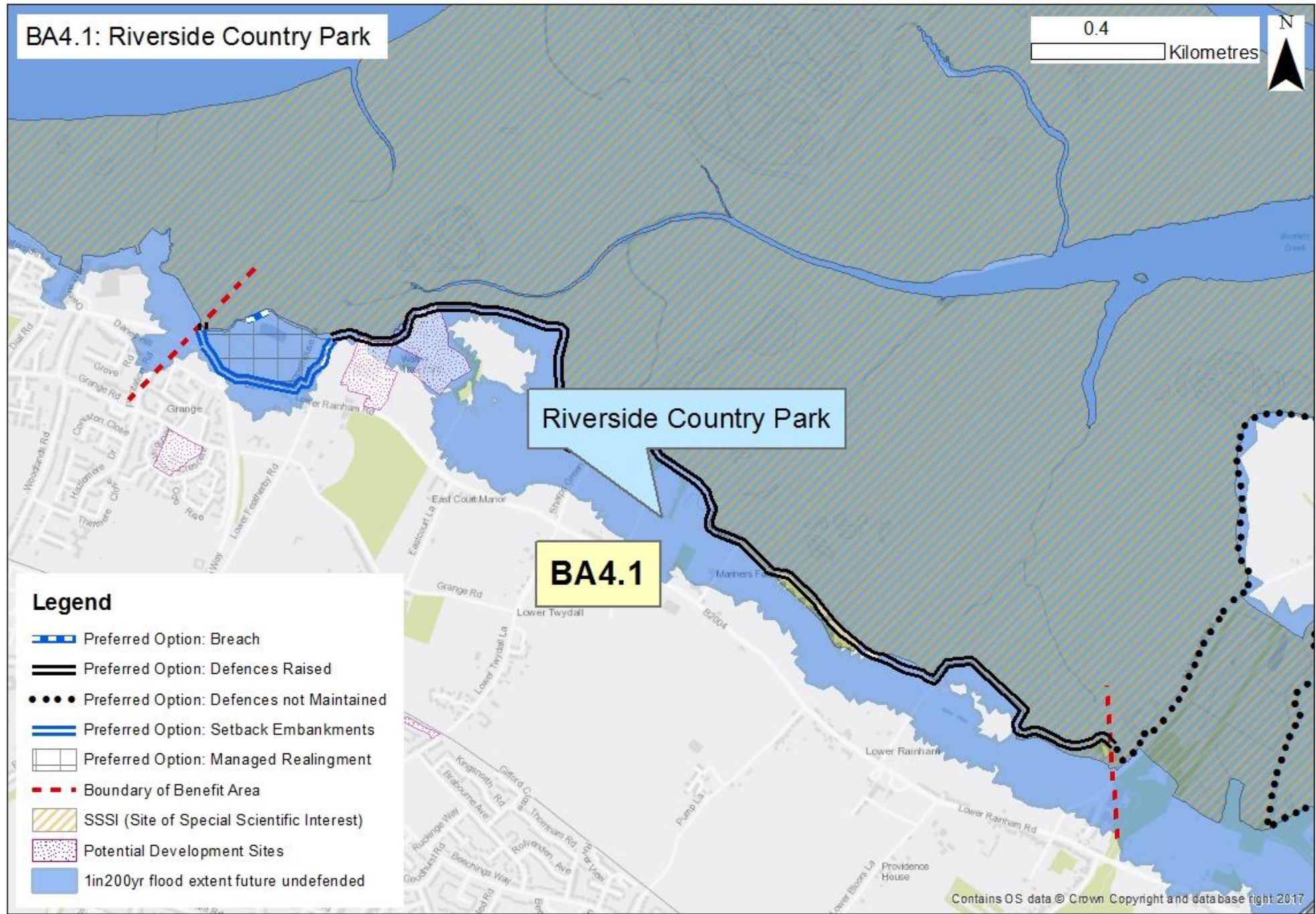


Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.1 - The Strand to west Motney Hill - MR site at Copperhouse Lane (Site 13)
Frontage Length	5.0 km
Defence Structure Type	Rock armoured embankment, seawalls, earth embankments
Min Standard of Protection (AEP%)	50%
Residual Life (years)	10

	0-20 years	20-50 years	50-100 years
SMP Policy	HTL	MR	MR
Aiming to comply with policy	No- suggest alternative considerations		
Comment	The policy is to HTL in the short term and then MR from year 20. However it is not viable to undertake MR over the whole Benefit Area. The Riverside Country Park is highly used by the public and is a key local amenity. Also there are landfill sites which need to be protected to prevent release of contaminants. In addition there are areas of high ground which will not be suitable for MR.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	0	7	8	13
Commercial & Industrial	1	1	1	5
Agricultural (Ha)	25	41	48	63
Key Infrastructure	Eastcourt Meadows Historic Landfill (inert), Bloors Wharf Historic Landfill (inert)	B2004, Eastcourt Meadows Historic Landfill (inert), Bloors Wharf Historic Landfill (inert)	B2004, Eastcourt Meadows Historic Landfill (inert), Bloors Wharf Historic Landfill (inert)	B2004, Eastcourt Meadows Historic Landfill (inert), Bloors Wharf Historic Landfill (inert)
Social and Environmental Considerations	Riverside Country Park, Medway Estuary and Marshes SPA and SSSI (seaward)	Riverside Country Park, Medway Estuary and Marshes SPA and SSSI (seaward)	Riverside Country Park, Medway Estuary and Marshes SPA and SSSI (seaward)	Riverside Country Park, Medway Estuary and Marshes SPA and SSSI (seaward)

Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	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	Y	Take forward - rock revetment currently present
	Construct rock revetment	Y	Take forward - rock revetment currently present
	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 - no significant assets at risk to warrant installation of temporary defences (significant resources to implement)
	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.
Non-Structural	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, walls and revetment	c) Maintain SOP (capital) embankments, walls and revetment	d) Raise (sustain SOP) embankments, walls and revetment	e) Raise (upgrade SOP) embankments, walls and revetment
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
Comment and decision on whether taken forward to shortlist	Y= Standard of protection of defences very low and residual life of defences low.	Y= as baseline. Following year 15 a Do nothing scenario would occur due to the failure of the defences.	Y= very low SOP and residual life therefore capital maintenance required. Potential contaminated land issues.	Y= Existing defence SOP variable but could be increased with sea level rise to ensure protection of the landfill sites.	N= no significant assets to warrant upgrade of defences.

Long List of Options (continued)			
	f) Construct new setback embankments at identified managed realignment sites and maintain SOP(capital) of existing embankments, walls and revetment around other areas. Adaptation of Riverside Country Park	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and revetment around other areas. Adaptation of Riverside Country Park	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and revetment around other areas. Adaptation of Riverside Country Park
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	Y	Y	Y
3- Reduce maintenance	TBC*	TBC*	TBC*
4 - WFD	TBC	TBC	TBC
5 - Local Plans	TBC	TBC	TBC
Comment and decision on whether taken forward to shortlist	Y = realignment site requires further consideration. Potential contaminated land issues. Maintain should be kept as there are limited properties at risk in the area.	Y = realignment site requires further consideration. Potential contaminated land issues. Defences along the section will require improvements in SOP.	N= no significant assets to warrant upgrade of defences.

Short List of Options	
a)	Do nothing
b)	Do minimum
c)	Maintain (capital) embankments, walls and revetment
d)	Raise (sustain) embankments, walls and revetment
e)	Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other
f)	Construct new setback embankments at identified managed realignment sites and sustain embankments, walls and flood gates around other areas.

Assessment of Short List				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment
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 10 years residual life. Eastcourt Meadows Historic Landfill (inert) and Bloors Wharf Historic Landfill (inert) potentially at risk.	Defences have 10 years residual life. Eastcourt Meadows Historic Landfill (inert) and Bloors Wharf Historic Landfill (inert) potentially at risk.	Current defences have 10 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Eastcourt Meadows Historic Landfill (inert) and Bloors Wharf Historic Landfill (inert) potentially at risk over time.	Current defences have 10 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Eastcourt Meadows Historic Landfill (inert) and Bloors Wharf Historic Landfill (inert) potentially at risk over time.
Assumptions/ Uncertainties	Assumes that all management and maintenance is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 15.	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%	2%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 2,216,321	£ 2,283,935
PV Maintenance Costs	£ -	£ 53,579	£ 324,963	£ 385,910
PV Other Costs	£ -	£ -	£ 267,256	£ 273,588
Total Cost (including Optimism Bias) (PV)	£ -	£ 85,727	£ 4,493,662	£ 4,709,494
Value of Benefits	£ -	£ 595,744	£ 1,466,679	£ 8,948,149
Benefit Cost Ratio (BCR)	0.0	6.9	0.3	1.9
PF Score	0%	39%	4%	13%
Further funding required to achieve 100% PF Score	£ -	£ 53,000	£ 4,302,631	£ 4,102,826
Flood/ erosion impacts				
Number of Residential Properties at risk under	19	19	15	0
Number of Commercial properties at risk under	7	7	7	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 1,609,949	£ 929,114	£ 458,973	£ 19,062
Critical Infrastructure	No assets at risk	No assets at risk	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	£80,139 B2004	£67,720 B2004	£11,722 B2004	-

Assessment of Short List		
Option	e) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas. Adaptation of Riverside Country Park	f) Construct new setback embankments at identified managed realignment sites and sustain embankments, walls and flood gates around other areas. Adaptation of Riverside Country Park
Description	Development of MR site. Capital works undertaken on remaining defences to maintain the current defences	Development of MR site. Capital works undertaken to improve the remaining defences
Technical Issue	Defences have no residual life (0 years) Potential 138m increase in defence lengths. Based on current sea levels the MR site would create 1.9ha of saltmarsh and 2.6ha of mudflat. With 100 years sea level rise there could be 1.6ha of saltmarsh and 3.4ha 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 10 years residual life. Potential 138m increase in defence lengths. Based on current sea levels the MR site would create 1.9ha of saltmarsh and 2.6ha of mudflat. With 100 years sea level rise there could be 1.6ha of saltmarsh and 3.4ha 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	MR site to provide at least a 2% AEP SOP. The crest height of the remaining defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in SOP for these sections of defence as the sea level rises.	MR site to provide at least a 2% AEP SOP. 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.
SOP Provided (% AEP)	2%	2%
Value of Economics		
PV Capital Costs	£ 2,349,817	£ 3,262,477
PV Maintenance Costs	£ 309,252	£ 334,156
PV Other Costs	£ 246,498	£ 381,563
Total Cost (including Optimism Bias) (PV)	£ 4,648,907	£ 6,365,114
Value of Benefits	£ 1,895,617	£ 9,251,554
Benefit Cost Ratio (BCR)	0.4	1.5
PF Score	10%	14%
Further funding required to achieve 100% PF Score	£ 4,174,324	£ 5,481,868
Flood/ erosion impacts		
Number of Residential Properties at risk under 0.1% AEP	15	0
Number of Commercial properties at risk under 0.1% AEP	7	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 458,973	£ -
Critical Infrastructure	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	£11,722 B2004	-

PV Value of Tourism and Recreation Impacts	£6,914,547 Riverside Country Park	£7,052,987 Riverside Country Park	£6,914,547 Riverside Country Park	£10,244 Riverside Country Park
PV Value of Agriculture Impacts	£676,225 Worst case scenario 67ha Grade 1 agricultural land flooded and 3ha Grade 4 flooded	£635,295 Worst case scenario 67ha Grade 1 agricultural land flooded and 3ha Grade 4 flooded	£428,939 Worst case scenario 65ha Grade 1 agricultural land flooded and 3ha Grade 4 flooded	£303,405 Worst case scenario 44ha Grade 1 agricultural land flooded and 3ha Grade 4 flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	No specific comments	No specific comments	HTL would protect the historic landfill at the country park	HTL would protect the historic landfill at the country park
Landowners	No specific comments	No specific comments	No specific comments	No specific comments
Technical Feasibility				
Site Specific	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)				
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 Heavily Modified Water Body (HMWB) maintained
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	2  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features.  Once the defences fail (year 10) there will be the creation of saltmarsh and mudflat behind the defences however this is not likely to be at a rate or to a quality to compensate for loss of existing intertidal habitats.	2  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features.  Once the defences fail (year 10) there will be the creation of saltmarsh and mudflat behind the defences however this is not likely to be at a rate or to a quality to compensate for loss of existing intertidal habitats.	2  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.  Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat in front of the defences. The creation of saltmarsh and mudflat behind the defences as overtopping occurs, with sea level rise, is not likely to be at a rate or to a quality to compensate for loss of existing intertidal habitats.  As the intertidal habitat decreases it is likely to reduce habitat for breeding waders such as ringed plover, redshank, dunlin, grey plover etc.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.  Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat in front of the defences. As the intertidal habitat decreases it is likely to reduce habitat for breeding waders such as ringed plover, redshank, dunlin, grey plover etc.
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

PV Value of Tourism and Recreation Impacts	£6,914,547 Riverside Country Park	£10,244 Riverside Country Park
PV Value of Agriculture Impacts	£0 Agriculture land included in the cost of MR	£0 Agriculture land included in the cost of MR
Stakeholders Feedback		
Statutory Stakeholders/ SEG	The MR options were preferred by some of the members of the SEG as it would help reduce access to the seawall and protect sensitive areas for birds. However there are concerns about the impacts on the Riverside country park	The MR options were preferred by some of the members of the SEG as it would help reduce access to the seawall and protect sensitive areas for birds. However there are concerns about the impacts on the Riverside country park
Landowners	No specific comments	No specific comments
Technical Feasibility		
Site Specific	Site does not flood during Spring tides. Potential 138m increase in defence lengths. MR site would create 1.9ha of saltmarsh and 2.6ha of mudflat. With 100 years sea level rise there could be 1.6ha of saltmarsh and 3.4ha of mudflat.	Site does not flood during Spring tides. Potential 138m increase in defence lengths MR site would create 1.9ha of saltmarsh and 2.6ha of mudflat. With 100 years sea level rise there could be 1.6ha of saltmarsh and 3.4ha of mudflat.
Strategy Wide	Site completely flooded during extreme events. Potential reduction of the flood risk in the Upper Medway during extreme events.	Site completely flooded during extreme events. Potential reduction of the flood risk in the Upper Medway during extreme events.
WFD (Water Framework Directive)		
Compliance assessment outcome	4 Some return to natural processes	4 Some return to natural processes
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	2  There may be potential significant effects on the intertidal Medway Estuary and Marshes SPA and its constituent qualifying features due to coastal squeeze where Hold the Line is maintained, although the Managed Realignment (c. 5.6 ha) will serve to mitigate for this loss by the creation of saltmarsh and mudflat habitats. It is not likely that the habitat creation would-be to the same quality of those similar habitats lost to coastal squeeze, however.  No Designated Sites would be directly affected by the Managed Realignment itself, however.	2  There may be potential significant effects on the intertidal Medway Estuary and Marshes SPA and its constituent qualifying features due to coastal squeeze where Hold the Line is maintained, although the Managed Realignment (c. 5.6 ha) will serve to mitigate for this loss by the creation of saltmarsh and mudflat habitats. It is not likely that the habitat creation would-be to the same quality of those similar habitats lost to coastal squeeze, however.  No Designated Sites would be directly affected by the Managed Realignment itself, however.
Impacts on freshwater habitats	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	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences. However when the defences fail in year 10 there will be the creation of intertidal habitat.</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 (where for example Managed Realignment would).</p>	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences. However when the defences fail in year 15 there will be the creation of intertidal habitat.</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 (where for example Managed Realignment would).</p>	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</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 (where for example Managed Realignment would).</p>	<p>2</p> <p>No -defences are maintained in the current position and raised in line with sea level rise, reducing the risk of overtopping.</p>
Habitat Connectivity	<p>3</p> <p>Initial loss of habitat following failure of defences would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.</p>	<p>3</p> <p>Initial loss of habitat following failure of defences would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.</p>	<p>3</p> <p>Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.</p>	<p>3</p> <p>Loss of intertidal habitat. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.</p>
<b>SEA (Strategic Environmental Assessment)</b>				
Historic Environment	<p>1</p> <p>1 listed building at risk from flooding following failure of the defences (year 10)</p>	<p>1</p> <p>1 listed building at risk from flooding following failure of the defences (year 15)</p>	<p>2</p> <p>1 listed building at risk from flooding over time with increased risk of overtopping due to sea level rise</p>	<p>5</p> <p>1 listed building at reduced risk from flooding</p>
Effects on population	<p>1</p> <p>Risk to coastal access and country park and the amenity it provides following failure of the defences in year 10. Agricultural livelihoods at risk too.</p>	<p>1</p> <p>Risk to coastal access and country park and the amenity it provides following failure of the defences in year 15. Agricultural livelihoods at risk too.</p>	<p>2</p> <p>Risk to coastal access and country park and the amenity it provides, and agricultural livelihoods at risk over time with increased risk of overtopping due to sea level rise</p>	<p>5</p> <p>No impacts</p>
Impact on plans/ programmes	<p>1</p> <p>Proposed development site potentially at risk from flooding following failure of the defences.</p>	<p>1</p> <p>Proposed development site potentially at risk from flooding following failure of the defences.</p>	<p>2</p> <p>Proposed development site potentially at risk from flooding over time with increased risk of overtopping due to sea level rise</p>	<p>5</p> <p>Proposed development site at reduced risk from flooding</p>
Freshwater Biodiversity	<p>3</p> <p>Failure of the defences will lead to impacts on freshwater biodiversity</p>	<p>3</p> <p>Failure of the defences will lead to impacts on freshwater biodiversity</p>	<p>3</p> <p>Impacts on freshwater biodiversity from overtopping, which will increase with sea level rise. However area is generally disturbed</p>	<p>3</p> <p>Potential Impacts on freshwater biodiversity from overtopping during larger events however area is generally disturbed</p>
Saline Biodiversity	<p>2</p> <p>SPA and SSSI affected by coastal squeeze until failure of the defences.</p>	<p>2</p> <p>SPA and SSSI affected by coastal squeeze until failure of the defences.</p>	<p>1</p> <p>SPA and SSSI affected by coastal squeeze</p>	<p>1</p> <p>SPA and SSSI affected by coastal squeeze</p>



Impacts on intertidal habitats	<p>4</p> <p>Yes. Development of saltmarsh and mudflat habitats within the MR site will begin to mitigate for coastal squeeze, although this is likely to take some time.</p> <p>The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.</p>	<p>4</p> <p>Yes. Development of saltmarsh and mudflat habitats within the MR site will begin to mitigate for coastal squeeze, although this is likely to take some time.</p> <p>The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.</p>
Habitat Connectivity	<p>3</p> <p>Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.</p>	<p>3</p> <p>Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.</p>
<b>SEA (Strategic Environmental Assessment)</b>		
Historic Environment	<p>2</p> <p>1 listed building at risk over time with increased risk of overtopping due to sea level rise</p>	<p>1</p> <p>Change to coastal access and country park and the amenity it provides. Agricultural livelihoods at risk</p>
Effects on population	<p>1</p> <p>Change to coastal access and country park and the amenity it provides. Agricultural livelihoods at risk</p>	<p>4</p> <p>Proposed development site at reduced risk from flooding - managed realignment unlikely to impact on development</p>
Impact on plans/ programmes	<p>4</p> <p>Proposed development site at reduced risk from flooding - managed realignment unlikely to impact on development</p>	<p>3</p> <p>Loss of freshwater habitat resulting from managed realignment however area is quite disturbed and provides little overwintering habitat.</p>
Freshwater Biodiversity	<p>3</p> <p>Loss of freshwater habitat resulting from managed realignment however area is quite disturbed and provides little overwintering habitat.</p>	<p>5</p> <p>Creation of new intertidal habitats</p>
Saline Biodiversity	<p>5</p> <p>Creation of new intertidal habitats</p>	<p>1</p> <p>Loss of agricultural soils with MR site development</p>

Soil	1 Risk of degradation of agricultural soils, including grade 1, following the failure of the defences	1 Risk of degradation of agricultural soils, including grade 1, following the failure of the defences	2 Gradual degradation of agricultural soils due to the increased risk of overtopping in line with sea level rise.	3 Agricultural soils protected
Groundwater	2 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally once the defences fail there may be the risk of contaminant release from the landfill sites.	2 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally once the defences fail there may be the risk of contaminant release from the landfill sites.	2 Risk to groundwater will increase overtime as sea levels rise. A detailed understanding of the links between surface and groundwater would be required to mitigate risks Risk to mobilisation of contaminants from the landfill sites will increase overtime with sea level rise too.	4 Reduced risk to groundwater and the mobilisation of contaminants from the landfill sites.
Landscape (visual impact)	4 Change to landscape type once the defences fail but giving back to natural processes from overtopping- assumed a benefit	4 Change to landscape type once the defences fail but giving back to natural processes from overtopping- assumed a benefit	3 Very gradual change to landscape type with overtopping of defences	2 Potential visual impact as defences rise
Carbon Storage	2 Loss of carbon storage from loss of intertidal habitat due to coastal squeeze until the failure of the defences	2 Loss of carbon storage from loss of intertidal habitat due to coastal squeeze until the failure of the defences	2 Loss of carbon storage from loss of intertidal habitat due to coastal squeeze	2 Loss of carbon storage from loss of intertidal habitat due to coastal squeeze
Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-53	-53	-38	-7
Comments	Major degradation in various ES (e.g. freshwater provision, food provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in various ES (e.g. freshwater provision, food provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in various ES (e.g. freshwater provision, food provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in various ES (e.g. aesthetic value, fisheries habitat, conservation habitat) outweigh enhancement opportunities (e.g. erosion regulation, natural hazard regulation)
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N	N	Y	Y
2 - Natura 2000 sites	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y
4 - WFD	N	N	N	N
5 - Local Plans	N	N	N	Y

