of compensatory freshwater habitat	4 Creation of compensatory freshwater habitat
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
<b>SEA (Strategic Environmental Assessment)</b>			
Historic Environment	5 Listed buildings, scheduled monuments at reduced risk of flooding	5 Listed buildings, scheduled monuments at reduced risk of flooding	5 Listed buildings, scheduled monuments at reduced risk of flooding
Effects on population	5 Coastal access, livelihoods and homes at reduced risk. Reduced risk to loss of agricultural livelihoods over time	5 Coastal access, livelihoods and homes at reduced risk but some loss of recreation and amenity and agricultural livelihoods	5 Coastal access, livelihoods and homes at reduced risk but some loss of recreation and amenity and agricultural livelihoods
Impact on plans/ programmes	5 Proposed development site at reduced risk from flooding	5 Managed realignment unlikely to impact on development sites. Therefore proposed development sites at reduced risk of flooding	5 Managed realignment unlikely to impact on development sites. Therefore proposed development sites at reduced risk of flooding
Freshwater Biodiversity	5 Protected	3 Loss of freshwater habitat with conversion to intertidal habitat for MR	3 Loss of freshwater habitat with conversion to intertidal habitat for MR
Saline Biodiversity	1 Loss of habitat due to coastal squeeze	4 Some intertidal habitat creation, but small in comparison to coastal squeeze effects throughout the benefit area	4 Some intertidal habitat creation, but small in comparison to coastal squeeze effects throughout the benefit area
Soil	3 Protected	2 Some soil loss as a result of managed realignment	2 Some soil loss as a result of managed realignment
Groundwater	3 Reduced risks to groundwater	1 Groundwater vulnerability is high in the area, so MR could have potential negative impacts. A detailed understanding of the links between surface and groundwater would be required to mitigate risks at detailed design stage	1 Groundwater vulnerability is high in the area, so MR could have potential negative impacts. A detailed understanding of the links between surface and groundwater would be required to mitigate risks at detailed design stage
Landscape (visual impact)	1 Significant change to visual impact as defence height increases immediately	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but giving back to natural processes	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but giving back to natural processes

Carbon Storage	2 Loss of carbon storage due to coastal squeeze and conversion of freshwater area to mudflat.	2 Loss of carbon storage due to coastal squeeze and conversion of freshwater area to mudflat.	2 Gradual loss of carbon storage due to coastal squeeze	1 Loss of carbon storage due to coastal squeeze and carbon costs from construction
<b>Ecosystem Services</b>				
Qualitative Score from Ecosystem Services Assessment	-39	-39	-22	2
Comments	Degradation in various ES (e.g. food provision, water flow regulation, natural hazard regulation, erosion regulation, cultural heritage, recreation) outweigh limited enhancement opportunities (e.g. fishery habitats, conservation habitat and aesthetic value)	Degradation in various ES (e.g. food provision, water flow regulation, natural hazard regulation, erosion regulation, cultural heritage, recreation) outweigh limited enhancement opportunities (e.g. fishery habitats, conservation habitat and aesthetic value)	Gradual degradation in various ES (e.g. food provision, water flow regulation, natural hazard regulation, erosion regulation, cultural heritage, recreation) outweigh limited enhancement opportunities (e.g. fishery habitats, conservation habitat and aesthetic value)	Balance of opportunities for enhancing some ES (e.g. erosion regulation, natural hazard regulation) with risks of degrading various ES (e.g. climate regulation, aesthetic value, conservation habitat, fisheries habitat)
<b>To what extent does the option meet the objectives?</b>				
1- Reduce Flood Risk	N	N	Y	Y
2 - Natura 2000 sites	N	N	N	N
3- Reduce maintenance	N	N	Y	Y
4 - WFD	N	N	N	N
5 - Local Plans	N	N	N	Y

Carbon Storage	1 Loss of carbon storage due to coastal squeeze and carbon costs from construction	1 Loss of carbon storage due to coastal squeeze across most of the benefit area plus generated carbon cost from construction	1 Loss of carbon storage due to coastal squeeze across most of the benefit area plus generated carbon cost from construction
<b>Ecosystem Services</b>			
Qualitative Score from Ecosystem Services Assessment	1	35	34
Comments	Balance of opportunities for enhancing some ES (e.g. erosion regulation, natural hazard regulation) with risks of degrading various ES (e.g. climate regulation, aesthetic value, conservation habitat, fisheries habitat)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat, conservation habitat) outweigh degradation risk in some ES (e.g. food provision, freshwater provision, water purification)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat, conservation habitat) outweigh degradation risk in some ES (e.g. food provision, freshwater provision, water purification)
<b>To what extent does the option meet the objectives?</b>			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	N	Y	Y
3- Reduce maintenance	Y	Y	Y
4 - WFD	N	Y	Y
5 - Local Plans	Y	Y	Y