Soil	1 Loss of agricultural soils with MR site development	2 Risk of contamination of groundwater with the development of the MR site. A detailed understanding of the links between surface and groundwater would be required to mitigate risks prior to detailed design. In areas where the defences are held there may also be a risk of mobilisation of contaminants from the landfill sites will increase overtime with sea level rise too.
Groundwater	2 Risk of contamination of groundwater with the development of the MR site. A detailed understanding of the links between surface and groundwater would be required to mitigate risks prior to detailed design. In areas where the defences are held there may also be a risk of mobilisation of contaminants from the landfill sites will increase overtime with sea level rise too.	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but giving back to natural processes
Landscape (visual impact)	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but giving back to natural processes	2 Some gain in terrestrial carbon storage, but construction carbon cost potentially outweighs the benefits
Carbon Storage	2 Some gain in terrestrial carbon storage, but construction carbon cost potentially outweighs the benefits	1 Carbon storage at managed realignment site if saltmarsh is converted from agricultural land. Carbon cost during construction.
Ecosystem Services		
Qualitative Score from Ecosystem Services Assessment	24	27
Comments	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat, conservation habitat) outweigh degradation risk in limited number of ES (e.g. freshwater provision, food provision)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat, conservation habitat) outweigh degradation risk in limited number of ES (e.g. freshwater provision, food provision)
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	Y	Y
3- Reduce maintenance	Y	Y
4 - WFD	Y	Y
5 - Local Plans	N	Y

Environmental Scores				
100 = best option, 0 = worst option				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	25	25	25	0
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	25	25	25	25
Habitat Connectivity	50	50	50	50
SEA (Strategic Environmental Assessment)				
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	50
Saline Biodiversity	25	25	0	0
Soil	0	0	25	50
Groundwater	25	25	25	75
Landscape (visual impact)	75	75	50	25
Carbon Storage	25	25	25	25
Total	375	375	400	650

Environmental Scores		
100 = best option, 0 = worst option		
Option	e) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas. Adaptation of Riverside Country Park. MR site at Copperhouse Lane (Site 13)	f) Construct new setback embankments at identified managed realignment sites and sustain embankments, walls and flood gates around other areas. Adaptation of Riverside Country Park. MR site at Copperhouse Lane (Site 13).
WFD (Water Framework Directive)		
Compliance assessment outcome	75	75
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	25	25
Impacts on freshwater habitats	50	50
Impacts on intertidal habitats	75	75
Habitat Connectivity	50	50
SEA (Strategic Environmental Assessment)		
Historic Environment	25	100
Effects on population	0	0
Impact on plans/ programmes	75	75
Freshwater Biodiversity	50	50
Saline Biodiversity	100	100
Soil	0	0
Groundwater	25	25
Landscape (visual impact)	0	0
Carbon Storage	25	25
Total	575	650



Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment (Do minimum)	d) Raise (sustain) embankments, walls and revetment
Costs	£ -	£ 85,727	£ 4,493,662	£ 4,572,194
Benefits	£ -	£ 595,744	£ 1,466,679	£ 9,252,449
NPV	£ -	£ 510,017	-£ 3,026,984	£ 4,680,255
BCR	0.0	6.9	0.3	2.0
Environmental Scoring	375	375	400	650

Summary of Results		
Option	e) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas. Adaptation of Riverside Country Park	f) Construct new setback embankments at identified managed realignment sites and sustain embankments, walls and flood gates around other areas. Adaptation of Riverside Country Park
Costs	£ 4,648,907	£ 6,365,114
Benefits	£ 1,895,617	£ 9,251,554
NPV	-£ 2,753,290	£ 2,886,440
BCR	0.4	1.5
Environmental Scoring	575	650

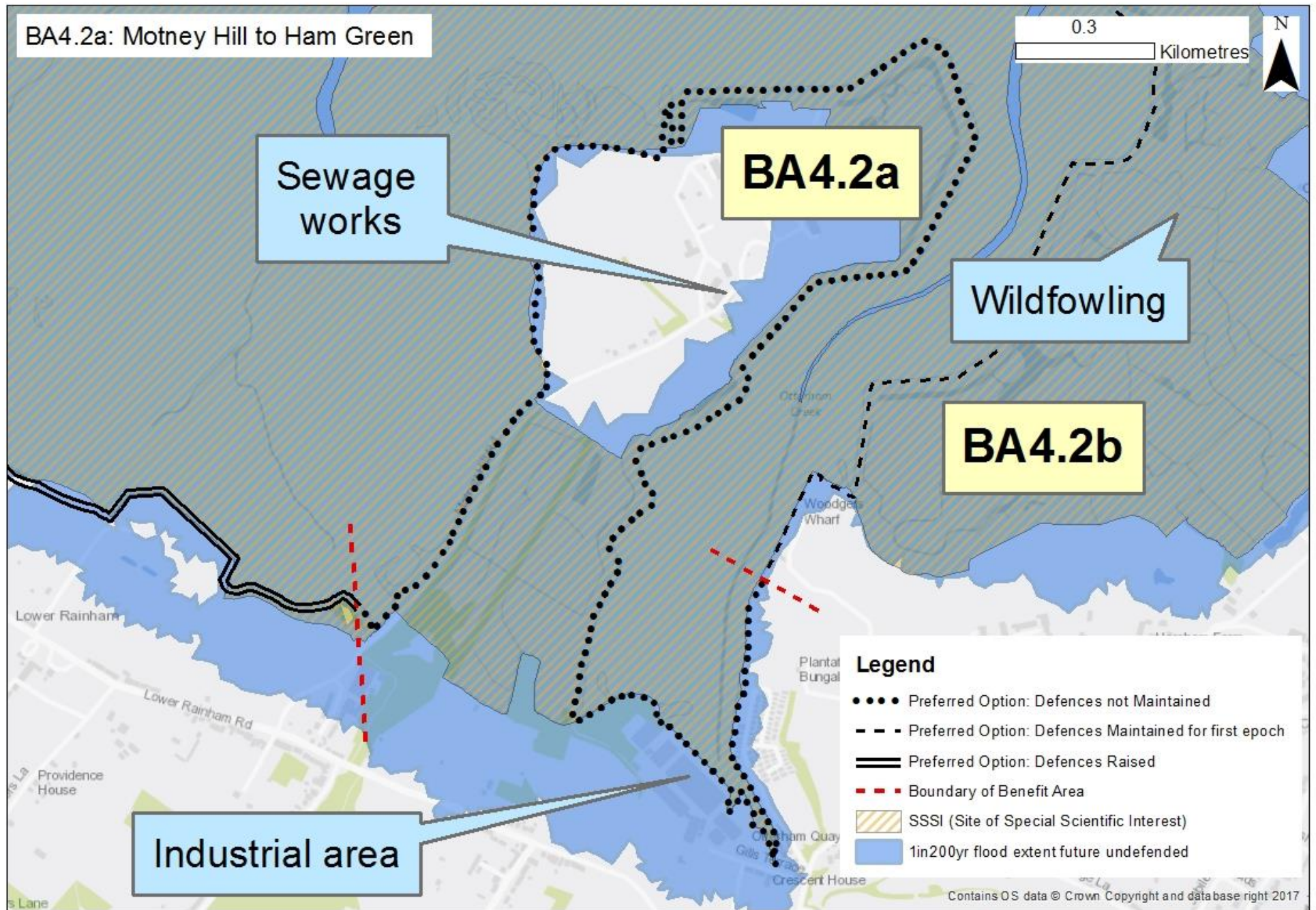
Preferred Option Name
Construct new setback embankments at Danes Hill and sustain embankments, walls and flood gates around other areas.

Justification
<p>HTL sustain has the highest NPV an incremental BCR greater than 1. 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.</p> <p>MR site at Danes Hill 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.</p>

Managed Realignment	
Managed Realignment site proposed at Riverside in Year 5	
PV Cost	Hectares of saltmarsh created
£ 1,273,349	1.9 ha

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.2A - Motney Hill to Ham Green - Motney Hill to Ottersham Creek
Frontage Length	4.8 km
Defence Structure Type	Earth embankments, high ground
Min Standard of Protection (AEP%)	50%
Residual Life (years)	10

	0-20 years	20-50 years	50-100 years
SMP Policy	MR with localised HTL	MR with localised HTL	MR with localised HTL
Aiming to comply with policy	Agree with the SMP		
Comment	Agree with SMP: MR with some areas of HTL (but also potential area for NAI)		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	0	0	0	5
Commercial & Industrial	1	4	10	25
Agricultural (Ha)	63.1	76.3	80.2	87.7
Key Infrastructure	Sewage works in the area, Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)), Otterham Industrial Estate Historic Landfill site	Sewage works in the area, Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)), Otterham Industrial Estate Historic Landfill site	Sewage works in the area, Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)), Otterham Industrial Estate Historic Landfill site	Sewage works in the area, Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)), Otterham Industrial Estate Historic Landfill site
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)



Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	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 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 potentially environmentally damaging in SPA habitat
	Install demountable defences	Y	Take forwards - demountable defences could be installed for access to the sewage works
	Install temporary defences	N	Exclude - no significant assets at risk to warrant installation of temporary defences
	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.
Non-Structural	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, walls and revetment	c) Maintain SOP (capital) embankments, walls and revetment	d) Raise (sustain SOP) embankments, walls and revetment (including demountable defences)	e) Raise (upgrade SOP) embankments, walls and revetment (including demountable defences)
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	NA	NA	NA	NA	NA
Comment and decision on whether taken forward to shortlist	Y= Standard of protection of defences very low and residual life of defences low.	Y= as above. Following year 15 a Do nothing scenario would occur due to failure of the defences.	Y= very low residual life and SOP so capital works required.	Y= Existing defence SOP variable but could be increased with sea level rise (particularly to protect freshwater habitat and the access to Motney Hill). Further discussions will be required with the asset owners over the level of protection required.	Y= Existing defence SOP variable but could be increased with sea level rise (particularly to protect freshwater habitat and the access to Motney Hill). Further discussions will be required with the asset owners over the level of protection required.

Long List of Options (continued)			
	f) Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and revetments around other areas.	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and revetments around other areas.	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and revetments around other areas.
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	Y	Y	Y
3- Reduce maintenance	TBC*	TBC*	TBC*
4 - WFD	TBC	TBC	TBC
5 - Local Plans	NA	NA	NA
Comment and decision on whether taken forward to shortlist	Y = realignment sites could be considered from 2nd epoch (year 20) given residual life of defences. There will be a requirement to find compensatory habitat if this option is taken forward due to MR over designated land. NB contaminated land.	Y = realignment sites could be considered from 2nd epoch (year 20) given residual life of defences. There will be a requirement to find compensatory habitat if this option is taken forward due to MR over designated land. NB contaminated land.	Y = realignment sites could be considered from 2nd epoch (year 20) given residual life of defences. There will be a requirement to find compensatory habitat if this option is taken forward due to MR over designated land. NB contaminated land.

Short List of Options	
a)	Do nothing
b)	Do minimum
c)	Maintain (capital) embankments, walls and revetment
d)	Raise (sustain) embankments, walls and revetment
e)	Raise (upgrade) embankments, walls and revetment
f)	Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and revetments around other areas.
g)	Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and revetments around other areas.
h)	Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and revetments around other areas.

Assessment of Short List					
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment	e) Raise (upgrade) embankments, walls and revetment
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	Capital works are undertaken to improve the current defences
Technical Issue	Defences have 10 years residual life. Potential impacts on designated freshwater habitat and therefore compensatory habitat is required. Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)) and Otterham Industrial Estate Historic Landfill site potentially at risk.	Defences have 10 years residual life. Potential impacts on designated freshwater habitat and therefore compensatory habitat is required. Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)) and Otterham Industrial Estate Historic Landfill site potentially at risk.	Current defences have 10 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Potential impacts on designated freshwater habitat and therefore compensatory habitat is required. Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)) and Otterham Industrial Estate Historic Landfill site potentially at risk over time.	Current defences have 10 years residual life . Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Potential impacts on designated freshwater habitat and therefore compensatory habitat is required. Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)) and Otterham Industrial Estate Historic Landfill site potentially at risk over time.	Current defences have 10 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Potential impacts on designated freshwater habitat and therefore compensatory habitat is required. Medway Secondary Historical Landfill (Inert, industrial), Motney Hill Wastewater treatment works current landfill (Industrial Waste Landfill (A7)) and Otterham Industrial Estate Historic Landfill site potentially at risk over time.
Assumptions/ Uncertainties	Assumes that all management is ceased.	Assumes that all management is ceased.	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.	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)	>50%	>50%	50%	2.0%	2.0%
Value of Economics					
PV Capital Costs	£ -	£ -	£ 4,024,763	£ 4,496,009	£ 6,888,535
PV Maintenance Costs	£ -	£ 147,500	£ 326,857	£ 330,772	£ 347,394
PV Other Costs	£ -	£ -	£ 343,288.87	£ 399,949.93	£ 527,778
Total Cost (including Optimism Bias) (PV)	£ -	£ 236,000	£ 7,511,855	£ 8,362,769	£ 12,421,931
Value of Benefits	£ -	£ 24,000	£ 161,613	£ 536,473	£ 574,975
Benefit Cost Ratio (BCR)	0.0	0.1	0.0	0.1	0.0
PF Score	0%	1%	0%	0%	0%

Further funding required to achieve 100% PF Score	£ -	£ 235,000	£ 7,502,876	£ 8,332,965	£ 12,389,987
Flood/ erosion impacts					
Number of Residential Properties at risk under 0.1% AEP	15	15	9	0	0
Number of Commercial properties at risk under 0.1% AEP	38	38	35	0	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 440,215	£ 444,583	£ 351,464	£ 35,632.93	£ -
Critical Infrastructure	Sewage works	Sewage works	Sewage works art risk over time with sea level rise	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	-	-	-	-	-
PV Value of Tourism and Recreation Impacts	£34,573 Motney Hill	£34,573 Motney Hill	£34,573 Motney Hill	£51 Motney Hill	-
PV Value of Agriculture Impacts	£147,510 Worst case scenario 13ha Grade 1 agricultural land flooded and 2ha Grade 2 flooded 77ha Grade 4 flooded	£136,500 Worst case scenario 13ha Grade 1 agricultural land flooded and 2ha Grade 2 flooded 77ha Grade 4 flooded	£89,660 Worst case scenario 13ha Grade 1 agricultural land flooded and 2ha Grade 2 flooded 76ha Grade 4 flooded	£67,664 Worst case scenario 10ha Grade 1 agricultural land flooded and 1ha Grade 2 flooded 73ha Grade 4 flooded	£64,968 Worst case scenario 1ha Grade 1 agricultural land flooded and 32ha Grade 4 flooded
Stakeholders Feedback					
Statutory Stakeholders/ SEG	No specific comments	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	No specific comments
Technical Feasibility					
Site Specific	n/a	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)					
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	1 Heavily Managed Water Body (HMWB) maintained	1 Heavily Managed Water Body (HMWB) maintained	1 Heavily Managed Water Body (HMWB) maintained
HRA (Habitats Regulation Assessment)					



Impact on SPA/ Ramsar qualifying features	<p>1</p> <p>There are potential significant effects on the Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until failure of defences.</p> <p>Coastal squeeze is likely to result in the loss of saltmarsh and mudflat in front of the existing defences, with impacts on the various wader and wildfowl qualifying species using this area for breeding, overwintering etc.</p> <p>Overtopping (likely to increase in frequency due to the minimum residual life of just four years) would likely result in the degradation of reed bed habitat and areas of scrubby woodland within the SPA/Ramsar site. This may impact on the known populations of wildfowl known to use the area, including various Qualifying Feature species.</p>	<p>1</p> <p>There are potential significant effects on the Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until failure of defences.</p> <p>Coastal squeeze is likely to result in the loss of saltmarsh and mudflat in front of the existing defences, with impacts on the various wader and wildfowl qualifying species using this area for breeding, overwintering etc.</p> <p>Overtopping (likely to increase in frequency due to the minimum residual life of just four years) would likely result in the degradation of reed bed habitat and areas of scrubby woodland within the SPA/Ramsar site. This may impact on the known populations of wildfowl known to use the area, including various Qualifying Feature species.</p>	<p>1</p> <p>There are potential significant effects on the Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze is likely to result in the loss of saltmarsh and mudflat in front of the existing defences, with impacts on the various wader and wildfowl qualifying species using this area for breeding, overwintering etc.</p> <p>Overtopping (likely to increase in frequency due to the minimum residual life of just four years) would likely result in the degradation of reed bed habitat and areas of scrubby woodland within the SPA/Ramsar site. This may impact on the known populations of wildfowl known to use the area, including various Qualifying Feature species.</p>	<p>1</p> <p>There are potential significant effects on the Medway Estuary and Marshes SPA (intertidal) and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze is likely to result in the loss of saltmarsh and mudflat in front of the existing defences, with impacts on the various wader and wildfowl qualifying species using this area for breeding, overwintering etc.</p>	<p>1</p> <p>There are potential significant effects on the Medway Estuary and Marshes SPA (intertidal) and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze is likely to result in the loss of saltmarsh and mudflat in front of the existing defences, with impacts on the various wader and wildfowl qualifying species using this area for breeding, overwintering etc.</p>
Impacts on freshwater habitats	<p>2</p> <p>Yes, once defences fail potential for inundation of the freshwater habitat.</p>	<p>2</p> <p>Yes, once defences fail potential for inundation of the freshwater habitat.</p>	<p>2</p> <p>Yes, overtime, with sea level rise the defences are likely to become overtopped, causing inundation of the freshwater habitat.</p>	<p>3</p> <p>No, defences maintained which will protect the freshwater habitat</p>	<p>3</p> <p>No, defences maintained which will protect the freshwater habitat</p>
Impacts on intertidal habitats	<p>2</p> <p>Yes, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</p> <p>Although new saltmarsh and mudflat habitat would potentially develop once the defences fail, the rate, area and quality would effectively be unmanaged, so this would not be a favourable means of mitigating for coastal squeeze (where for example Managed Realignment would).</p>	<p>2</p> <p>Yes, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</p> <p>Although new saltmarsh and mudflat habitat would potentially develop once the defences fail, the rate, area and quality would effectively be unmanaged, so this would not be a favourable means of mitigating for coastal squeeze (where for example Managed Realignment would).</p>	<p>2</p> <p>Yes, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</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 (where for example Managed Realignment would).</p>	<p>1</p> <p>Yes - defence line held which will result in increased coastal squeeze</p>	<p>1</p> <p>Yes - defence line held which will result in increased coastal squeeze</p>

Habitat Connectivity	1 No, the overall loss of habitat connectivity through the estuary would not be compensated for, as the potential formation of new habitats would be unmanaged and of lesser quality, with a net loss in SPA habitats.	1 No, the overall loss of habitat connectivity through the estuary would not be compensated for, as the potential formation of new habitats would be unmanaged and of lesser quality, with a net loss in SPA habitats.	1 No, the loss of habitat connectivity through the estuary would be compensated for by the gradual establishment of intertidal habitats.	2 Habitat connectivity would be reduced as available habitat was lost to coastal squeeze.	2 Habitat connectivity would be reduced as available habitat was lost to coastal squeeze.
<b>SEA (Strategic Environmental Assessment)</b>					
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk
Effects on population	1 Loss of agricultural livelihoods and coastal access amenity following failure of the defences in year 10	1 Loss of agricultural livelihoods and coastal access amenity following failure of the defences in year 15	2 Loss of agricultural livelihoods and coastal access amenity over time with increased risk of overtopping due to sea level rise	4 Agricultural livelihoods at reduced risk from flooding	5 Agricultural livelihoods at reduced risk from flooding
Impact on plans/programmes	1 Proposed development site potentially at risk from flooding	1 Proposed development site potentially at risk from flooding	2 Proposed development site potentially 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	5 Proposed development site at reduced risk from flooding
Freshwater Biodiversity	1 Landward SPA and SSSI at risk following failure of the defences in year 10. Its reed bed is probably the largest within the Medway Estuary. Motney Hill Marshes form an integral part of the Medway Estuary and Marshes SSSI, SPA and RAMSAR site. There is a wide diversity of wildlife due to the differing habitats on site. The reed beds, fresh marshes, ditch systems, woodland, seawall and mudflats support a variety of breeding birds, with marsh harrier and bearded tit the most notable species to occur. Its prolific ditch system hosts a large population of water voles.	1 Landward SPA and SSSI at risk following failure of the defences in year 15. Its reed bed is probably the largest within the Medway Estuary. Motney Hill Marshes form an integral part of the Medway Estuary and Marshes SSSI, SPA and RAMSAR site. There is a wide diversity of wildlife due to the differing habitats on site. The reed beds, fresh marshes, ditch systems, woodland, seawall and mudflats support a variety of breeding birds, with marsh harrier and bearded tit the most notable species to occur. Its prolific ditch system hosts a large population of water voles.	2 Landward SPA and SSSI at risk with increased risk of overtopping due to sea level rise. Its reed bed is probably the largest within the Medway Estuary. Motney Hill Marshes form an integral part of the Medway Estuary and Marshes SSSI, SPA and RAMSAR site. There is a wide diversity of wildlife due to the differing habitats on site. The reed beds, fresh marshes, ditch systems, woodland, seawall and mudflats support a variety of breeding birds, with marsh harrier and bearded tit the most notable species to occur. Its prolific ditch system hosts a large population of water voles.	5 Freshwater habitat at reduced risk from overtopping	5 Freshwater habitat at reduced risk from overtopping

Saline Biodiversity	1 Following the failure of defences in year 10 there may be the opportunity for uncontrolled development of intertidal habitat which could alleviate the loss of intertidal habitat within the wider estuary, but the extent and quality of this is unknown.	1 Following the failure of defences in year 15 there may be the opportunity for uncontrolled development of intertidal habitat which could alleviate the loss of intertidal habitat within the wider estuary, but the extent and quality of this is unknown.	2 Potential for coastal squeeze of the intertidal SPA habitat. However overtime the risk of overtopping will increase with sea level rise, which could allow the development of intertidal habitats behind the defences, but this is uncontrolled.	1 Seaward SPA and SSSI at risk (including coastal squeeze)	1 Seaward SPA and SSSI at risk (including coastal squeeze)
Soil	1 Degradation of soils, risk of pollutant mobilisation following failure of the defences in year 10	1 Degradation of soils, risk of pollutant mobilisation following failure of the defences in year 15	2 Degradation of soils, risk of pollutant mobilisation over time with increased risk of overtopping due to sea level rise	4 Soils protected	5 Soils protected immediately
Groundwater	2 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally once the defences fail there may be the risk of contaminant release from the landfill sites.	2 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally once the defences fail there may be the risk of contaminant release from the landfill sites.	2 Risk to groundwater will increase overtime as sea levels rise. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Risk to mobilisation of contaminants from the landfill sites will increase overtime with sea level rise too.	4 Reduced risk to groundwater and the mobilisation of contaminants from the landfill sites.	4 Reduced risk to groundwater and the mobilisation of contaminants from the landfill sites.
Landscape (visual impact)	2 Change once the defences fail but giving back to natural processes	2 Change once the defences fail but giving back to natural processes	3 Very gradual change to landscape type with overtopping of defences	4 Change in visual impact with rising defences	4 Change in visual impact with rising defences
Carbon Storage	2 Loss of carbon storage in saltmarsh and freshwater marshland with assumed conversion to mudflat once the defences failed	2 Loss of carbon storage in saltmarsh and freshwater marshland with assumed conversion to mudflat once the defences failed	2 Gradual loss of carbon storage in saltmarsh and freshwater marshland with assumed conversion to mudflat	2 Carbon storage loss due to coastal squeeze, and carbon cost generated through construction	2 Carbon storage loss due to coastal squeeze, and carbon cost generated through construction

Ecosystem Services					
Qualitative Score from Ecosystem Services Assessment	-44	-44	-29	-3	-4
Comments	Major degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) roughly balance with risks of minor degradation in many services (e.g. genetic resource provision, climate regulation, aesthetic value, provision of habitat for conservation and fisheries habitat)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) roughly balance with risks of minor degradation in many services (e.g. genetic resource provision, climate regulation, aesthetic value, provision of habitat for conservation and fisheries habitat)
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	Y	Y	Y	Y	Y
4 - WFD	N	N	N	N	N
5 - Local Plans	N	N	Y	Y	Y



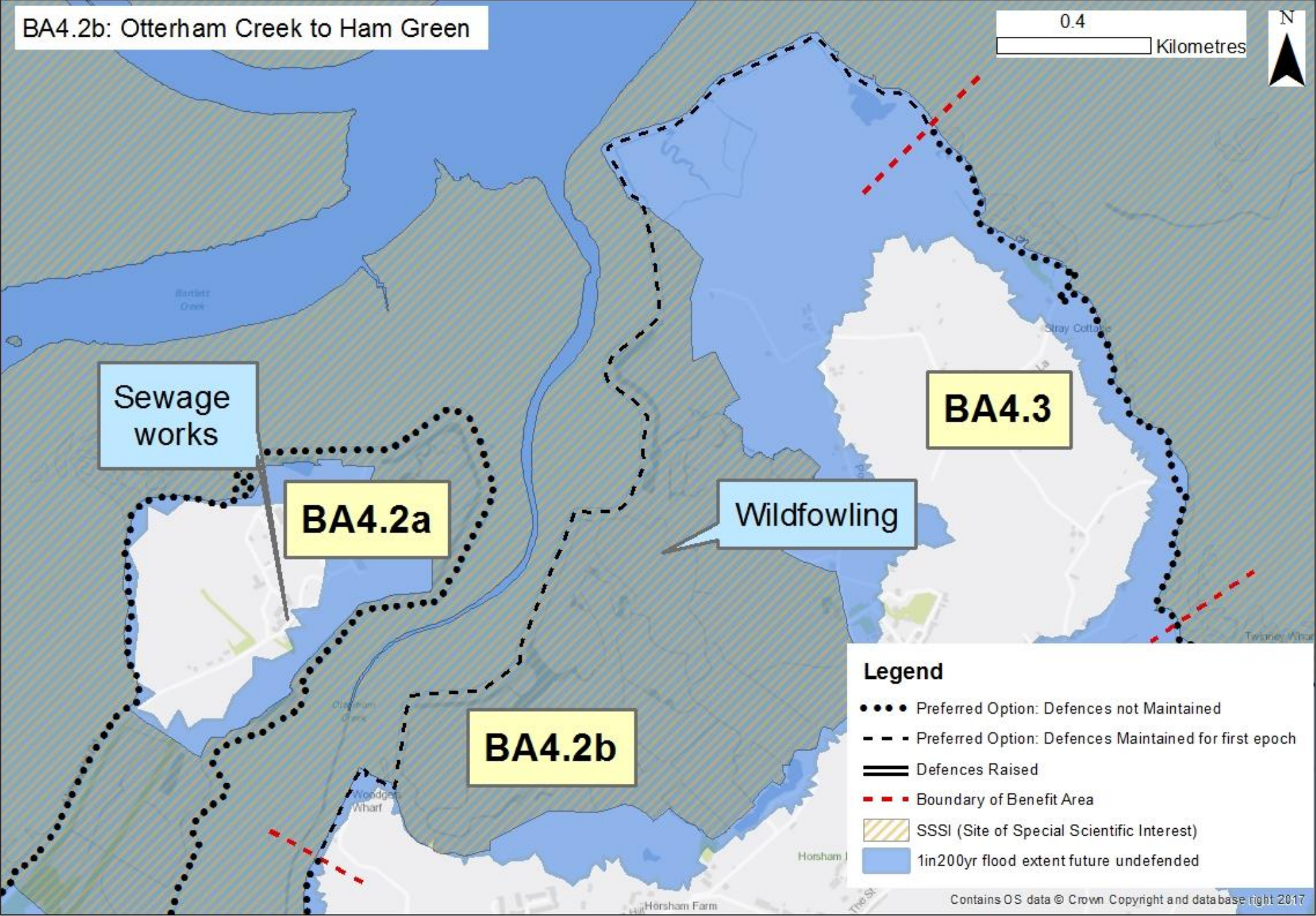
Environmental Scores					
100 = best option, 0 = worst option					
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment	e) Raise (upgrade) embankments, walls and revetment
WFD (Water Framework Directive)					
Compliance assessment outcome	25	25	0	0	0
HRA (Habitats Regulation Assessment)					
Impact on SPA/ Ramsar qualifying	0	0	0	0	0
Impacts on freshwater habitats	25	25	25	50	50
Impacts on intertidal habitats	25	25	25	0	0
Habitat Connectivity	0	0	0	25	25
SEA (Strategic Environmental Assessment)					
Historic Environment	50	50	50	50	50
Effects on population	0	0	25	75	100
Impact on plans/ programmes	0	0	25	100	100
Freshwater Biodiversity	0	0	25	100	100
Saline Biodiversity	0	0	25	0	0
Soil	0	0	25	75	100
Groundwater	25	25	25	75	75
Landscape (visual impact)	25	25	50	75	75
Carbon Storage	25	25	25	25	25
Total	200	200	325	650	700

Summary of Results					
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment	e) Raise (upgrade) embankments, walls and revetment
Costs	£ -	£ 236,000	£ 7,511,855	£ 8,362,769	£ 12,421,931
Benefits	£ -	£ 24,000	£ 161,613	£ 536,473	£ 574,975
NPV	£ -	-£ 211,000	-£ 7,350,242	-£ 7,826,296	-£ 11,846,955
BCR	0.0	0.1	0.0	0.1	0.0
Environmental Scoring	200	200	325	650	700

Impacts on freshwater designated habitat	
Ramsar and SPA habitat at risk from Year 9. Cost effectiveness analysis shows preferred management approach: Provide compensation by year 9.	
Cost of providing compensation for impacts	Cost of holding the line with SLR
£ 2,000,032	£ 7,511,855

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.2B - Motney Hill to Ham Green - Ottersham Creek to Ham Green - MR in area to the west of Upchurch (Site 17)
Frontage Length	4.2 km
Defence Structure Type	Earth embankments, high ground
Min Standard of Protection (AEP%)	50%
Residual Life (years)	10

	0-20 years	20-50 years	50-100 years
SMP Policy	MR with localised HTL	MR with localised HTL	MR with localised HTL
Aiming to comply with policy	Agree with the SMP		
Comment	Agree with SMP: MR with some areas of HTL (but also potential area for NAI)		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	1	4	6	8
Commercial & Industrial	0	0	1	1
Agricultural (Ha)	153	172	176	189
Key Infrastructure	None	None	None	None
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)



Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	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	currently present and will not significantly reduce flood risk. Also potentially environmentally damaging in SPA habitat
	Construct rock revetment	N	currently present and will not significantly reduce flood risk. Also 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 - no significant assets at risk to warrant installation of temporary defences (significant resources to implement)
	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. Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
Non-Structural	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, walls and revetment	c) Maintain SOP (capital) embankments, walls and revetment	d) Raise (sustain SOP) embankments, walls and revetment	e) Raise (upgrade SOP) embankments, walls and revetment
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	-	-	-	-	-
Comment and decision on whether taken forward to shortlist	Y= baseline. SOP of defences very low and residual life of defences low.	Y= as baseline. Following year 15 a Do nothing scenario would occur due to failure of the defences.	Y= very low residual life and SOP so capital works required.	Y= Existing defence SOP variable but could be increased with sea level rise (particularly to protect freshwater habitat and the access to Motney Hill). Included to consider the risk of overtopping onto designated sites.	N= no significant assets to warrant upgrade of defences.

Long List of Options			
	f) Construct new setback embankments at identified managed realignment and maintain SOP of existing embankments, along the rest of the section.	g) Construct new setback embankments at identified managed realignment and sustain SOP of existing embankments, walls and revetment along the rest of the section.	h) Construct new setback embankments at identified managed realignment and upgrade SOP of existing embankments, walls and revetment along the rest of the section.
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	Y	Y	Y
3- Reduce maintenance	TBC*	TBC*	TBC*
4 - WFD	TBC	TBC	TBC
5 - Local Plans	-	-	-
Comment and decision on whether taken forward to shortlist	Y = realignment site requires further consideration to assess the impact on the designated habitats.	Y = realignment site requires further consideration to assess the impacts on designated habitats. Defences along the section will require improvements in SOP.	N= no significant assets to warrant upgrade of defences.

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

Assessment of Short List				
Option	a) Do nothing	b) Do nothing	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment
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 10 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.	Defences have 10 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.	Current defences have 10 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.	Current defences have 10 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.
Assumptions/ Uncertainties	Assumes that all management and maintenance is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure.	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%	5%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 2,551,678	£ 3,847,771
PV Maintenance Costs	£ -	£ 20,802,021	£ 184,915	£ 185,780
PV Other Costs	£ -	£ -	£ 251,810	£ 351,375
Total Cost (including Optimism Bias) (PV)	£ -	£ 33,283,234	£ 4,781,445	£ 7,015,882
Value of Benefits	£ -	£ 312,163,981	£ 260,569	£ 1,673,349
Benefit Cost Ratio (BCR)	0.0	9.4	0.1	0.2
PF Score	0%	53%	0%	2%
Further funding required to achieve 100% PF Score	£ -	£ 16,000	£ 4,758,135	£ 6,887,580
Flood/ erosion impacts				
Number of Residential Properties at risk under 0.1% AEP	10	10	10	1

Assessment of Short List		
Option	e) Construct new setback embankments at identified managed realignment and maintain embankments, along the rest of the section. MR in area to the west of Upchurch (Site 17)	f) Construct new set back embankment at identified managed realignment sites and sustain existing embankment and revetment.
Description	Development of MR site. Capital works undertaken on remaining defences to maintain the current defences	Development of MR site. Capital works undertaken to improve the remaining defences
Technical Issue	<p>Current defences have 10 years residual life.</p> <p>The MR site ties back into high ground. The MR is freshwater designated habitat and therefore compensatory habitat is required.</p> <p>Based on current sea levels the MR site would create 74.3ha of saltmarsh and 40ha of mudflat. With 100 years sea level rise there could be 22.6ha of saltmarsh and 92.4ha of mudflat.</p>	<p>Current defences have 10 years residual life.</p> <p>The MR site ties back into high ground.</p> <p>The MR is freshwater designated habitat and therefore compensatory habitat is required.</p> <p>Based on current sea levels the MR site would create 74.3ha of saltmarsh and 40ha of mudflat. With 100 years sea level rise there could be 22.6ha of saltmarsh and 92.4ha of mudflat.</p>
Assumptions/ Uncertainties	MR site to provide at least a 5% AEP SOP. The crest height of the remaining defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in SOP for these sections of defence as the sea level rises.	MR site to provide at least a 5% AEP SOP. 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.
SOP Provided (% AEP)	5%	5%
Value of Economics		
PV Capital Costs	£ 3,136,376	£ 3,524,074
PV Maintenance Costs	£ 132,545	£ 124,955
PV Other Costs	£ 288,120	£ 331,487
Total Cost (including Optimism Bias) (PV)	£ 5,691,265	£ 6,368,825
Value of Benefits	£ 1,044,133	£ 1,784,839
Benefit Cost Ratio (BCR)	0.2	0.3
PF Score	101%	91%
Further funding required to achieve 100% PF Score	£ -	£ 563,510
Flood/ erosion impacts		
Number of Residential Properties at risk under 0.1% AEP	10	1

Number of Commercial properties at risk under 0.1% AEP	2	2	2	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 879,415	£ 587,339	£ 761,004	£ 20,299
Critical Infrastructure	No assets at risk	No assets at risk	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	£925,722 Worst case scenario 66ha Grade 1 agricultural land flooded and 129ha Grade 4 flooded	£905,634 Worst case scenario 66ha Grade 1 agricultural land flooded and 129ha Grade 4 flooded	£783,564 Worst case scenario 65ha Grade 1 agricultural land flooded and 129ha Grade 4 flooded	£111,489 Worst case scenario 53ha Grade 1 agricultural land flooded and 129ha Grade 4 flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	HTL preferred	HTL preferred	HTL preferred	HTL preferred
Landowners	Landowners prefers HTL to protect their homes and businesses Would like to see the defences maintained and improved over time	Landowners prefers HTL to protect their homes and businesses Would like to see the defences maintained and improved over time	Landowners prefers HTL to protect their homes and businesses Would like to see the defences maintained and improved over time	Landowners prefers HTL to protect their homes and businesses Would like to see the defences maintained and improved over time
Technical Feasibility				
Site Specific	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a



Number of Commercial properties at risk under 0.1% AEP	2	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 761,004	£ -
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	£0 Agriculture land included in the cost of MR	£0 Agriculture land included in the cost of MR
Stakeholders Feedback		
Statutory Stakeholders/ SEG	Kent Wildfowlers have concern over MR as they have invested in the freshwater habitat. Other stakeholders believe MR could be possible here but is not the first choice	Kent Wildfowlers have concern over MR as they have invested in the freshwater habitat. Other stakeholders believe MR could be possible here but is not the first choice
Landowners	Concerned that MR will result in the loss of significant areas of valuable agricultural land. Would also destroy the neighbourhood and local community. Landowners also noted that there might be some technical issues due to low areas on the sites	Concerned that MR will result in the loss of significant areas of valuable agricultural land. Would also destroy the neighbourhood and local community. Landowners also noted that there might be some technical issues due to low areas on the sites
Technical Feasibility		
Site Specific	Approx. 80% flooded on Spring tide. Potentially 1,467m decrease in defence length due to setback defences/ tie into high ground. MR site would create 74.3ha of saltmarsh and 40ha of mudflat. With 100 years sea level rise there could be 22.6ha of saltmarsh and 92.4ha of mudflat.	Approx. 80% flooded on Spring tide. Potentially 1,467m decrease in defence length due to setback defences/ tie into high ground. MR site would create 74.3ha of saltmarsh and 40ha of mudflat. With 100 years sea level rise there could be 22.6ha of saltmarsh and 92.4ha of mudflat.
Strategy Wide	Completely flooded during extreme events	Completely flooded during extreme events

WFD (Water Framework Directive)				
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
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until failure of the defences in year 10. Once the defences fail there will be degradation and loss of existing Designated freshwater grazing marsh, which is known to be of good quality. The southern portion of this c. 106 ha site is the best quality, managed under Stewardship Agreements for breeding waders - there is a large breeding population of avocets in this southern portion. Other waders, including redshank and lapwing, use the whole of this area.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until failure of the defences in year 15. Once the defences fail there will be degradation and loss of existing Designated freshwater grazing marsh, which is known to be of good quality. The southern portion of this c. 106 ha site is the best quality, managed under Stewardship Agreements for breeding waders - there is a large breeding population of avocets in this southern portion. Other waders, including redshank and lapwing, use the whole of this area.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader species including redshank, ringed and grey plover, dunlin etc. Increased risk of overtopping due to sea level rise, would result in the degradation and loss of existing Designated freshwater grazing marsh, which is known to be of good quality. The southern portion of this c106 ha site is the best quality, managed under Stewardship Agreements for breeding waders.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader species including redshank, ringed and grey plover, dunlin etc. Increased risk of overtopping due to sea level rise, would result in the degradation and loss of existing Designated freshwater grazing marsh, which is known to be of good quality. The southern portion of this c106 ha site is the best quality, managed under Stewardship Agreements for breeding waders.
Impacts on freshwater habitats	1  Compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to intertidal habitats as overtopping and failure of defences occur.	1  Compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to intertidal habitats as overtopping and failure of defences occur.	1  Compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to intertidal habitats as overtopping occurs.	3  No - Designated freshwater habitats at a reduced risk of overtopping
Impacts on intertidal habitats	2  No, until the defences fail and overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.  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 (where for example Managed Realignment would).	2  No, until the defences fail and overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.  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 (where for example Managed Realignment would).	2  No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.  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 (where for example Managed Realignment would).	1  No the defence line is being maintained which will result in coastal squeeze overtime.

WFD (Water Framework Directive)		
Compliance assessment outcome	2 Some return to natural processes but controlled	2 Some return to natural processes but controlled
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader species including redshank, ringed and grey plover, dunlin etc.	1  There may be potential significant effects on the freshwater Medway Estuary and Marshes SPA and its constituent qualifying features due to the intrusion of works into Designated areas.  The Managed Realignment (c. 106.6 ha) would result in the loss of existing Designated freshwater grazing marsh, which is known to be of good quality. The southern portion of this c. 106 ha site is the best quality, managed under Stewardship Agreements for breeding waders - there is a large breeding population of avocets in this southern portion. Other waders, including redshank and lapwing, use the whole of this area. The conversion to saltmarsh and mudflat may not keep up with the rate of habitat lost to coastal squeeze, and the quality of the newly formed habitats is not likely to be the same as those habitats lost to coastal squeeze.
Impacts on freshwater habitats	1  Compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to the Managed Realignment site	1  Compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to the Managed Realignment site
Impacts on intertidal habitats	4  Yes, the Managed Realignment site, and the development of saltmarsh and mudflat therein would support mitigation for coastal squeeze as the habitats developed and established.  The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.	4  Yes, the Managed Realignment site, and the development of saltmarsh and mudflat therein would support mitigation for coastal squeeze as the habitats developed and established.  The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.