Environmental Scores				
100 = best option, 0 = worst option				
Option	a) Do nothing	b) Do nothing	c) Maintain (capital) embankments and walls.	d) Raise (sustain) embankments and walls.
<b>WFD (Water Framework Directive)</b>				
Compliance assessment outcome	25	25	0	0
<b>HRA (Habitats Regulation Assessment)</b>				
Impact on SPA/ Ramsar qualifying features	50	50	50	50
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	50	50	50	50
Habitat Connectivity	50	50	50	50
<b>SEA (Strategic Environmental Assessment)</b>				
Historic Environment	0	0	25	100
Effects on population	0	0	25	100
Impact on plans/ programmes	0	0	25	100
Freshwater Biodiversity	50	50	50	100
Saline Biodiversity	25	25	0	0
Soil	0	0	25	50
Groundwater	0	0	25	50
Landscape (visual impact)	75	75	50	25
Carbon Storage	25	25	25	0
<b>Total</b>	<b>400</b>	<b>400</b>	<b>450</b>	<b>725</b>

Environmental Scores (continued)				
100 = best option, 0 = worst option				
Option	e) Raise (upgrade) embankments and walls.	f) Construct new setback embankments at identified managed realignment sites. Sustain embankments and walls along the rest of the section. MR site at the Northern end of Milton Creek (site 22)	g) Construct new setback embankments identified managed realignment sites. Upgrade embankments and walls along the rest of the section. MR site at the Northern end of Milton Creek (site 22)	
<b>WFD (Water Framework Directive)</b>				
Compliance assessment outcome	0	75	75	
<b>HRA (Habitats Regulation Assessment)</b>				
Impact on SPA/ Ramsar qualifying features	50	50	50	
Impacts on freshwater habitats	50	50	50	
Impacts on intertidal habitats	50	75	75	
Habitat Connectivity	50	50	50	
<b>SEA (Strategic Environmental Assessment)</b>				
Historic Environment	100	100	100	
Effects on population	100	100	100	
Impact on plans/ programmes	100	100	100	
Freshwater Biodiversity	100	50	50	
Saline Biodiversity	0	75	75	
Soil	50	25	25	
Groundwater	50	0	0	
Landscape (visual impact)	0	0	0	
Carbon Storage	0	0	0	
<b>Total</b>	<b>700</b>	<b>750</b>	<b>750</b>	

Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls.	d) Raise (sustain) embankments and walls.
Costs	£ -	£ 358,000	£ 3,372,313	£ 6,754,007
Benefits	£ -	£ 4,390,000	£ 55,254,449	£ 67,427,790
NPV	£ -	£ 4,032,000	£ 51,882,137	£ 60,673,783
BCR	0.0	12.2	16.4	10.0
Environmental Scoring	400	400	450	725

Summary of Results (continued)			
Option	e) Raise (upgrade) embankments and walls.	f) Construct new setback embankments at identified managed realignment sites. Sustain embankments and walls along the rest of the section. MR site at the Northern end of Milton Creek (site 22)	g) Construct new setback embankments identified managed realignment sites. Upgrade embankments and walls along the rest of the section. MR site at the Northern end of Milton Creek (site 22)
Costs	£ 12,535,311	£ 8,783,094	£ 12,285,185
Benefits	£ 67,490,727	£ 67,428,138	£ 67,491,044
NPV	£ 54,955,417	£ 58,645,044	£ 55,205,859
BCR	5.4	7.7	5.4
Environmental Scoring	700	750	750



Preferred Option Decision Making		
DLO	Leading Option at DLO Stage	Justification for Leading Option
DLO1 - Economic Assessment	Maintain (capital) embankments and walls.	This option has the highest BCR.
DLO2 - Economic Sensitivities	Maintain defences until year 20. Raise (sustain) embankments and walls from year 20.	Delayed sustain option has highest BCR and better environmental scoring compared to the Maintain option.
DLO3 - Review of Compensatory Intertidal Habitat Requirements	Construct new setback embankments at identified managed realignment site at Kemsley. Raise (sustain) embankments and walls along the rest of the section.	This area has a MR site which has a PF score over 100% and BCR over 1 and is not impacting on any designated sites. The hectares are required to help compensate for coastal squeeze across the Strategy in the first epoch.
DLO4 - Review of Compensatory Freshwater Habitat Requirements		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name
Construct new setback embankments at identified Managed Realignment site at Kemsley. Raise (sustain) embankments and walls along the rest of the section.

Preferred Option
This option involves improving the SoP provided by the defences to improve the SoP to 0.5% AEP with sea level rise; in year 5 to 4.9m AOD and then in year 50 to 6.0m AOD to continue to provide protection in line with sea level rise. Additionally, construction of a MR site from year 5 at Kemsley to help compensate for the strategy wide coastal squeeze impacts. Setback embankments will be constructed to manage tidal water and a breach in the current defences created.

Justification
The sustain option has an incremental BCR of greater than 3 and it has one of the highest environmental ranking from the short list of options. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term. The MR site at Kemsley is required to help compensate for coastal squeeze across the Strategy in the first epoch. The justification for the MR site is related to the Strategy wide requirement for coastal squeeze compensation.

Preferred Option Costs			
Cost	Benefits	BCR	PF Score
£ 8,751,316	£ 67,428,138	7.71	105%

Managed Realignment	
Managed Realignment site proposed at Kemsley in YEAR 5	
PV Cost	Hectares of saltmarsh created
£ 2,132,062	4.8 ha