Habitat Connectivity	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.	2 Slight negative impacts due to loss of habitat
<b>SEA (Strategic Environmental Assessment)</b>				
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk
Effects on population	1 Agricultural livelihoods and coastal access and amenity at risk following failure of the defences in year 10	1 Agricultural livelihoods and coastal access and amenity at risk following failure of the defences in year 15	2 Agricultural livelihoods and coastal access and amenity at risk over time with increased risk of overtopping due to sea level rise	4 Agricultural livelihoods, and coastal access and amenity at reduced risk from flooding
Impact on plans/ programmes	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites
Freshwater Biodiversity	1 Currently under a stewardship agreement for the management of breeding waders. In the lower part of the site there are 20 breeding pairs of Avocet's, and the landowner has undertaken works to improve the site for them. In the upper section there is Lapwing, but the area is not as productive for breeding waders. Potential loss of reed bed habitat following failure of the defences in year 10.	1 Currently under a stewardship agreement for the management of breeding waders. In the lower part of the site there are 20 breeding pairs of Avocet's, and the landowner has undertaken works to improve the site for them. In the upper section there is Lapwing, but the area is not as productive for breeding waders. Potential loss of reed bed habitat following failure of the defences in year 10.	2 Gradual loss of freshwater marshland with conversion to mudflat may provide in some areas for roll back mosaic of habitats could be affected over time with increased risk of overtopping due to sea level rise.	5 Freshwater marshland at reduced risk from saline overtopping
Saline Biodiversity	4 Creation of intertidal habitat following failure of the defences	4 Creation of intertidal habitat following failure of the defences	3 Gradual creation of intertidal habitat over time with increased risk of overtopping due to sea level rise	1 Risk of coastal squeeze
Soil	1 Degradation of soil following the failure of the defences. Risk of pollutant mobilisation	1 Degradation of soil following the failure of the defences. Risk of pollutant mobilisation	2 Degradation over time. Risk of pollutant mobilisation	5 Soils protected



Habitat Connectivity	<p>4</p> <p>Yes, over time, the created habitats (and the compensatory freshwater habitat) should serve to help maintain habitat connectivity across the estuary and the SPA.</p>	<p>4</p> <p>Yes, over time, the created habitats (and the compensatory freshwater habitat) should serve to help maintain habitat connectivity across the estuary and the SPA.</p>
SEA (Strategic Environmental Assessment)		
Historic Environment	<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>2</p> <p>Agricultural livelihoods and coastal access and amenity at risk with the development of the MR site.</p>	<p>2</p> <p>Agricultural livelihoods and coastal access and amenity at risk with the development of the MR site.</p>
Impact on plans/ programmes	<p>3</p> <p>Benefit area does not coincide with proposed development sites</p>	<p>3</p> <p>Benefit area does not coincide with proposed development sites</p>
Freshwater Biodiversity	<p>1</p> <p>Create new intertidal habitat which would replace freshwater habitat this could impact on freshwater habitat supporting wetland bird species This is an area of traditional coastal marsh grazing marsh, saltmarsh encounterable Scattered isolated patches of scrub. Currently under a stewardship agreement for the management of breeding waders see above for species.</p>	<p>1</p> <p>Create new intertidal habitat which would replace freshwater habitat this could impact on freshwater habitat supporting wetland bird species This is an area of traditional coastal marsh grazing marsh, saltmarsh encounterable Scattered isolated patches of scrub. Currently under a stewardship agreement for the management of breeding waders see above for species.</p>
Saline Biodiversity	<p>5</p> <p>Creation of intertidal habitat</p>	<p>5</p> <p>Creation of intertidal habitat</p>
Soil	<p>1</p> <p>Loss of soils due to Managed Realignment, risk of pollutant mobilisation over time</p>	<p>1</p> <p>Loss of soils due to Managed Realignment, risk of pollutant mobilisation over time</p>

Groundwater	1 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	1 Risk to groundwater is high 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.	5 No impact
Landscape (visual impact)	4 Change following the failure of the defences but giving back to natural processes	4 Change following the failure of the defences but giving back to natural processes	3 Very gradual change to landscape type with overtopping of defences	2 Change in visual impact with rising defences
Carbon Storage	1 Loss of carbon storage with assumed conversion of marshland to mudflat following the failure of the defences	1 Loss of carbon storage with assumed conversion of marshland to mudflat following the failure of the defences	2 Gradual loss of carbon storage with assumed conversion of marshland to mudflat	4 Carbon storage loss due to coastal squeeze, with carbon cost generated through construction
Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-40	-40	-25	-1
Comments	Major degradation in various ES (e.g. freshwater provision, food provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in various ES (e.g. freshwater provision, food provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in various ES (e.g. freshwater provision, food provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) balance with risks of minor degradation in many services (e.g. climate regulation, aesthetic value, provision of habitat for conservation and fisheries habitat)
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N	N	Y	Y
2 - Natura 2000 sites	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y
4 - WFD	N	N	N	N
5 - Local Plans	N	N	Y	Y

Groundwater	2 Risk of pollutant mobilisation over time.	2 Risk of pollutant mobilisation over time.
Landscape (visual impact)	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	1 Loss of carbon storage due to habitat change and carbon cost generated through construction and habitat change	1 Loss of carbon storage due to habitat change and carbon cost generated through construction and habitat change
Ecosystem Services		
Qualitative Score from Ecosystem Services Assessment	14	19
Comments	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat) outweigh degradation risk in many ES (e.g. freshwater provision, food provision, water purification, conservation habitat)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat) outweigh degradation risk in many ES (e.g. freshwater provision, food provision, water purification, conservation habitat)
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	Y	Y
3- Reduce maintenance	Y	Y
4 - WFD	Y	Y
5 - Local Plans	Y	Y

Environmental Scores				
100 = best option, 0 = worst option				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	0	0	0	0
Impacts on freshwater habitats	0	0	0	50
Impacts on intertidal habitats	25	25	25	0
Habitat Connectivity	50	50	50	25
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	0	0	25	75
Impact on plans/ programmes	50	50	50	50
Freshwater Biodiversity	0	0	25	100
Saline Biodiversity	75	75	50	0
Soil	0	0	25	100
Groundwater	0	0	25	100
Landscape (visual impact)	75	75	50	25
Carbon Storage	0	0	25	75
Total	350	350	400	650

Environmental Scores		
100 = best option, 0 = worst option		
Option	e) Construct new setback embankments at identified managed realignment and maintain embankments, along the rest of the section.	f) Construct new setback embankments at identified managed realignment and sustain embankments, walls and revetment along the rest of the section.
WFD (Water Framework Directive)		
Compliance assessment outcome	25	25
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	0	0
Impacts on freshwater habitats	0	0
Impacts on intertidal habitats	75	75
Habitat Connectivity	75	75
SEA (Strategic Environmental Assessment)		
Historic Environment	50	50
Effects on population	25	25
Impact on plans/ programmes	50	50
Freshwater Biodiversity	0	0
Saline Biodiversity	100	100
Soil	0	0
Groundwater	25	25
Landscape (visual impact)	0	0
Carbon Storage	0	0
Total	425	425

Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment	d) Raise (sustain) embankments, walls and revetment
Costs	£ -	£ 33,283	£ 4,781,445	£ 7,015,882
Benefits	£ -	£ 312,164	£ 260,569	£ 1,673,349
NPV	£ -	£ 279,881	-£ 4,520,876	-£ 5,342,533
BCR	0.0	9.4	0.1	0.2
Environmental Scoring	350	350	400	650

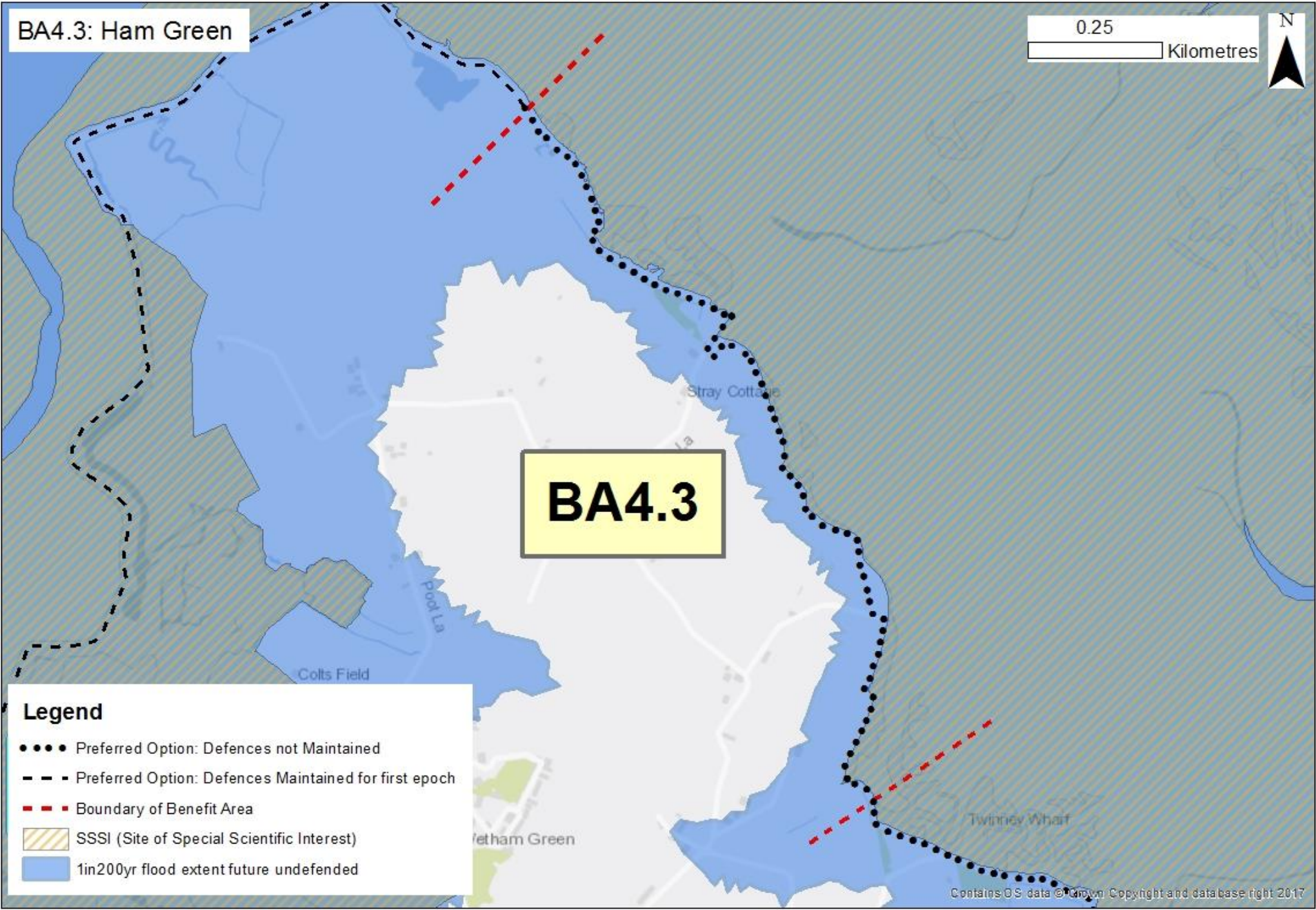
Summary of Results		
Option	e) Construct new setback embankments at identified managed realignment and maintain embankments, along the rest of the section.	f) Construct new setback embankments at identified managed realignment and sustain embankments, walls and revetment along the rest of the section.
Costs	£ 5,691,265	£ 6,368,825
Benefits	£ 1,044,133	£ 1,784,839
NPV	-£ 4,647,132	-£ 4,583,986
BCR	0.2	0.3
Environmental Scoring	425	425



Impacts on freshwater designated habitat			
Ramsar and SPA habitat at risk from Year 15. Cost effectiveness analysis shows preferred management approach: Provide compensation by year 15.			
Cost of providing compensation for impacts		Cost of holding the line with SLR	
£	3,242,955	£	4,781,445

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.3 - Ham Green to east of Upchurch
Frontage Length	2.3 km
Defence Structure Type	Earth embankments
Min Standard of Protection (AEP%)	50%
Residual Life (years)	20

	0-20 years	20-50 years	50-100 years
SMP Policy	NAI	NAI	NAI
Aiming to comply with policy	Agree with the SMP		
Comment	Agree with SMP: NAI for all epochs due to lack of assets protected by defences		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	0	0	0	3
Commercial & Industrial	0	1	1	1
Agricultural (Ha)	3.5	6.2	7.6	12.6
Key Infrastructure	None	None	None	None
Social and Environmental Considerations	Natural England Coastal Path (Saxon Shore Way)	Natural England Coastal Path (Saxon Shore Way)	Natural England Coastal Path (Saxon Shore Way)	Natural England Coastal Path (Saxon Shore Way)



Long List to Short List			
Potential Measures			
Structural	Measures	Selected	Reasoning
	Construct new embankment	N	Exclude - limited benefits and will not implement the SMP Policy
	Maintain embankment	N	Exclude - limited benefits and will not implement the SMP Policy
	Raise embankment (sustain)	N	Exclude - limited benefits and will not implement the SMP Policy
	Raise embankment (upgrade)	N	Exclude - limited benefits and will not implement the SMP Policy
	Construct new wall	N	Exclude - limited benefits and will not implement the SMP Policy
	Maintain wall	N	Exclude - limited benefits and will not implement the SMP Policy
	Raise wall (sustain)	N	Exclude - limited benefits and will not implement the SMP Policy
	Raise wall (upgrade)	N	Exclude - limited benefits and will not implement the SMP Policy
	Maintain rock revetment	N	Exclude - limited benefits and will not implement the SMP Policy
	Construct rock revetment	N	Exclude - limited benefits and will not implement the SMP Policy
	Install demountable defences	N	Exclude - limited benefits and will not implement the SMP Policy
	Install temporary defences	N	Exclude - limited benefits and will not implement the SMP Policy
	Beach recharge (sand or shingle)	N	Exclude - limited benefits and will not implement the SMP Policy
	Construct rock groynes	N	Exclude - limited benefits and will not implement the SMP Policy
	Maintain rock groynes	N	Exclude - limited benefits and will not implement the SMP Policy
	Construct timber structures	N	Exclude - limited benefits and will not implement the SMP Policy
	Maintain timber structures	N	Exclude - limited benefits and will not implement the SMP Policy
	Construct a tidal barrier	N	Exclude - limited benefits and will not implement the SMP Policy
Non-Structural	Implement monitoring	N	Exclude - limited defences to monitor (suggest monitor for health and safety only)
	Implement flood warning system	N	Exclude - erosion risk
	Land use planning	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Adaptation measures	Y	Take forwards - will support the SMP policy
	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) Adaptation- rollback of properties at risk of erosion	c) Monitoring only	d) Ongoing maintenance of embankments
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N	N	N	N
2 - Natura 2000 sites	N	Y	N	N
3- Reduce maintenance	N	Y	Y	N
4 - WFD	N	TBC	TBC	Y
5 - Local Plans	-	-	-	-
Comment and decision on whether taken forward to shortlist	Y= baseline. SOP of defences very low and residual life of defences low.	N = no significant assets at risk.	Y= monitoring of the cliff as it erodes for health and safety.	N= the SMP policy in the area is NAI, therefore not viable to suggest HTL options. Additionally limited assets at risk in the area.

Short List of Options	
a) Do nothing	
b) Monitoring only	

Assessment of Short List		
Option	a) Do nothing	b) Monitoring only
Description	Used as an economic baseline to compare the other options against.	No capital works completed but monitoring of the cliffs is undertaken for health and safety
Technical Issue	Defences have 20 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	Current defences have 20 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.
Assumptions/ Uncertainties	Assumes that all management is ceased.	No capital works.
SOP Provided (% AEP)	0% (Erosion)	0% (Erosion)
Value of Economics		
PV Capital Costs	£ -	£ -
PV Maintenance Costs	£ -	£ -
PV Other Costs	£ -	£ -
Total Cost (including Optimism Bias) (PV)	£ -	£ -
Value of Benefits	£ -	£ -
Benefit Cost Ratio (BCR)	0.0	0.0
PF Score	0%	0%
Further funding required to achieve 100% PF Score	£ -	£ -
Flood/ erosion impacts		
Number of Residential Properties at risk under 0.1% AEP	5	5
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)	£ 16,894,209	£ 16,894,209
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	£116,272 Worst case scenario 15.7ha Grade 1 Agric land flooded	£116,272 Worst case scenario 15.7ha Grade 1 Agric 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	2 Some return to natural processes	2 Some return to natural processes



HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	<div>1</div> <div>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze, as the rate of erosion may not allow the retreat of the cliff in line with sea level rise.</div> <div>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species.</div>	<div>1</div> <div>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze, as the rate of erosion may not allow the retreat of the cliff in line with sea level rise.</div> <div>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species.</div>
Impacts on freshwater habitats	<div>3</div> <div>n/a - no designated freshwater habitats in the BA</div>	<div>3</div> <div>n/a - no designated freshwater habitats in the BA</div>
Impacts on intertidal habitats	<div>2</div> <div>Potential for loss of intertidal habitats from coastal squeeze.</div>	<div>2</div> <div>Potential for loss of intertidal habitats from coastal squeeze.</div>
Habitat Connectivity	<div>2</div> <div>Slight negative impact in connectivity due to loss of habitat from coastal squeeze.</div>	<div>2</div> <div>Slight negative impact in connectivity due to loss of habitat from coastal squeeze.</div>
SEA (Strategic Environmental Assessment)		
Historic Environment	<div>1</div> <div>Saxon shore way historic footpath at risk</div>	<div>1</div> <div>Saxon shore way historic footpath at risk</div>
Effects on population	<div>1</div> <div>Coastal access and agricultural livelihoods at risk following failure of the defences in year 20.</div>	<div>1</div> <div>Coastal access and agricultural livelihoods at risk following failure of the defences in year 9</div>
Impact on plans/ programmes	<div>3</div> <div>Benefit area does not coincide with proposed development sites</div>	<div>3</div> <div>Benefit area does not coincide with proposed development sites</div>
Freshwater Biodiversity	<div>3</div> <div>No significant impacts, as risk from erosion not overtopping.</div>	<div>3</div> <div>No significant impacts, as risk from erosion not overtopping.</div>
Saline Biodiversity	<div>3</div> <div>Although the area is eroding there may still be the potential for coastal squeeze</div>	<div>3</div> <div>Although the area is eroding there may still be the potential for coastal squeeze</div>
Soil	<div>1</div> <div>Loss of soils through erosion</div>	<div>1</div> <div>Loss of soils through erosion</div>
Groundwater	<div>3</div> <div>No impacts</div>	<div>3</div> <div>No impacts</div>
Landscape (visual impact)	<div>4</div> <div>Change but giving back to natural processes</div>	<div>4</div> <div>Change but giving back to natural processes</div>
Carbon Storage	<div>2</div> <div>Loss of terrestrial carbon storage</div>	<div>2</div> <div>Loss of terrestrial carbon storage</div>
Ecosystem Services		
Qualitative Score from Ecosystem Services Assessment	<div>-21</div>	<div>-19</div>

Comments	Degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	N	N
2 - Natura 2000 sites	N	N
3- Reduce maintenance	Y	Y
4 - WFD	Y	Y
5 - Local Plans	Y	Y

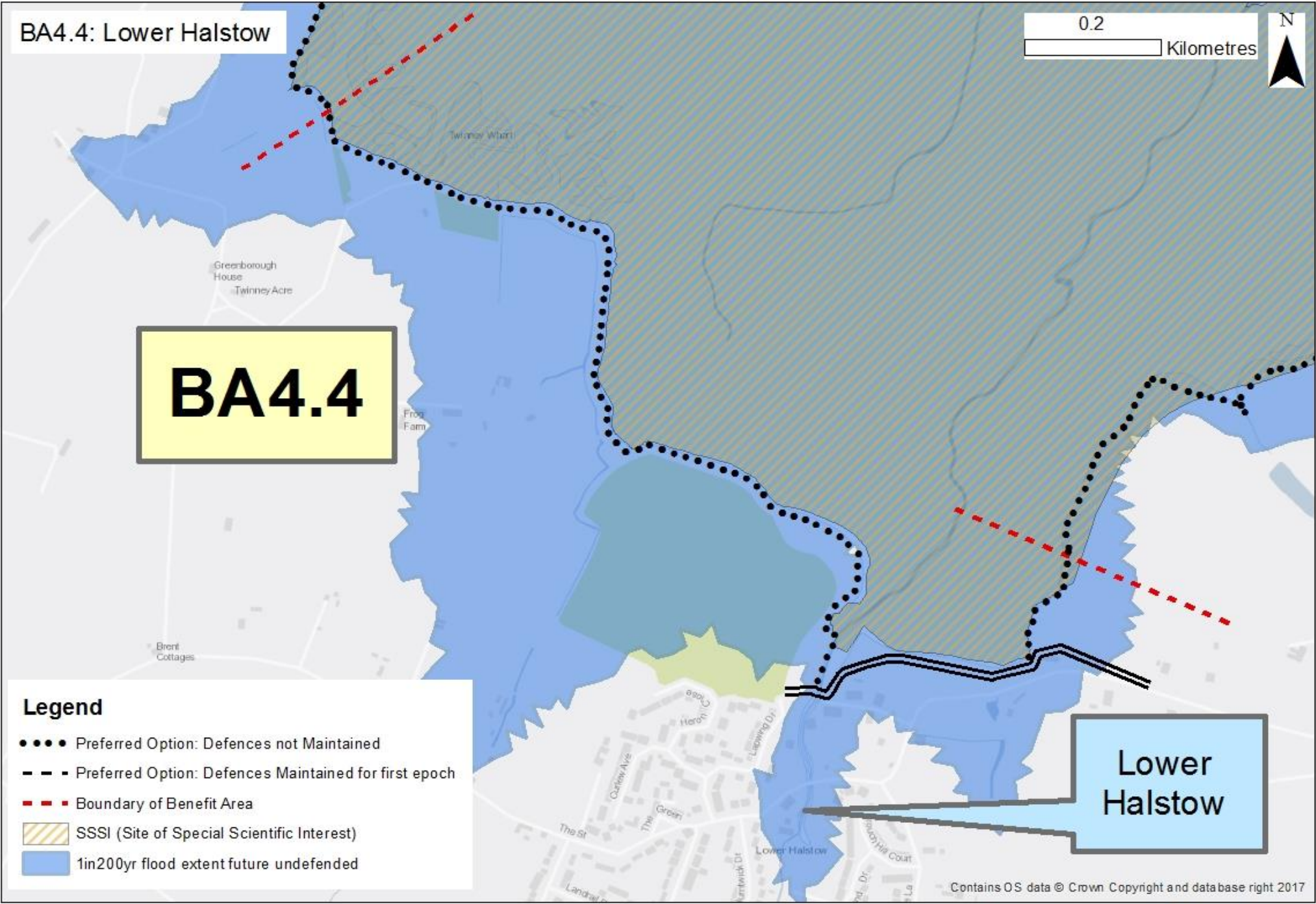
Environmental Scores		
100 = best option, 0 = worst option		
Option	a) Do nothing	b) Monitoring only
WFD (Water Framework Directive)		
Compliance assessment outcome	25	25
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	0	0
Impacts on freshwater habitats	50	50
Impacts on intertidal habitats	25	25
Habitat Connectivity	25	25
SEA (Strategic Environmental Assessment)		
Historic Environment	0	0
Effects on population	0	0
Impact on plans/ programmes	50	50
Freshwater Biodiversity	50	50
Saline Biodiversity	50	50
Soil	0	0
Groundwater	50	50
Landscape (visual impact)	75	75
Carbon Storage	25	25
Total	425	425

Summary of Results		
Option	a) Do nothing	b) Monitoring only
Costs	£ -	£ -
Benefits	£ -	£ -
NPV	£ -	£ -
BCR	0.0	0.0
Environmental Scoring	425	425

Preferred Option Costs			
Cost	Benefits	BCR	PF Score
N/A	N/A	N/A	N/A

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.4 - East of Upchurch to east of Lower Halstow
Frontage Length	2.0 km
Defence Structure Type	Earth embankments, high ground
Min Standard of Protection (AEP%)	5%
Residual Life (years)	20

	0-20 years	20-50 years	50-100 years
SMP Policy	MR with localised HTL	MR with localised HTL	MR with localised HTL
Aiming to comply with policy	Agree with the SMP		
Comment	Agree with SMP: MR with localised 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
Residential	0	1	13	18
Commercial & Industrial	4	6	8	13
Agricultural (Ha)	17.9	28.8	32.8	42.3
Key Infrastructure	None	None	None	None
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward)



Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	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 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 - no significant assets at risk to warrant installation of temporary defences (significant resources to implement)
	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
Non-Structural	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. Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	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	-	-	-	-	-
Comment and decision on whether taken forward to shortlist	Y= baseline. SOP of defences low and residual life of defences low.	Y= as baseline. Following year 25 a Do nothing scenario would occur due to failure of the defences.	Y = existing defences have low min SOP and low min residual life so capital works required.	Y= Existing defence SOP variable but could be increased with sea level rise.	N = few assets to warrant significant increase in defence height

Long List of Options			
	f) Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments and walls around other areas.	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments and walls around other areas.	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments and walls around other areas.
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	Y	Y	Y
3- Reduce maintenance	TBC*	TBC*	TBC*
4 - WFD	TBC	TBC	TBC
5 - Local Plans	-	-	-
Comment and decision on whether taken forward to shortlist	Y = realignment site requires further consideration.	N= few assets to warrant significant increase in defence heights over time.	N= few assets to warrant significant increase in defence heights over time.

Short List of Options	
a) Do nothing	
b) Do minimum	
c) Maintain (capital) embankments, and walls	
d) Raise (sustain) embankments and walls	
e) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments and walls around other areas.	

Assessment of Short List				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankment and revetment	d) Raise embankment and revetment (sustain)
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. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	Defences have 20 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	Current defences have 20 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	Current defences have 20 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.
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 Standard of Protection (SOP) as the sea level rises.	The Standard of Protection(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 Standard of Protection (SOP) provided by the defences by keeping pace with sea level rise.
SOP Provided (% AEP)	>50%	>50%	5%	1.0%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 760,642	£ 1,716,405
PV Maintenance Costs	£ -	£ 20,625	£ 96,132	£ 94,707
PV Other Costs	£ -	£ -	£ 79,829	£ 182,966
Total Cost (including Optimism Bias) (PV)	£ -	£ 33,000	£ 1,498,563	£ 3,190,525
Value of Benefits	£ -	£ 33,000	£ 384,272	£ 1,089,142
Benefit Cost Ratio (BCR)	0.0	1.0	0.3	0.3
PF Score	0%	6%	3%	2%
Further funding required to achieve 100% PF Score	£ -	£ 31,000	£ 1,459,545	£ 3,112,348
Flood/ erosion impacts				
Number of Residential Properties at risk under	26	26	21	7
Number of Commercial properties at risk under	11	11	10	5
PV Value of Properties (Total including AAD,	£ 914,172	£ 903,699	£ 632,045	£ 44,720.09
Critical Infrastructure	None	None	None	None
PV Value of Impacts on road and rail	-	-	-	-
PV Value of Tourism and Recreation Impacts	-	-	-	-
PV Value of Agriculture Impacts	£368,515 Worst case scenario 36.61ha Grade 1 Agric land flooded and 12.18ha Grade 2 Agric land flooded	£345,679 Worst case scenario 36.61ha Grade 1 Agric land flooded and 12.18ha Grade 2 Agric land flooded	£266,371 Worst case scenario 35.5ha Grade 1 Agric land flooded and 11.39ha grade 2 Agric land flooded	£148,825 Worst case scenario 28ha Grade 1 Agric land flooded and 8.04ha Grade 2 Agric land flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	Defences should be maintained to protect local wildlife site	Defences should be maintained to protect local wildlife site	HTL option preferred to protect local wildlife site in the area	HTL option preferred to protect local wildlife site in the area
Landowners	No specific comments	No specific comments	No specific comments	No specific comments

Technical Feasibility				
Site Specific	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)				
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	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 Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until the failure of the defences in year 20.  Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until the failure of the defences in year 25.  Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.  Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.	1  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.  Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.
Impacts on freshwater habitats	3 No designated freshwater habitat in the benefit area	3 No designated freshwater habitat in the benefit area	3 No designated freshwater habitat in the benefit area	3 No designated freshwater habitat in the benefit area
Impacts on intertidal habitats	2 Potential for coastal squeeze	2 Potential for coastal squeeze	2 Potential for coastal squeeze	2 Potential for coastal squeeze
Habitat Connectivity	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.
SEA (Strategic Environmental Assessment)				
Historic Environment	1 Listed buildings at risk following the failure of the defences in year 20	1 Listed buildings at risk following the failure of the defences in year 25	2 Listed buildings at risk over time with increased risk of overtopping due to sea level rise	5 Listed buildings at reduced risk from flooding
Effects on population	1 Loss of agricultural livelihood and coastal access amenity following the failure of the defences in year 20. Risk of flooding to both residential and commercial properties once the defences fail.	1 Loss of agricultural livelihood and coastal access amenity following the failure of the defences in year 25. Risk of flooding to both residential and commercial properties once the defences fail.	2 Loss of agricultural livelihood and coastal access amenity over time with increased risk of overtopping due to sea level rise.  Risk of flooding to both residential and commercial properties over time with increased risk of overtopping due to sea level rise	5 Agricultural livelihood and coastal access amenity at reduced risk from flooding
Impact on plans/ programmes	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites

Freshwater Biodiversity	1 Freshwater habitat at risk from overtopping and saline intrusion following the failure of the defences in year 20. The most important feature in the area is the heronry which at over 200 pairs is the largest in Britain. There is a diverse breeding bird community and the insect fauna is also of interest particularly moths and butterflies. The site consists of mixed deciduous woodland and scrub with some open areas of grassland and bracken. A number of small ponds are present and also a few open ditches.	1 Freshwater habitat at risk from overtopping and saline intrusion following the failure of the defences in year 25. The most important feature in the area is the heronry which at over 200 pairs is the largest in Britain. There is a diverse breeding bird community and the insect fauna is also of interest particularly moths and butterflies. The site consists of mixed deciduous woodland and scrub with some open areas of grassland and bracken. A number of small ponds are present and also a few open ditches.	2 Freshwater habitat at risk from overtopping and saline intrusion over time with increased risk of overtopping due to sea level rise. The most important feature in the area is the heronry which at over 200 the pairs is the largest in Britain. There is a diverse breeding bird community and the insect fauna is also of interest particularly moths and butterflies. The site consists of mixed deciduous woodland and scrub with some open areas of grassland and bracken. A number of small ponds are present and also a few open ditches. Opportunity for some roll back gradually.	5 Freshwater habitat at reduced risk from overtopping
Saline Biodiversity	2 Seaward SSSI SPA at risk due to coastal squeeze until defences fail.	2 Seaward SSSI SPA at risk due to coastal squeeze until defences fail.	1 Seaward SSSI SPA at risk due to coastal squeeze, but there may be overtopping of the defences overtime which will allow intertidal habitat to develop behind the defences.	1 Seaward SSSI SPA at risk due to coastal squeeze
Soil	1 Degradation of soils	1 Degradation of soils	2 Degradation of soils over time with increased risk of overtopping due to sea level rise	5 Protected
Groundwater	3 No impacts predicted	3 No impacts predicted	3 No impacts predicted	3 No impacts predicted
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 Change in visual impact with rising defences
Carbon Storage	2 Loss of carbon storage with changes to habitat type over time	2 Loss of carbon storage with changes to habitat type over time	2 Loss of carbon storage from saltmarsh due to coastal squeeze	1 Loss of carbon storage from saltmarsh due to coastal squeeze, some carbon cost generated through construction
Ecosystem Services				
Qualitative Score from Ecosystem Services	-21	-21	-18	-11
Comments	Degradation in various ES (e.g. natural hazard regulation, erosion regulation, tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in various ES (e.g. natural hazard regulation, erosion regulation, tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in various ES (e.g. natural hazard regulation, erosion regulation, tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in various ES (e.g. climate regulation, aesthetic value, fisheries habitat, conservation habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation, erosion regulation)
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N	N	Y	Y
2 - Natura 2000 sites	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y
4 - WFD	N	N	N	N
5 - Local Plans	Y	Y	Y	Y



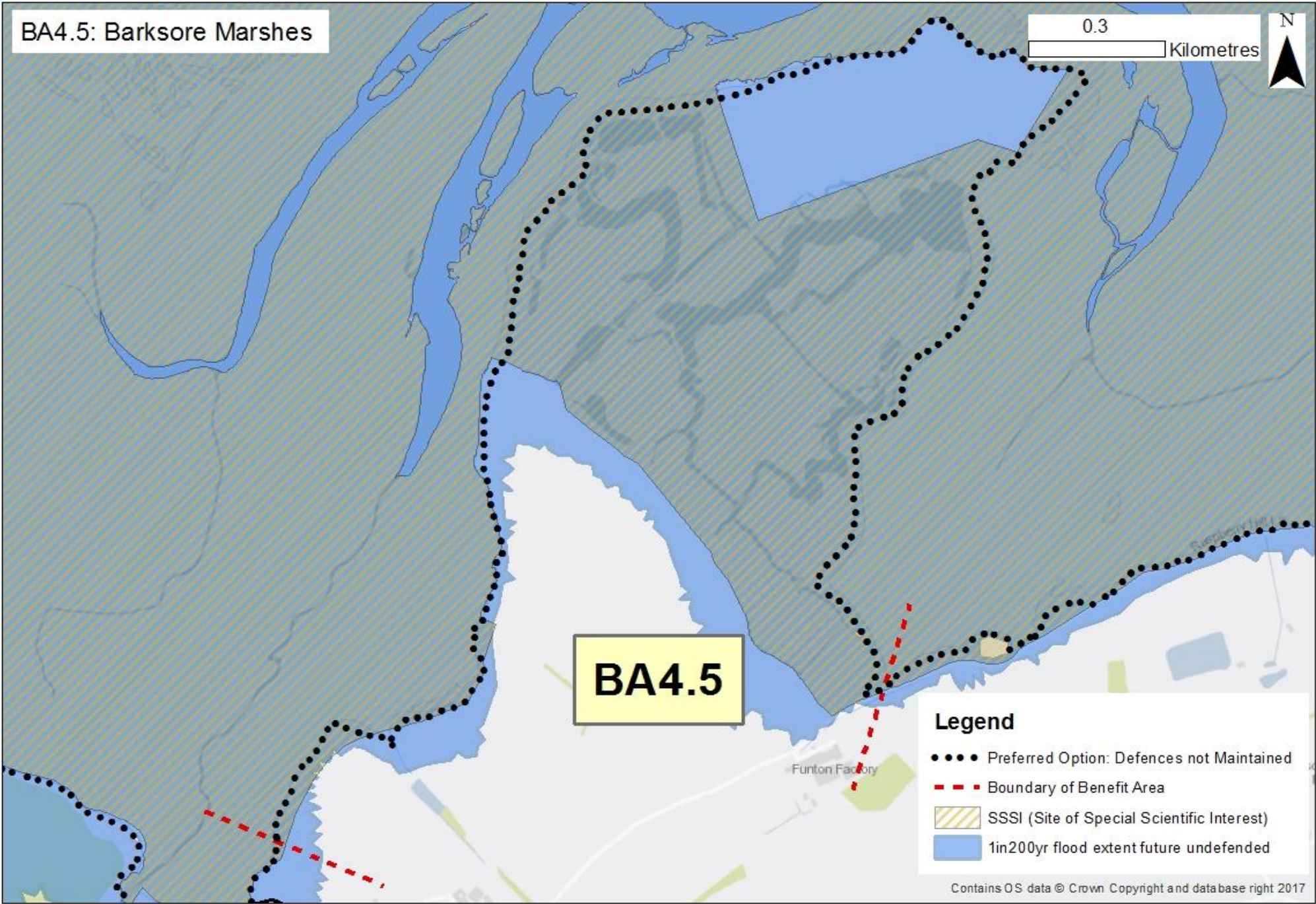
Environmental Scores				
100 = best option, 0 = worst option				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, and walls (Do minimum)	d) Raise (sustain) embankments and walls
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	0	0	0	0
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	25	25	25	25
Habitat Connectivity	25	25	25	25
SEA (Strategic Environmental Assessment)				
Historic Environment	0	0	25	100
Effects on population	0	0	25	100
Impact on plans/ programmes	50	50	50	50
Freshwater Biodiversity	0	0	25	100
Saline Biodiversity	25	25	0	0
Soil	0	0	25	100
Groundwater	50	50	50	50
Landscape (visual impact)	75	75	50	25
Carbon Storage	25	25	25	0
Total	350	350	375	625

Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, and walls (Do minimum)	d) Raise (sustain) embankments and walls
Costs	£ -	£ 33,000	£ 1,498,563	£ 3,190,525
Benefits	£ -	£ 33,000	£ 384,272	£ 1,089,142
NPV	£ -	-	-£ 1,114,292	-£ 2,101,384
BCR	0.0	1.0	0.3	0.3
Environmental Scoring	350	350	375	625

Preferred Option Costs			
Cost	Benefits	BCR	PF Score
£ 813,522	£ 764,704	0.9	7%

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.5 - Barksore Marshes - MR site at Barksore Marshes (Site 19)
Frontage Length	4.9 km
Defence Structure Type	Embankment and high ground
Min Standard of Protection (AEP%)	50%
Residual Life (years)	20

	0-20 years	20-50 years	50-100 years
SMP Policy	MR	MR	MR
Aiming to comply with policy	No- suggest alternative considerations		
Comment	The SMP states MR for the first epoch and then NAI from year 20. However a large area of the site is high ground and therefore not suitable for MR, or is designated habitat. Also the site is a historic landfill site.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	0	0	0	0
Commercial & Industrial	0	1	1	1
Agricultural (Ha)	18.1	23.2	24.6	28.8
Key Infrastructure	Barksore Marshes Landfill Site (A6 : Landfill taking other wastes)	Barksore Marshes Landfill Site (A6 : Landfill taking other wastes)	Barksore Marshes Landfill Site (A6 : Landfill taking other wastes)	Barksore Marshes Landfill Site (A6 : Landfill taking other wastes)
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)



Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	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	N	currently present and will not significantly reduce flood risk. Also potentially
	Maintain wall	N	Exclude - no wall currently present
	Raise wall (sustain)	N	Exclude - no wall currently present
	Raise wall (upgrade)	N	Exclude - no wall 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 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 - no significant assets at risk to warrant installation of temporary defences (significant resources to implement)
	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.
Non-Structural	Implement monitoring	Y	Take forwards - will support the SMP policy
	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	Y	Take forwards - will support the SMP policy
	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) Adaptation- relocation of landfill	c) Monitoring only	d) Ongoing maintenance of embankments	e) Maintain SOP (capital) embankments
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	NA	NA	NA	NA	NA
2 - Natura 2000 sites	N	Y	N	N	N
3- Reduce maintenance	N	Y	N	N	N
4 - WFD	N	TBC	TBC	Y	Y
5 - Local Plans	-	-	-	-	-
Comment and decision on whether taken forward to shortlist	Y= baseline. SOP of defences very low and residual life of defences low.	Y= landfill at risk of erosion- could need removal and decontamination.	N = does not meet the objectives as could lead to contamination of the wider environment.	Y= as baseline. Following year 25 a Do nothing scenario would occur due to the failure of the defences.	Y= existing defences have very low min SOP and low residual life, so capital works needed.

Long List of Options					
	f) Raise (sustain SOP) embankments	g) Raise (upgrade SOP) embankments	h) Construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments along the rest of the section.	i) Construct new setback embankments at identified managed realignment sites. Sustain SOP of existing embankments along the rest of the section.	j) Construct new setback embankments at identified managed realignment sites. Upgrade SOP of existing embankments along the rest of the section.
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	NA	NA	NA	NA	NA
2 - Natura 2000 sites	N	N	Y	Y	Y
3- Reduce maintenance	N	N	TBC*	TBC*	TBC*
4 - WFD	Y	Y	TBC	TBC	TBC
5 - Local Plans	-	-	-	-	-
Comment and decision on whether taken forward to shortlist	N = limited benefits at the area to warrant raising the defences. Upgrade included as a worst case scenario.	Y = Very low min SOP. Option kept in short list to consider the potential contamination issues, will provide the worst case scenario.	Y = realignment site requires further consideration. Potential contamination issues to be considered. It was decided to tie the MR site back into high ground, therefore no maintenance of the defences will be required.	N= only one type of MR site required as the defences will be tied into high ground.	N = limited benefits at the area to warrant raising the defences. Upgrade included as a worst case scenario.

Short List of Options	
a) Do nothing	
b) Do minimum	
c) Adaptation- relocation of landfill	
d) Maintain (capital) embankments	
e) Raise (upgrade) embankments	
f) Construct new setback embankments at identified managed realignment sites in first epoch. Tie the managed realignment site into high ground.	



Assessment of Short List				
Option	a) Do nothing	b) Do minimum	c) Adaptation- relocation of landfill	d) Maintain (capital) embankments
Description	Used as an economic baseline to compare the other options against.	Used as an economic baseline to compare the other options against.	Adaptation of the landfill	Capital works are undertaken to maintain the current defences
Technical Issue	Defences have 20 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. Current Barksore Marshes Landfill Site (A6 : Landfill taking other wastes) potentially at risk.	Defences have 20 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. Current Barksore Marshes Landfill Site (A6 : Landfill taking other wastes) potentially at risk.	Detailed adaptation study required	Current defences have 20 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. Current Barksore Marshes Landfill Site (A6 : Landfill taking other wastes) 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.	Adapt the landfill so that there is no risk of pollution.	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 Standard of Protection (SOP) as the sea level rises.
SOP Provided (% AEP)	>50%	>50%	n/a	50.0%
Value of Economics				
PV Capital Costs	£ -	£ -	Costs would need to be disucssed in collaboration with other parties	£ 1,082,022
PV Maintenance Costs	£ -	£ 133,750		£ 230,624
PV Other Costs	£ -	£ -		£ 113,557
Total Cost (including Optimism Bias) (PV)	£ -	£ 214,000		£ 2,281,924
Value of Benefits	£ -	£ 6,000	£ 150,637	£ 150,637
Benefit Cost Ratio (BCR)	0.0	0.0	0.0	0.1
PF Score	0%	0%	0%	0%
Further funding required to achieve 100% PF Score	£ -	£ 214,000	£	£ 2,273,555
Flood/ erosion impacts				
Number of Residential Properties at risk under 0.1% AEP	0	0	0	0

Assessment of Short List		
Option	e) Raise (upgrade) embankments	f) Construct new setback embankments at identified managed realignment sites in first epoch. Tie the managed realignment site into high ground. MR site at Barksore Marshes (Site 19)
Description	Capital works are undertaken to improve the current defences	Development of MR site.
Technical Issue	<p>Current defences have 20 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>Current Barksore Marshes Landfill Site (A6 : Landfill taking other wastes) potentially at risk over time.</p>	<p>Current defences have 20 years residual life.</p> <p>The MR site ties back into high ground.</p> <p>The MR is freshwater designated habitat and therefore compensatory habitat is required.</p> <p>Based on current sea levels the MR site would create 51.7ha of saltmarsh and 27.5ha of mudflat. With 100 years sea level rise there could be 29.3ha of saltmarsh and 64.8ha of mudflat.</p> <p>Impacts on current Barksore Marshes Landfill Site will need to be considered at the next stage.</p>
Assumptions/ Uncertainties	The crest height and Standard of Protection (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 tied into high ground, so limited lengths of defence need to be constructed. Cost for compensatory habitat not included.
SOP Provided (% AEP)	2.0%	2.0%
Value of Economics		
PV Capital Costs	£ 3,721,517	£ 864,266
PV Maintenance Costs	£ 223,589	£ 133,174
PV Other Costs	£ 331,106	£ 90,704
Total Cost (including Optimism Bias) (PV)	£ 6,841,939	£ 1,741,031
Value of Benefits	£ 191,909	£ 355,115
Benefit Cost Ratio (BCR)	0.0	0.2
PF Score	0%	1%
Further funding required to achieve 100% PF Score	£ 6,831,277	£ 1,721,302
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	1	1
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£149,732	£146,207	£-	£20,058.06
Critical Infrastructure	No assets at risk	No assets at risk	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	£205,383 Worst case scenario 19.92ha Grade 2 Agric land flooded and 18.25ha Grade 3 Agric land flooded	£203,372 Worst case scenario 19.92ha Grade 2 Agric land flooded and 18.25ha Grade 3 Agric land flooded	£184,420 Worst case scenario 12.6ha Grade 2 Agric land flooded and 18ha Grade 3 Agric land flooded	£184,420 Worst case scenario 12.6ha Grade 2 Agric land flooded and 18ha Grade 3 Agric land flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	SEG members said that the Fulton Brickworks development area could be at risk if defences are not maintained	SEG members said that the Fulton Brickworks development area could be at risk if defences are not maintained	SEG members said that the Fulton Brickworks development area could be at risk over time	SEG members said that the options would protect the Fulton Brickworks development area
Landowners	Landowner wants to maintain the existing defences to protect the environment	Landowner wants to maintain the existing defences to protect the environment	Landowner wants to maintain the existing defences to protect the environment	Landowner wants to maintain the existing defences to protect the environment
Technical Feasibility				
Site Specific	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)				
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	1 HMWB maintained
HRA (Habitats Regulation Assessment)				

Number of Commercial properties at risk under 0.1% AEP	0	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ -	£ -
Critical Infrastructure	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	-	-
PV Value of Tourism and Recreation	-	-
PV Value of Agriculture Impacts	£163,652 Worst case scenario 7.96ha Grade 2 Agric land flooded and 15.15ha Grade 3 Agric land flooded	£ 0 Agriculture land included in the cost of MR
Stakeholders Feedback		
Statutory Stakeholders/ SEG	SEG members said that the options would protect the Fulton Brickworks development area	SEG members said that the Fulton Brickworks development area could be at risk Also MR not preferred as would result in the loss of high value conservation land.
Landowners	Landowner wants to maintain the existing defences to protect the environment	Landowner does not agree with any MR options
Technical Feasibility		
Site Specific	n/a	Approx. 70% flooded on Spring tide. Potential loss of 3,388m of defence line due to tie into high ground. MR site would create 51.7ha of saltmarsh and 27.5ha of mudflat. With 100 years sea level rise there could be 29.3ha of saltmarsh and 64.8ha of mudflat.
Strategy Wide	n/a	Site is completely flooded on extreme events
WFD (Water Framework Directive)		
Compliance assessment outcome	1 HMWB maintained	2 Some return to natural processes
HRA (Habitats Regulation Assessment)		

Impact on SPA/ Ramsar qualifying features	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until failure of the defences.</p> <p>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.</p> <p>Overtopping would result in the degradation and loss of existing Designated freshwater grazing marsh, which is known to be of moderately good quality, representing good habitat for breeding and overwintering waders.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until failure of the defences.</p> <p>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.</p> <p>Overtopping would result in the degradation and loss of existing Designated freshwater grazing marsh, which is known to be of moderately good quality, representing good habitat for breeding and overwintering waders.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.</p> <p>Overtopping (due as the minimum residual life is only 9 years) would result in the degradation and loss of existing Designated freshwater grazing marsh, which is known to be of moderately good quality, representing good habitat for breeding and overwintering waders.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.</p> <p>Overtopping (due as the minimum residual life is only 9 years) would result in the degradation and loss of existing Designated freshwater grazing marsh, which is known to be of moderately good quality, representing good habitat for breeding and overwintering waders.</p>
Impacts on freshwater habitats	<p>1</p> <p>Yes, compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to intertidal habitats as overtopping occurs.</p>	<p>1</p> <p>Yes, compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to intertidal habitats as overtopping occurs.</p>	<p>1</p> <p>Yes</p>	<p>1</p> <p>Yes, compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to intertidal habitats as overtopping occurs.</p>
Impacts on intertidal habitats	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</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 (where for example Managed Realignment would).</p>	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</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 (where for example Managed Realignment would).</p>	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</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 (where for example Managed Realignment would).</p>	<p>2</p> <p>No, until overtopping happens regularly enough to trigger the development of tidal habitats behind the existing defences.</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 (where for example Managed Realignment would).</p>



Impact on SPA/ Ramsar qualifying features	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze, reducing the amount of saltmarsh and mudflat in front of the defences, would likely reduce the amount of habitat available for wader and wildfowl species listed as qualifying features.</p>	<p>1</p> <p>There may be potential significant effects on the freshwater Medway Estuary and Marshes SPA and its constituent qualifying features due to the intrusion of works into Designated areas.</p> <p>The Managed Realignment (c. 106.6 ha) would result in the loss of existing Designated freshwater grazing marsh, which is known to be of moderately good quality, representing good habitat for breeding and overwintering waders.</p> <p>The conversion to saltmarsh and mudflat may not keep up with the rate of habitat lost to coastal squeeze, and the quality of the newly formed habitats is not likely to be the same as those habitats lost to coastal squeeze.</p>
Impacts on freshwater habitats	<p>3</p> <p>No</p>	<p>1</p> <p>Yes, compensatory freshwater habitat would be required for the existing Designated freshwater grazing marsh that would be lost to the Managed Realignment site</p>
Impacts on intertidal habitats	<p>1</p> <p>No</p>	<p>4</p> <p>Yes, the Managed Realignment site, and the development of saltmarsh and mudflat therein would support mitigation for coastal squeeze as the habitats developed and established.</p> <p>The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.</p>

Habitat Connectivity	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.	3 Initial loss of habitat would be followed by gradual gain, which would serve to offset to a certain extent. Its very small size, and location at the edge of the estuary mean benefits to connectivity are predicted to be negligible.
<b>SEA (Strategic Environmental Assessment)</b>				
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk
Effects on population	1 Loss of commercial property and livelihoods following the failure of the defences	1 Loss of commercial property and livelihoods following the failure of the defences	2 Loss of commercial property and livelihoods over time following failure of the defences	4 Loss of commercial property and livelihoods over time over time with increased risk of overtopping due to sea level rise.
Impact on plans/ programmes	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites
Freshwater Biodiversity	1 Landward SSSI and SPA at risk due to overtopping and saline intrusion following the failure of the defences. At Barksore Marshes the saltmarsh is limited to thin slivers along the river shore, and visually separated from adjacent land by the sea walls. The traditional land cover is coastal grazing marsh, which is limited and fragmented into small pockets by extensive creeks and ditches. Barksore Marshes are distinctive because of the presence of large areas of open water.	1 Landward SSSI and SPA at risk due to overtopping and saline intrusion following the failure of the defences. At Barksore Marshes the saltmarsh is limited to thin slivers along the river shore, and visually separated from adjacent land by the sea walls. The traditional land cover is coastal grazing marsh, which is limited and fragmented into small pockets by extensive creeks and ditches. Barksore Marshes are distinctive because of the presence of large areas of open water.	2 Landward SSSI and SPA at risk due to overtopping and saline intrusion but very gradually	3 Landward SSSI and SPA at risk from saline intrusion over time with increased risk of overtopping due to sea level rise.
Saline Biodiversity	1 Seaward SSSI and SPA at risk due to coastal squeeze until failure of the defences	1 Seaward SSSI and SPA at risk due to coastal squeeze until failure of the defences	1 Seaward SSSI and SPA at risk due to coastal squeeze until failure of the defences	1 Seaward SSSI and SPA at risk due to coastal squeeze
Soil	1 Degradation of soils and risk of pollutant mobilisation from landfill site following failure of the defences	1 Degradation of soils and risk of pollutant mobilisation from landfill site following failure of the defences	1 Degradation of agricultural soils following the failure of the defences.	2 Degradation of the Agric soils overtime due to increased risk of overtopping.

Habitat Connectivity	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.	5 Beneficial impact on connectivity due to the provision of new habitats that would otherwise be affected by coastal squeeze.
SEA (Strategic Environmental Assessment)		
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk
Effects on population	5 Commercial property and livelihoods at reduced risk from flooding	5 Commercial property and livelihoods at reduced risk from flooding
Impact on plans/ programmes	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites
Freshwater Biodiversity	5 Landward SSSI and SPA at reduced risk from saline intrusion	1 Creation of new intertidal habitat which would replace freshwater habitat with saline within the SSSI and SPA. At Barksore Marshes the saltmarsh is limited to thin slivers along the river shore, and visually separated from adjacent land by the sea walls. The traditional land cover is coastal grazing marsh, which is limited and fragmented into small pockets by extensive creeks and ditches. Barksore Marshes are distinctive because of the presence of large areas of open water which may be wholly or partially lost.
Saline Biodiversity	1 Seaward SSSI and SPA at risk due to coastal squeeze	5 Creation of new intertidal habitat which would replace freshwater habitat with saline within the SSSI and SPA
Soil	5 Protected	1 Loss of agricultural soil to managed realignment

Groundwater	1 Potential of risk to groundwater from pollutant mobilisation from landfill site once the defences fail	1 Potential of risk to groundwater from pollutant mobilisation from landfill site once the defences fail	1 Potential of risk to groundwater from pollutant mobilisation during the adaptation stage.	2 gradual increasing risk to groundwater from pollutant mobilisation from landfill site as the risk of overtopping increase.
Landscape (visual impact)	4 Change but giving back to natural processes	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
Carbon Storage	2 Loss of carbon storage due to coastal squeeze	2 Loss of carbon storage due to coastal squeeze	2 Loss of carbon storage due to coastal squeeze	2 Loss of carbon storage due to coastal squeeze
<b>Ecosystem Services</b>				
Qualitative Score from Ecosystem Services Assessment	-24	-24	-56	-20
Comments	Degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in various ES (e.g. freshwater provision, water purification, aesthetic value, natural hazard regulation, erosion regulation, conservation habitat) and no enhancement opportunities	Degradation in various ES (e.g. freshwater provision, natural hazard regulation, erosion regulation, conservation habitat) 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	N	Y
2 - Natura 2000 sites	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y
4 - WFD	N	N	N	N
5 - Local Plans	N	N	Y	Y

Groundwater	5 Protected	1 Potential risk to groundwater from pollutant mobilisation from landfill site with the construction of the MR site.
Landscape (visual impact)	2 Significant change in visual impact as defences increase	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	1 Loss of carbon storage from habitat changes
Ecosystem Services		
Qualitative Score from Ecosystem Services Assessment	-8	43
Comments	Degradation in some ES (e.g. climate regulation, aesthetic value, conservation habitat, fisheries habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation, erosion regulation)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat) outweigh degradation risk in many ES (e.g. freshwater provision, food provision, water purification)
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	N	Y
3- Reduce maintenance	Y	Y
4 - WFD	N	Y
5 - Local Plans	Y	Y



Environmental Scores				
100 = best option, 0 = worst option				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, walls and revetment (Do minimum)	d) Raise (sustain) embankments, walls and revetment
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	0	0	0	0
Impacts on freshwater habitats	25	25	25	50
Impacts on intertidal habitats	25	25	25	0
Habitat Connectivity	0	0	0	25
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	0	0	25	75
Impact on plans/ programmes	0	0	25	100
Freshwater Biodiversity	0	0	25	100
Saline Biodiversity	0	0	25	0
Soil	0	0	25	75
Groundwater	25	25	25	75
Landscape (visual impact)	25	25	50	75
Carbon Storage	25	25	25	25
Total	200	200	325	650

Environmental Scores		
100 = best option, 0 = worst option		
Option	e) Raise (upgrade) embankments, walls and revetment	f) Construct new setback embankments at identified managed realignment sites in first epoch. Tie the managed realignment site into high ground. MR site at Barksore Marshes (Site 19)
WFD (Water Framework Directive)		
Compliance assessment outcome	0	25
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	0	0
Impacts on freshwater habitats	50	0
Impacts on intertidal habitats	0	75
Habitat Connectivity	25	100
SEA (Strategic Environmental Assessment)		
Historic Environment	50	50
Effects on population	100	100
Impact on plans/ programmes	100	50
Freshwater Biodiversity	100	0
Saline Biodiversity	0	100
Soil	100	0
Groundwater	75	0
Landscape (visual impact)	75	0
Carbon Storage	25	0
Total	700	500

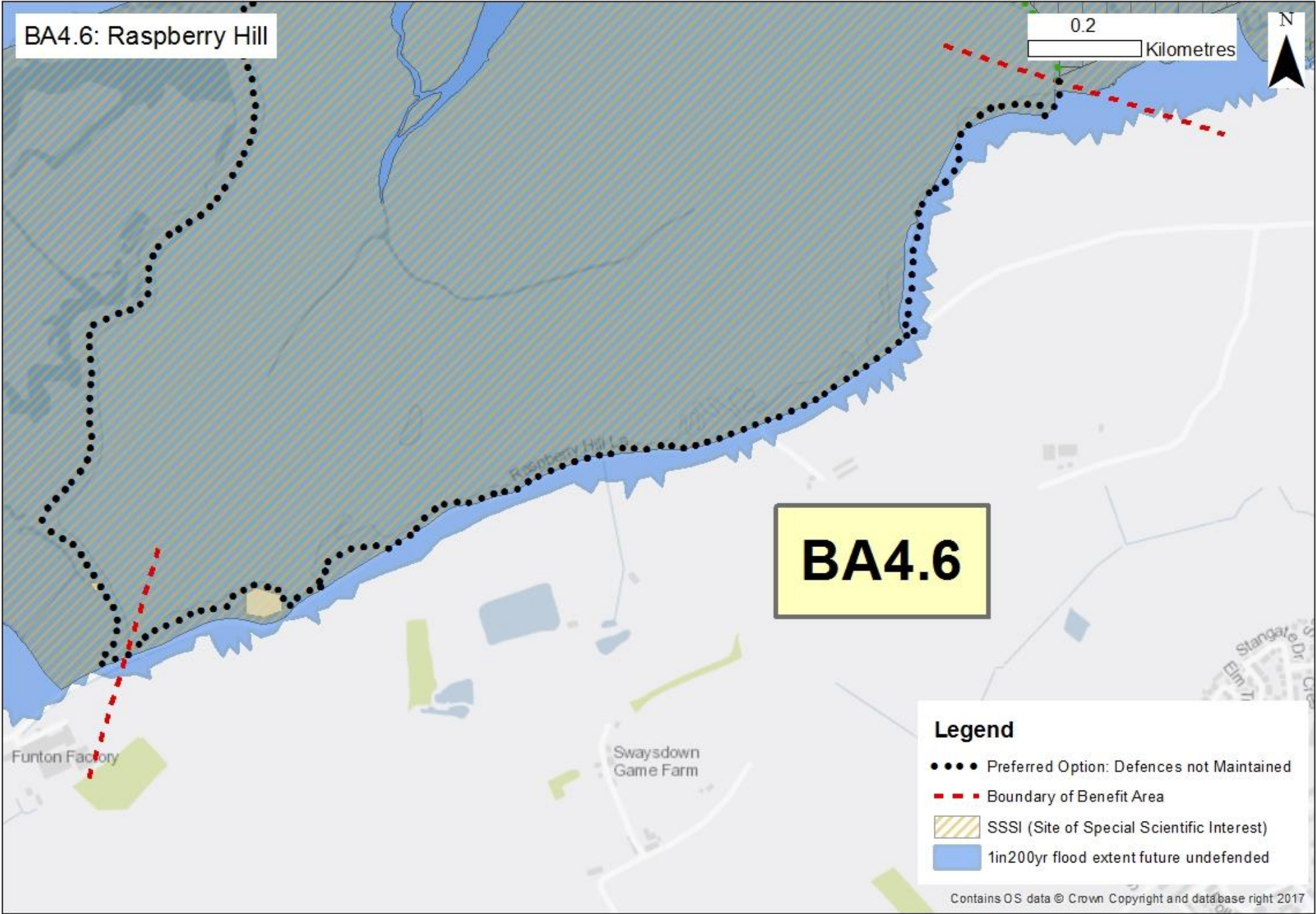
Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Adaptation- relocation of landfill	d) Maintain (capital) embankments
Costs	£ -	£ 214,000	£ -	£ 2,281,924
Benefits	£ -	£ 6,000	£ 150,637	£ 150,637
NPV	£ -	-£ 208,000	£ 150,637	-£ 2,131,287
BCR	0.0	0.0	0.0	0.1
Environmental Scoring	200	200	325	650

Summary of Results		
Option	e) Raise (upgrade) embankments	f) Construct new setback embankments at identified managed realignment sites in first epoch. Tie the managed realignment site into high ground. MR site at Barksore Marshes (Site 19)
Costs	£ 6,841,939	£ 1,741,031
Benefits	£ 191,909	£ 355,115
NPV	-£ 6,650,030	-£ 1,385,916
BCR	0.0	0.2
Environmental Scoring	700	500

Impacts on freshwater designated habitat	
Ramsar and SPA habitat at risk from Year 21. Cost effectiveness analysis shows preferred management approach: Provide	
Cost of providing compensation for impacts	Cost of holding the line with SLR
£ 2,381,140	£ 2,572,196

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.6 - Funton to Raspberry Hill
Frontage Length	2.3km
Defence Structure Type	Embankment and high ground
Min Standard of Protection (AEP%)	50%
Residual Life (years)	25

	0-20 years	20-50 years	50-100 years
SMP Policy	NAI	NAI	NAI
Aiming to comply with policy	Agree with SMP		
Comment	NAI for all epochs		



Do Nothing Assets at Risk (Erosion)			
	Year 20 (undefended)	Year 50 (undefended)	Year 100 (undefended)
Residential	0	0	0
Commercial & Industrial	0	0	0
Agricultural (Ha)	1	2	4
Key Infrastructure	None	Raspberry Hill Lane	Raspberry Hill Lane
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward and landward)	Medway Estuary and Marshes SPA and SSSI (seaward)



Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	Construct new embankment	N	Exclude - limited benefits in constructing a revetment where high ground is currently present and will not significantly reduce flood risk. Also potentially environmentally damaging in SPA
	Maintain embankment	N	Exclude - no embankment currently present
	Raise embankment (sustain)	N	Exclude - no embankment currently present
	Raise embankment (upgrade)	N	Exclude - no embankment currently present
	Construct new wall	N	Exclude - limited benefits in constructing a wall where high ground is currently present and
	Maintain wall	N	Exclude - no wall currently present
	Raise wall (sustain)	N	Exclude - no wall currently present
	Raise wall (upgrade)	N	Exclude - no wall currently present
	Maintain rock revetment	N	Exclude - revetment currently present
	Construct rock revetment	N	Exclude - limited benefits in constructing a revetment where high ground is currently present and will not significantly reduce flood risk. Also 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 - no significant assets at risk to warrant installation of temporary defences (significant resources to implement)
	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.
Non-Structural	Implement monitoring	Y	Take forwards - will support the SMP policy
	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	Y	Take forwards - will support the SMP policy
	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) Adaptation- rollback of road	c) Monitoring only
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	N	N	N
2 - Natura 2000 sites	N	Y	Y
3- Reduce maintenance	N	Y	Y
4 - WFD	N	TBC	TBC
5 - Local Plans	-	-	-
Comment and decision on whether taken forward to shortlist	Y= baseline for economic assessment.	Y= road at risk of erosion-could be rolled back in time.	Y= monitoring of shoreline as erodes.

Short List of Options		
a) Do nothing		
b) Adaptation- rollback of road		
c) Monitoring only		

Assessment of Short List			
Option	a) Do nothing	b) Adaptation- rollback of road	c) Monitoring only
Description	Used as an economic baseline to compare the other options against.	Relocating the road landwards to avoid risk of erosion	No capital works completed but monitoring of the cliffs is undertaken for health and safety
Technical Issue	Defences have 25 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	A detailed adaptation study will need to be undertaken.	Current defences have 25 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.
Assumptions/ Uncertainties	Assumes that all management is ceased.	Assumed that there is space to relocate the road landwards.	No capital works.
SOP Provided (% AEP)	N/A (Erosion risk)	N/A (Erosion risk)	N/A (Erosion risk)
Value of Economics			
PV Capital Costs	£ -	£ 4,927,800	£ -
PV Maintenance Costs	£ -	£ 7,603	£ 59,625
PV Other Costs	£ -	£ 544,322	£ -
Total Cost (including Optimism Bias) (PV)	£ -	£ 8,767,561	£ 95,400
Value of Benefits	£ -	£ 807,543	£ -
Benefit Cost Ratio (BCR)	0.0	0.1	0.0
PF Score	0%	1%	0%
Further funding required to achieve 100% PF Score	£ -	£ 8,722,697	£ 95,400
Flood/ erosion impacts			
Number of Residential Properties at risk under	0	0	0
Number of Commercial properties at risk under	0	0	0
PV Value of Properties (Total including AAD,	£ -	£ -	£ -
Critical Infrastructure	Raspberry Hill Lane	Raspberry Hill Lane	Raspberry Hill Lane
PV Value of Impacts on road and rail	£ 16,150,858	£ -	£ 16,150,858
PV Value of Tourism and Recreation Impacts	£ -	£ -	£ -
PV Value of Agriculture Impacts	£258,018 Worst case scenario 23ha Grade 2 agricultural land flooded and 6ha Grade 4 flooded	£258,018 Worst case scenario 23ha Grade 2 agricultural land flooded and 6ha Grade 4 flooded	£258,018 Worst case scenario 23ha Grade 2 agricultural land flooded and 6ha Grade 4 flooded
Stakeholders Feedback			
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments
Landowners	No specific comments	No specific comments	No specific comments
Technical Feasibility			
Site Specific	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a
WFD (Water Framework Directive)			
Compliance assessment outcome	2 Some return to natural processes	2 Some return to natural processes	2 Some return to natural processes
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	2  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Until defences fail.  Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat in front of the defences.	2  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Until defences fail.  Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat in front of the defences.	2  There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze until defences fail.  Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat in front of the defences.

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
Impacts on intertidal habitats	2 Potential risk of coastal squeeze as the rate of retreat might be less than the rate of sea level rise. No creation of compensatory habitat.	2 Potential risk of coastal squeeze as the rate of retreat might be less than the rate of sea level rise. No creation of compensatory habitat.	2 Potential risk of coastal squeeze as the rate of retreat might be less than the rate of sea level rise. No creation of compensatory habitat.
Habitat Connectivity	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze.	2 Slight 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 Coastal access and road will need a new route to ensure accessibility following failure of the defences in year 25	3 Benefit area does not coincide with proposed development sites
Effects on population	3 No observable historic assets at risk	5 Coastal road re-routed	3 Benefit area does not coincide with proposed development sites
Impact on plans/ programmes	3 No observable historic assets at risk	3 Coastal access and road will need a new route to ensure accessibility following failure of the defences in year 24	3 Benefit area does not coincide with proposed development sites
Freshwater Biodiversity	1 Loss of freshwater habitat from coastal erosion	1 Loss of freshwater habitat from coastal erosion	1 Loss of freshwater habitat from coastal erosion
Saline Biodiversity	3 Intertidal habitat may be lost over time due to sea level rise.	3 Intertidal habitat may be lost over time due to sea level rise.	3 Intertidal habitat may be lost over time due to sea level rise.
Soil	1 Degradation of soils as they are lost to erosion	1 Degradation of soils as they are lost to erosion	1 Degradation of soils as they are lost to erosion
Groundwater	3 No impact anticipated	3 No impact anticipated	3 No impact anticipated
Landscape (visual impact)	3 Change but giving back to natural processes	3 Change but giving back to natural processes	3 Change but giving back to natural processes
Carbon Storage	2 Loss of terrestrial carbon storage	2 Loss of terrestrial carbon storage	2 Loss of terrestrial carbon storage
<b>Ecosystem Services</b>			
Qualitative Score from Ecosystem Services Assessment	-9	-14	-9

Comments	Degradation of many ES (e.g. water purification, erosion regulation, natural hazard regulation) outweigh enhancement opportunities (e.g. conservation habitats and aesthetic value)	Degradation of many ES (e.g. water purification, erosion regulation, natural hazard regulation) outweigh enhancement opportunities (e.g. conservation habitats and aesthetic value)	Degradation of many ES (e.g. water purification, erosion regulation, natural hazard regulation) outweigh enhancement opportunities (e.g. conservation habitats and aesthetic value)
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	N	N	N
2 - Natura 2000 sites	N	N	N
3- Reduce maintenance	Y	Y	Y
4 - WFD	Y	Y	Y
5 - Local Plans	Y	Y	Y

Environmental Scores			
100 = best option, 0 = worst option			
Option	a) Do nothing	b) Adaptation- rollback of road	c) Monitoring only
WFD (Water Framework Directive)			
Compliance assessment outcome	25	25	25
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	25	25	25
Impacts on freshwater habitats	50	50	50
Impacts on intertidal habitats	25	25	25
Habitat Connectivity	25	25	25
SEA (Strategic Environmental Assessment)			
Historic Environment	50	50	50
Effects on population	50	100	50
Impact on plans/ programmes	50	50	50
Freshwater Biodiversity	0	0	0
Saline Biodiversity	50	50	50
Soil	0	0	0
Groundwater	50	50	50
Landscape (visual impact)	50	50	50
Carbon Storage	25	25	25
Total	475	525	475

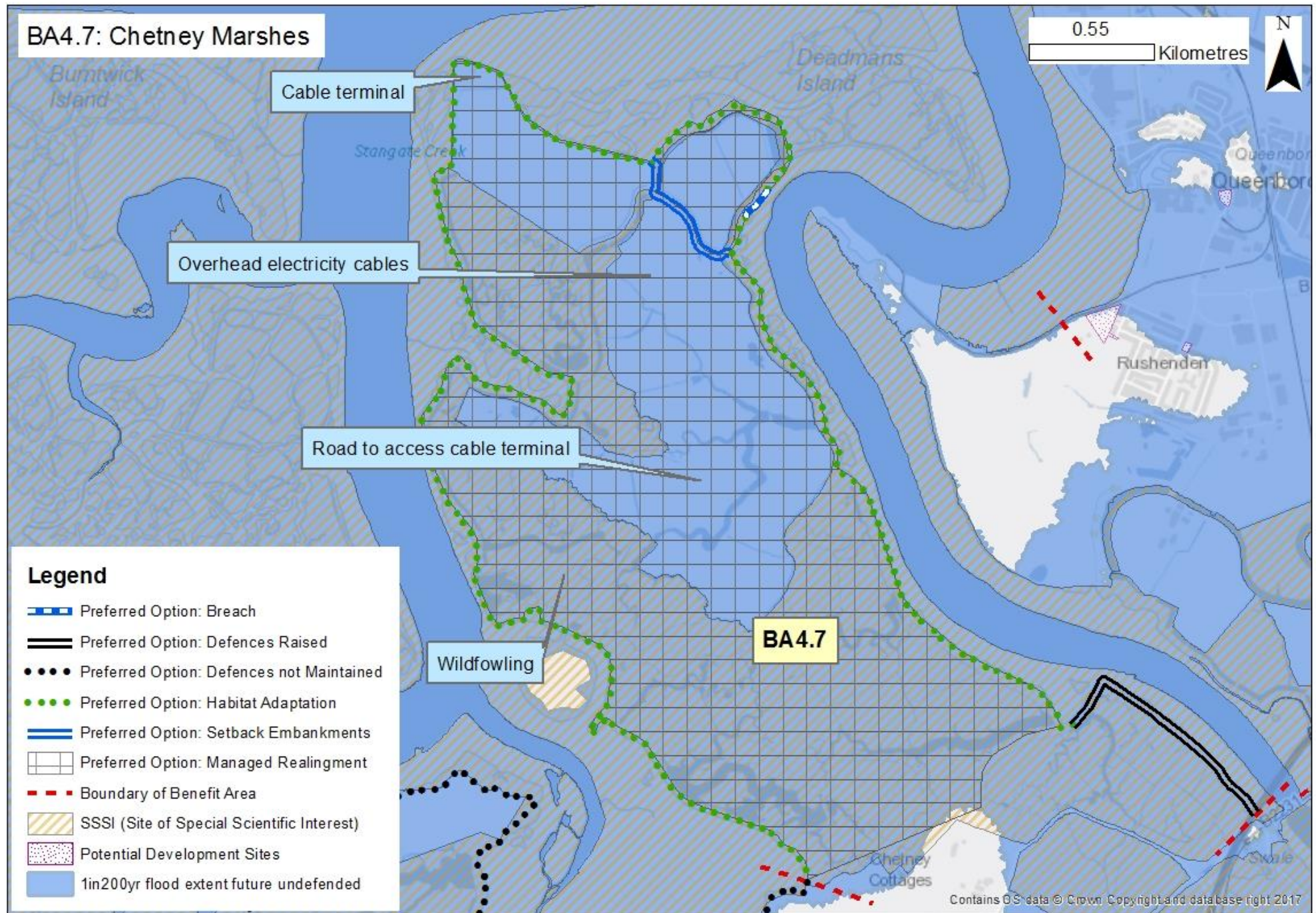
Summary of Results			
Option	a) Do nothing	b) Adaptation- rollback of road	c) Monitoring only
Costs	£ -	£ 8,767,561	£ 95,400
Benefits	£ -	£ 807,543	£ -
NPV	£ -	-£ 7,960,018	-£ 95,400
BCR	0.0	0.1	0.0
Environmental Scoring	475	525	475



Preferred Option Costs			
Cost	Benefits	BCR	PF Score
N/A	N/A	N/A	N/A

Benefit Area Name	4 - Medway Marshes
Benefit Unit Name	4.7 - Chetney Marshes - MR in Chetney Marshes (Site 20)
Frontage Length	14km
Defence Structure Type	Embankment, Wall, High ground
Min Standard of Protection (AEP%)	50%
Residual Life (years)	10

	0-20 years	20-50 years	50-100 years
SMP Policy	MR	MR	MR
Aiming to comply with policy	Agree with the SMP		
Comment	Agree with SMP: MR for all epochs but need to consider designations		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	0	1	1	2
Commercial & Industrial	5	5	5	7
Agricultural (Ha)	687	698	701	710
Key Infrastructure	Overhead electricity cables	Overhead electricity cables Cable terminal	Overhead electricity cables Cable terminal	Overhead electricity cables Cable terminal
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward and landward), wildfowling interest. Agricultural land.	Medway Estuary and Marshes SPA and SSSI (seaward and landward), wildfowling interest. Agricultural land.	Medway Estuary and Marshes SPA and SSSI (seaward and landward), wildfowling interest. Agricultural land.	Medway Estuary and Marshes SPA and SSSI (seaward and landward), wildfowling interest. Agricultural land.



Long List to Short List			
Potential Measures			
	Measures	Selected	Reasoning
Structural	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 high ground is currently present and will not significantly reduce flood risk. Also 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 - no significant assets at risk to warrant installation of temporary defences (significant resources to implement)
	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.
Non-Structural	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	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	-	-	-	-	-
Comment and decision on whether taken forward to shortlist	Y= baseline for economic assessment	Y = as baseline. Following year 15 a Do nothing scenario would occur due to failure of the defences.	Y= defences have a very poor residual life and SOP. Capital works required to maintain defences.	Y= Existing defence SOP variable but could be increased with sea level rise (particularly to protect freshwater habitat and the access to Cable terminal). Further discussions may be required with the landowners.	Y= Existing defence SOP variable but could be increased with sea level rise (particularly to protect freshwater habitat and the access to Cable terminal). Further discussions may be required with the landowners.

Long List of Options (continued)			
	f) Construct new setback embankments at identified managed realignment sites and maintain SOP(capital) of existing embankments and walls around other areas.	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments and walls around other areas.	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments and walls around other areas.
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	N*	N*	N*
2 - Natura 2000 sites	Y	Y	Y
3- Reduce maintenance	TBC**	TBC**	TBC**
4 - WFD	TBC	TBC	TBC
5 - Local Plans	-	-	-
Comment and decision on whether taken forward to shortlist	Y = realignment site could be considered from 2nd epoch (year 20) given residual life of defences. There will be a requirement to find compensatory habitat if this option is taken forward.	Y= as above. Key infrastructure at risk that could warrant sustaining of defences in time (cable)	Y= as above. Key infrastructure at risk that could warrant upgrading of defences in time (cable).

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 and maintain SOP(capital) of existing embankments and walls around other areas.
g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments and walls around other areas.
h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments and walls around other areas.



Assessment of Short List				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, and walls (Do Minimum)	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 10 years residual life. Designated habitat and therefore compensatory habitat is required.	Defences have 10 years residual life. Designated habitat and therefore compensatory habitat is required.	Current defences have 10 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.	Current defences have 10 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.
Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 15.	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%	5%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 11,644,657	£ 14,495,105
PV Maintenance Costs	£ -	£ 374,375	£ 869,095	£ 862,509
PV Other Costs	£ -	£ -	£ 544,322	£ 674,519
Total Cost (including Optimism Bias) (PV)	£ -	£ 599,000	£ 20,892,920	£ 25,651,413
Value of Benefits	£ -	£ 750,000	£ 760,760	£ 1,348,804
Benefit Cost Ratio (BCR)	0.0	1.3	0.0	0.1

Assessment of Short List				
Option	e) Raise (upgrade) embankments and walls	f) Construct new setback embankments at identified managed realignment sites and maintain SOP(capital) of existing embankments and walls around other areas. MR in Chetney Marshes (Site 20)	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments and walls around other areas. MR in Chetney Marshes (Site 20)	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments and walls around other areas. MR in Chetney Marshes (Site 20)
Description	Capital works are undertaken to improve the current defences	Development of MR site. Capital works undertaken on remaining defences to maintain 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 10 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.	Current defences have 10 years residual life. The MR site ties back into high ground. The MR is freshwater designated habitat and therefore compensatory habitat is required. Based on current sea levels the MR site would create 121.1ha of saltmarsh and 335ha of mudflat. With 100 years sea level rise there could be 22.5ha of saltmarsh and 440.7ha of mudflat.	Current defences have 10 years residual life. The MR site ties back into high ground. The MR is freshwater designated habitat and therefore compensatory habitat is required. Based on current sea levels the MR site would create 121.1ha of saltmarsh and 335ha of mudflat. With 100 years sea level rise there could be 22.5ha of saltmarsh and 440.7ha of mudflat.	Current defences have 10 years residual life. The MR site ties back into high ground. The MR is freshwater designated habitat and therefore compensatory habitat is required. Based on current sea levels the MR site would create 121.1ha of saltmarsh and 335ha of mudflat. With 100 years sea level rise there could be 22.5ha of saltmarsh and 440.7ha of mudflat.
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 a 5% AEP SOP. The crest height of the remaining defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in SOP for these sections of defence as the sea level rises.	MR site to provide at least a 5% AEP SOP. 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 a 5% AEP SOP. 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. Cost for compensatory habitat not included.
SOP Provided (% AEP)	5%	50% (5% at MR site)	5%	5%
Value of Economics				
PV Capital Costs	£18,752,827	£16,912,663	£20,070,802	£24,076,510
PV Maintenance Costs	£841,292	£939,546	£936,456	£942,937
PV Other Costs	£583,092	£544,322	£670,346	£583,092
Total Cost (including Optimism Bias)	£32,283,537	£29,434,449	£34,684,167	£40,964,062
Value of Benefits	£1,370,361	£1,028,748	£1,497,499	£1,516,547
Benefit Cost Ratio (BCR)	0.0	0.0	0.0	0.0

PF Score	0%	7%	0%	0%
Further funding required to achieve 100% PF Score	£ -	£ 557,000	£ 20,843,588	£ 25,569,412
Flood/ erosion impacts				
Number of Residential Properties at risk under 0.1% AEP	2	2	2	0
Number of Commercial properties at risk under 0.1% AEP	9	9	9	5
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 944,632	£ 355,552	£ 487,985	£ 19,233.63
Critical Infrastructure	Overhead electricity cables Cable terminal	Overhead electricity cables Cable terminal	Impacts overtime with sea level rise	No assets at risk
PV Value of Impacts on road and rail	-	-	-	-
PV Value of Tourism and Recreation	-	-	-	-
PV Value of Agriculture Impacts	£572,101 Worst case scenario 3ha Grade 3 agricultural land flooded and 710ha Grade 4 flooded	£505,965 Worst case scenario 3ha Grade 3 agricultural land flooded and 710ha Grade 4 flooded	£267,987 Worst case scenario 2ha Grade 3 agricultural land flooded and 709ha Grade 4 flooded	£148,695 Worst case scenario 0.3ha Grade 3 agricultural land flooded and 652ha Grade 4 flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	RSPB would prefer HTL	RSPB would prefer HTL	RSPB would prefer HTL	RSPB would prefer HTL
Landowners	Landowner would prefer HTL and is happy to maintain the defences themselves but also willing to work with Environment Agency around different options	Landowner would prefer HTL and is happy to maintain the defences themselves but also willing to work with Environment Agency around different options	Landowner would prefer HTL and is happy to maintain the defences themselves but also willing to work with Environment Agency around different options	Landowner would prefer HTL and is happy to maintain the defences themselves but also willing to work with Environment Agency around different options
Technical Feasibility				
Site Specific	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)				
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	1 HMWB maintained	1 HMWB maintained
HRA (Habitats Regulation Assessment)				

PF Score	0%	10%	8%	7%
Further funding required to achieve 100% PF Score	£ 32,200,338	£ 26,626,386	£ 31,876,104	£ 38,155,999
Flood/ erosion impacts				
Number of Residential Properties at risk under 0.1% AEP	0	2	0	0
Number of Commercial properties at risk under 0.1% AEP	5	9	5	5
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 185.46	£ -	£ -	£ -
Critical Infrastructure	No assets at risk	Overhead electricity cables Cable terminal	Overhead electricity cables Cable terminal	Overhead electricity cables Cable terminal
PV Value of Impacts on road and rail	-	-	-	-
PV Value of Tourism and Recreation	-	-	-	-
PV Value of Agriculture Impacts	£146,186 Worst case scenario 652ha Grade 4 agricultural land flooded	0 Value of land included in the cost of the MR option	0 Value of land included in the cost of the MR option	0 Value of land included in the cost of the MR option
Stakeholders Feedback				
Statutory Stakeholders/ SEG	RSPB would prefer HTL	RSPB against MR due to the importance of the site for breeding waders	RSPB against MR due to the importance of the site for breeding waders	RSPB against MR due to the importance of the site for breeding waders
Landowners	Landowner would prefer HTL and is happy to maintain the defences themselves but also willing to work with Environment Agency around different options	Landowner believes that MR could adversely impact important environmental areas but is willing to discuss further with Environment Agency	Landowner believes that MR could adversely impact important environmental areas but is willing to discuss further with Environment Agency	Landowner believes that MR could adversely impact important environmental areas but is willing to discuss further with Environment Agency
Technical Feasibility				
Site Specific	n/a	Approx. 30-40% flooded on Spring tide. All the area in the West side is flooded under Spring conditions. Potentially 2,003m decrease in defence length due to the set back of embankments MR site would create 121ha of saltmarsh and 335ha of mudflat. With 100 years sea level rise there could be 23ha of saltmarsh and 441ha of mudflat.	Approx. 30-40% flooded on Spring tide. All the area in the West side is flooded under Spring conditions. Potentially 2,003m decrease in defence length due to the set back of embankments. MR site would create 121ha of saltmarsh and 335ha of mudflat. With 100 years sea level rise there could be 23ha of saltmarsh and 441ha of mudflat.	Approx. 30-40% flooded on Spring tide. All the area in the West side is flooded under Spring conditions. Potentially 2,003m decrease in defence length due to the set back of embankments. MR site would create 121.1ha of saltmarsh and 335ha of mudflat. With 100 years sea level rise there could be 22.5ha of saltmarsh and 440.7ha of mudflat.
Strategy Wide	n/a	Completely flooded during extreme events	Completely flooded during extreme events	Completely flooded during extreme events
WFD (Water Framework Directive)				
Compliance assessment outcome	1 HMWB maintained	2 Some return to natural processes	2 Some return to natural processes	2 Some return to natural processes
HRA (Habitats Regulation Assessment)				

Impact on SPA/ Ramsar qualifying features	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Once the defences fail there are potential impacts on designated freshwater grazing marsh as overtopping occurs, resulting in the likely degradation of the freshwater habitats and ultimate conversion to estuarine/intertidal habitats.</p> <p>Alterations to habitat on the western part of Chetney Marshes would potentially impact on the most productive area for breeding waders. Alterations to habitat to the north would potentially impact on healthy populations of breeding lapwing that utilise localised areas of arable agriculture, whereas to the east, alteration of habitat may impact on overwintering wildfowl assemblages.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Once the defences fail there are potential impacts on designated freshwater grazing marsh as overtopping occurs, resulting in the likely degradation of the freshwater habitats and ultimate conversion to estuarine/intertidal habitats.</p> <p>Alterations to habitat on the western part of Chetney Marshes would potentially impact on the most productive area for breeding waders. Alterations to habitat to the north would potentially impact on healthy populations of breeding lapwing that utilise localised areas of arable agriculture, whereas to the east, alteration of habitat may impact on overwintering wildfowl assemblages.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze, leading to a loss of saltmarsh and mudflat habitat.</p> <p>With sea level rise there are potential impacts on designated freshwater grazing marsh as overtopping occurs, resulting in the degradation of the freshwater habitats. Alterations to habitat on the western part of Chetney Marshes would potentially impact on the most productive area for breeding waders. Alterations to habitat to the north would potentially impact on healthy populations of breeding lapwing that utilise localised areas of arable agriculture, whereas to the east, alteration of habitat may impact on overwintering wildfowl assemblages.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze.</p> <p>Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat, potentially affecting the various wader and wildfowl qualifying species that make use of them throughout the year. These would include species including ringer and grey plover, dunlin, redshank etc. using Greenborough Marshes etc., small populations of overwintering black-tailed godwit etc.</p>
Impacts on freshwater habitats	<p>1</p> <p>Yes. 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. 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. Potential for overtopping of the defences with sea level rise. Compensatory habitat would need to be in place to compensate for this loss of freshwater habitat.</p>	<p>2</p> <p>Yes, there is still a potential risk that there may be overtopping in large storm events which will impact on the freshwater habitat</p>
Impacts on intertidal habitats	<p>1</p> <p>Yes, until the defences fail and 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 (where for example Managed Realignment would).</p>	<p>1</p> <p>Yes, until the defences fail and 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 (where for example Managed Realignment would).</p>	<p>1</p> <p>Yes as defences will still be maintained, so risk of coastal squeeze. But this is only 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 (where for example Managed Realignment would).</p>	<p>1</p> <p>Yes, the defences are maintained over the whole appraisal period, so risk of coastal squeeze</p>



Impact on SPA/ Ramsar qualifying features	<p>1</p> <p>There are potential significant effects on the intertidal Medway Estuary and Marshes SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat, potentially affecting the various wader and wildfowl qualifying species that make use of them throughout the year. These would include species including ringer and grey plover, dunlin, redshank etc. using Greenborough Marshes etc., small populations of overwintering black-tailed godwit etc.</p>	<p>1</p> <p>There may be potential significant effects on the freshwater Medway Estuary and Marshes SPA and its constituent qualifying features due to the intrusion of works into Designated areas.</p> <p>The Managed Realignment would impact on a maximum of 469 ha of designated freshwater grazing marsh habitat. This would result in the alteration of the freshwater grazing marsh habitats and ultimate conversion to estuarine/intertidal habitats, potentially affecting those qualifying species that use these habitats. Alterations to habitat on the western part of Chetney Marshes would potentially impact on the most productive area for breeding waders. Alterations to habitat to the north would potentially impact on, for example, healthy populations of breeding lapwing that utilise localised areas of arable agriculture, whereas to the east, alteration of habitat may impact on the populations of ringer plover, Brent geese, and the overwintering wildfowl assemblages.</p>	<p>1</p> <p>There may be potential significant effects on the freshwater Medway Estuary and Marshes SPA and its constituent qualifying features due to the intrusion of works into Designated areas.</p> <p>The Managed Realignment would impact on a maximum of 469 ha of designated freshwater grazing marsh habitat. This would result in the alteration of the freshwater grazing marsh habitats and ultimate conversion to estuarine/intertidal habitats, potentially affecting those qualifying species that use these habitats. Alterations to habitat on the western part of Chetney Marshes would potentially impact on the most productive area for breeding waders. Alterations to habitat to the north would potentially impact on, for example, healthy populations of breeding lapwing that utilise localised areas of arable agriculture, whereas to the east, alteration of habitat may impact on the populations of ringer plover, Brent geese, and the overwintering wildfowl assemblages.</p>	<p>1</p> <p>There may be potential significant effects on the freshwater Medway Estuary and Marshes SPA and its constituent qualifying features due to the intrusion of works into Designated areas.</p> <p>The Managed Realignment would impact on a maximum of 469 ha of designated freshwater grazing marsh habitat. This would result in the alteration of the freshwater grazing marsh habitats and ultimate conversion to estuarine/intertidal habitats, potentially affecting those qualifying species that use these habitats. Alterations to habitat on the western part of Chetney Marshes would potentially impact on the most productive area for breeding waders. Alterations to habitat to the north would potentially impact on, for example, healthy populations of breeding lapwing that utilise localised areas of arable agriculture, whereas to the east, alteration of habitat may impact on the populations of ringer plover, Brent geese, and the overwintering wildfowl assemblages.</p>
Impacts on freshwater habitats	<p>2</p> <p>Yes, there is still a potential risk that there may be overtopping in large storm events which will impact on the freshwater habitat</p>	<p>1</p> <p>Yes, compensatory freshwater habitat will be required to compensate for the loss of freshwater grazing marsh and associated habitats.</p>	<p>1</p> <p>Yes, compensatory freshwater habitat will be required to compensate for the loss of freshwater grazing marsh and associated habitats.</p>	<p>1</p> <p>Yes, compensatory freshwater habitat will be required to compensate for the loss of freshwater grazing marsh and associated habitats.</p>
Impacts on intertidal habitats	<p>1</p> <p>Yes, the defences are maintained over the whole appraisal period, so risk of coastal squeeze</p>	<p>5</p> <p>No, the Managed Realignment site, and the development of saltmarsh and mudflat therein would support mitigation for coastal squeeze as the habitats developed and established.</p> <p>The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.</p>	<p>5</p> <p>No, the Managed Realignment site, and the development of saltmarsh and mudflat therein would support mitigation for coastal squeeze as the habitats developed and established.</p> <p>The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.</p>	<p>5</p> <p>No, the Managed Realignment site, and the development of saltmarsh and mudflat therein would support mitigation for coastal squeeze as the habitats developed and established.</p> <p>The Managed nature of the proposed works would allow control over area, rate, and to a certain extent quality of newly formed habitat, so would be preferable (as a means of mitigating for coastal squeeze) to the Do Nothing or Maintain options.</p>

Habitat Connectivity	2 Potential slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before suitable saltmarsh and mudflat habitats establish behind the existing defences.	2 Potential slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before suitable saltmarsh and mudflat habitats establish behind the existing defences.	2 Potential slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before suitable saltmarsh and mudflat habitats establish behind the existing defences.	2 Negative impact on connectivity due to loss of habitat from coastal squeeze.
SEA (Strategic Environmental Assessment)				
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk
Effects on population	1 Agricultural livelihoods, amenity land and essential infrastructure at risk following failure of defences in year 10.	1 Agricultural livelihoods, amenity land and essential infrastructure at risk following failure of defences in year 15.	2 Agricultural livelihoods, amenity land and essential infrastructure at risk over time with increased risk of overtopping due to sea level rise.	5 Agricultural livelihoods, amenity land and essential infrastructure at reduced risk from flooding
Impact on plans/ programmes	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites
Freshwater Biodiversity	1 Landward SSSI at risk from storm event overtopping. This consists of the grazing marsh and numerous dykes and fleets. Each of these has its own characteristic assemblage of plants and animals. Both breeding and wintering birds are of interest. The vegetation is primarily a mixture of several species of grass, but with a considerable variety of other plants, some uncommon. The dykes and their margins usually have sea club-rush Scirpus maritimus as the most abundant plant, but here too rarities can be found, sometimes in quite large amounts.	1 Landward SSSI at risk from storm event overtopping. This consists of the grazing marsh and numerous dykes and fleets. Each of these has its own characteristic assemblage of plants and animals. Both breeding and wintering birds are of interest. The vegetation is primarily a mixture of several species of grass, but with a considerable variety of other plants, some uncommon. The dykes and their margins usually have sea club-rush Scirpus maritimus as the most abundant plant, but here too rarities can be found, sometimes in quite large amounts.	2 Landward SSSI at risk over time with increased risk of overtopping due to sea level rise.	3 Landward SSSI at reduced risk from saline intrusion from overtopping
Saline Biodiversity	2 Seaward SPA at risk due to coastal squeeze until failure of the defences	2 Seaward SPA at risk due to coastal squeeze until failure of the defences	1 Seaward SPA at risk due to coastal squeeze	1 Seaward SPA at risk due to coastal squeeze

Habitat Connectivity	2 Negative impact on connectivity due to loss of habitat from coastal squeeze.	5 Beneficial impact on connectivity due to the provision of new habitats that would otherwise be affected by coastal squeeze.  The location of the MR site here would serve to replace lost saltmarsh and mudflat habitat in the Medway estuary, promoting the connectivity between here and the Swale, and allowing movement of bird species through the landscape that could otherwise be lost.	5 Beneficial impact on connectivity due to the provision of new habitats that would otherwise be affected by coastal squeeze.  The location of the MR site here would serve to replace lost saltmarsh and mudflat habitat in the Medway estuary, promoting the connectivity between here and the Swale, and allowing movement of bird species through the landscape that could otherwise be lost.	5 Beneficial impact on connectivity due to the provision of new habitats that would otherwise be affected by coastal squeeze.  The location of the MR site here would serve to replace lost saltmarsh and mudflat habitat in the Medway estuary, promoting the connectivity between here and the Swale, and allowing movement of bird species through the landscape that could otherwise be lost.
SEA (Strategic Environmental Assessment)				
Historic Environment	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets at risk	3 No observable historic assets
Effects on population	5 Agricultural livelihoods, amenity land and essential infrastructure at reduced risk from flooding	2 Agricultural livelihoods, amenity land and essential infrastructure at risk due to development of MR site and over time where the defences are held with increased risk of overtopping due to sea level rise.	2 Agricultural livelihoods, amenity land and essential infrastructure at risk due to development of MR site and over time where the defences are held with increased risk of overtopping due to sea level rise.	2 Agricultural livelihoods, amenity land and essential infrastructure at risk due to development of MR site and over time where the defences are held with increased risk of overtopping due to sea level rise.
Impact on plans/ programmes	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites	3 Benefit area does not coincide with proposed development sites
Freshwater Biodiversity	5 Landward SSSI at reduced risk from saline intrusion from overtopping	1 Create new intertidal habitat which would replace freshwater grazing marsh with saline habitat within SPA. Significant loss of grazing marsh that is part of a complex habitat of pasture, seawalls and counter walls, and numerous dykes and fleets. Each of these has its own characteristic assemblage of plants and animals. Both breeding and wintering birds are of interest. The vegetation is primarily a mixture of several species of grass, but with a considerable variety of other plants, some uncommon. The dykes and their margins usually have sea club-rush Scirpus maritimus as the most abundant plant, but here too rarities can be found, sometimes in quite large amounts.	1 Create new intertidal habitat which would replace freshwater grazing marsh with saline habitat within SPA. Significant loss of grazing marsh that is part of a complex habitat of pasture, seawalls and counter walls, and numerous dykes and fleets. Each of these has its own characteristic assemblage of plants and animals. Both breeding and wintering birds are of interest. The vegetation is primarily a mixture of several species of grass, but with a considerable variety of other plants, some uncommon. The dykes and their margins usually have sea club-rush Scirpus maritimus as the most abundant plant, but here too rarities can be found, sometimes in quite large amounts.	1 Create new intertidal habitat which would replace freshwater grazing marsh with saline habitat within SPA. Significant loss of grazing marsh that is part of a complex habitat of pasture, seawalls and counter walls, and numerous dykes and fleets. Each of these has its own characteristic assemblage of plants and animals. Both breeding and wintering birds are of interest. The vegetation is primarily a mixture of several species of grass, but with a considerable variety of other plants, some uncommon. The dykes and their margins usually have sea club-rush Scirpus maritimus as the most abundant plant, but here too rarities can be found, sometimes in quite large amounts.
Saline Biodiversity	1 Seaward SPA at risk due to coastal squeeze	5 Create new intertidal habitat which would replace freshwater grazing marsh SSSI with saline habitat within SPA	5 Create new intertidal habitat which would replace freshwater grazing marsh with saline habitat within SPA	5 Create new intertidal habitat which would replace freshwater grazing marsh with saline habitat within SPA

Soil	1 Degradation of soils following the failure of the defences	1 Degradation of soils following the failure of the defences	2 Degradation of soils over time with increased risk of overtopping due to sea level rise.	5 Soils protected as defences improved.
Groundwater	3 No impacts anticipated	3 No impacts anticipated	3 No impacts anticipated	3 No impacts anticipated
Landscape (visual impact)	4 Change following failure of the defences but gradual giving back to natural processes	4 Change following failure of the defences but gradual giving back to natural processes	3 Change over time but giving back to natural processes	2 Incremental change in visual amenity due to increased defence heights
Carbon Storage	2 Loss of carbon storage in intertidal habitat and through changes to freshwater grazing marsh following failure of the defences	2 Loss of carbon storage in intertidal habitat and through changes to freshwater grazing marsh following failure of the defences	2 Gradual loss of carbon storage in intertidal habitat and through changes to freshwater grazing marsh over time with increased risk of overtopping due to sea level rise.	1 Loss of carbon storage in saltmarsh due to coastal squeeze
Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-42	-24	-12	-15
Comments	Major degradation in various ES (e.g. food provision, water flow regulation, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in various ES (e.g. food provision, water flow regulation, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in some ES (e.g. aesthetic value, climate regulation, conversation habitat, fisheries habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation and erosion regulation)	Degradation in some ES (e.g. aesthetic value, climate regulation, conversation habitat, fisheries habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation and erosion regulation)
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N	Y	Y	Y
2 - Natura 2000 sites	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y
4 - WFD	N	N	N	N
5 - Local Plans	Y	Y	Y	Y

Soil	5 Soils protected as defences improved.	1 Loss of soils to managed realignment	1 Loss of soils to managed realignment	1 Loss of soils to managed realignment
Groundwater	3 No impacts anticipated	3 No impacts anticipated	3 No impacts anticipated	3 No impacts anticipated
Landscape (visual impact)	2 Significant change in visual amenity due to increased defence heights	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	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but giving back to natural processes
Carbon Storage	1 Loss of carbon storage in saltmarsh due to coastal squeeze	2 Loss of carbon storage with habitat changes and generated carbon cost from construction activities	2 Loss of carbon storage with habitat changes and generated carbon cost from construction activities	2 Loss of carbon storage with habitat changes and generated carbon cost from construction activities
Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-15	39	50	53
Comments	Degradation in some ES (e.g. aesthetic value, climate regulation, conversation habitat, fisheries habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation and erosion regulation)	Enhancement for some ES (e.g. water flow regulation, aesthetic value, fisheries and conservation habitat) outweigh degradation risk in many 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) outweigh degradation risk in many ES (e.g. freshwater provision, food provision, water purification)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat) outweigh degradation risk in many ES (e.g. freshwater provision, food provision, water purification)
To what extent does the option meet the objectives?				
1- Reduce Flood Risk		Y	Y	Y
2 - Natura 2000 sites		Y	Y	Y
3- Reduce maintenance		Y	Y	Y
4 - WFD		Y	Y	Y
5 - Local Plans		Y	Y	Y



Environmental Scores				
100 = best option, 0 = worst option				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, and walls	d) Raise (sustain) embankments and walls
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	0	0	0	0
Impacts on freshwater habitats	0	0	0	25
Impacts on intertidal habitats	0	0	0	0
Habitat Connectivity	25	25	25	25
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	0	0	25	100
Impact on plans/ programmes	50	50	50	50
Freshwater Biodiversity	0	0	25	50
Saline Biodiversity	25	25	0	0
Soil	0	0	25	100
Groundwater	50	50	50	50
Landscape (visual impact)	75	75	50	25
Carbon Storage	25	25	25	0
Total	325	325	325	475

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 and maintain SOP(capital) of existing embankments and walls around other areas.	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments and walls around other areas.	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments and walls around other areas.
WFD (Water Framework Directive)				
Compliance assessment outcome	0	25	25	25
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	0	0	0	0
Impacts on freshwater habitats	25	0	0	0
Impacts on intertidal habitats	0	100	100	100
Habitat Connectivity	25	100	100	100
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	100	25	25	25
Impact on plans/ programmes	50	50	50	50
Freshwater Biodiversity	100	0	0	0
Saline Biodiversity	0	100	100	100
Soil	100	0	0	0
Groundwater	50	50	50	50
Landscape (visual impact)	25	0	0	0
Carbon Storage	0	25	25	25
Total	525	525	525	525

Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments, and walls (Do Minimum)	d) Raise (sustain) embankments and walls
Costs	£ -	£ 599,000	£ 20,892,920	£ 25,651,413
Benefits	£ -	£ 750,000	£ 760,760	£ 1,348,804
NPV	£ -	£ 151,000	-£ 20,132,159	-£ 24,302,609
BCR	0.0	1.3	0.0	0.1
Environmental Scoring	325	325	325	475

Summary of Results				
Option	e) Raise (upgrade) embankments and walls	f) Construct new setback embankments at identified managed realignment sites and maintain SOP(capital) of existing embankments and walls around other areas.	g) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments and walls around other areas.	h) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments and walls around other areas.
Costs	£ 32,283,537	£ 29,434,449	£ 34,684,167	£ 40,964,062
Benefits	£ 1,370,361	£ 1,028,748	£ 1,497,499	£ 1,516,547
NPV	-£ 30,913,176	-£ 28,405,702	-£ 33,186,668	-£ 39,447,514
BCR	0.0	0.0	0.0	0.0
Environmental Scoring	525	525	525	525

Preferred Option Decision Making		
DLO	Leading Option at DLO Stage	Justification for Leading Option
DLO1 - Economic Assessment	Do minimum - ongoing maintainance until Year 15, following by NAI.	The current defences have a 15-year median residual life if maintenance continues and have a positive BCR if maintained until residual life fails, enabling HTL policy in the short term.
DLO2 - Economic Sensitivities		
DLO3 - Review of Compensatory Intertidal Habitat Requirements		
DLO4 - Review of Compensatory Freshwater Habitat Requirements	Ongoing maintenance until year 15, followed by managed realignment: habitat adaptation, with freshwater compensation potentially required by year 30.	The current defences have a 15-year median residual life and have a positive BCR if maintained until residual life fails, enabling HTL policy in the short term. After this there is a legal requirement to compensate for the loss of SPA habitat. Habitat adaptation is preferred over managed realignment as it is more cost effective and will reduce adverse impacts on freshwater designated sites.
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase	Ongoing maintenance until year 15 followed by Habitat Adaptation. Managed Realignment site at Tailness in year 5.	The current defences have a 15-year median residual life and have a positive BCR if maintained until residual life fails, enabling HTL policy in the short term. After this there is legal requirement to compensate for the loss of SPA habitat. Habitat adaptation is preferred over managed realignment as it is more cost effective and will reduce adverse impacts on freshwater designated sites. The MR site in the first epoch will help contribute to coastal squeeze compensation in the short term, with the rest of the frontage contributing coastal squeeze compensation in the third epoch.

Preferred Option Name
Ongoing maintenance until year 15 followed by Habitat Adaptation. Managed Realignment site at Tailness in year 5.

Preferred Option
<p>Initial MR site by year 5 in the northeast corner at Tailness marshes, to provide compensation for coastal squeeze in the first epoch of the Strategy.</p> <p>For the rest of the frontage, maintenance (patch and repair) of the current defences (earth embankments) for the first 15 years. After year 15 the natural adaptation of the frontage will be allowed to occur through the ‘MR – habitat adaptation’ option. This option involves the natural adaptation of the frontage, by slowly reducing maintenance efforts and allowing inundation in particular areas, to help ensure a slower and more gentle adaptation of the functionality of the freshwater designated habitat and the SPA intertidal habitat.</p> <p>There is a risk regarding the access to the electricity pylons during extreme events, but this risk is reduced compared to undertaking a MR site approach here, as it is envisaged only the fringes of the site will be regularly inundated. The whole of the BA will only be affected in extreme events, and this is similar to the impacts under a NAI option. If required localised adaptation of the access roads etc can be undertaken to allow access to the pylons in extreme events.</p>
Justification
<p>Due to the limited assets at risk in the area, options to Hold the Line in the long term do not provide a BCR above one. The current defences have a 15-year median residual life. If patch and repair maintenance continues, the overall BCR is above one and the NPV is positive, enabling HTL policy in the short term. It is economically viable to maintain the defences for the first 15 years. After this, there is a legal requirement to compensate or protect the freshwater designated habitat. The MR - habitat adaptation option will allow the freshwater habitat to adapt over time. This will result in a low-level impact over a longer period of time, which is more in line with Natural England’s aspirations, and will help mitigate against the loss of functionality of the intertidal habitat in the upper Medway Estuary. As such this is a more long term sustainable option.</p> <p>The MR site in the first epoch will help contribute to coastal squeeze compensation in the short term, with the rest of the frontage contributing coastal squeeze compensation in the third epoch. Freshwater compensation may be required in the medium term.</p>

Preferred Option Costs			
Cost	Benefits	BCR	PF Score
£ 598,720	£ 749,811	1.25	8%

Managed Realignment	
Managed Realignment site proposed at Tailness in Year 5. From Year 15 there will be habitat adaptation at Chetney	
PV Cost	Hectares of saltmarsh created
£ 7,078,231	108.6 ha

Impacts on freshwater designated habitat
Ramsar and SPA habitat at risk from Year 15 due to habitat adaptation. Freshwater compensation required but costs considered within scheme costs.