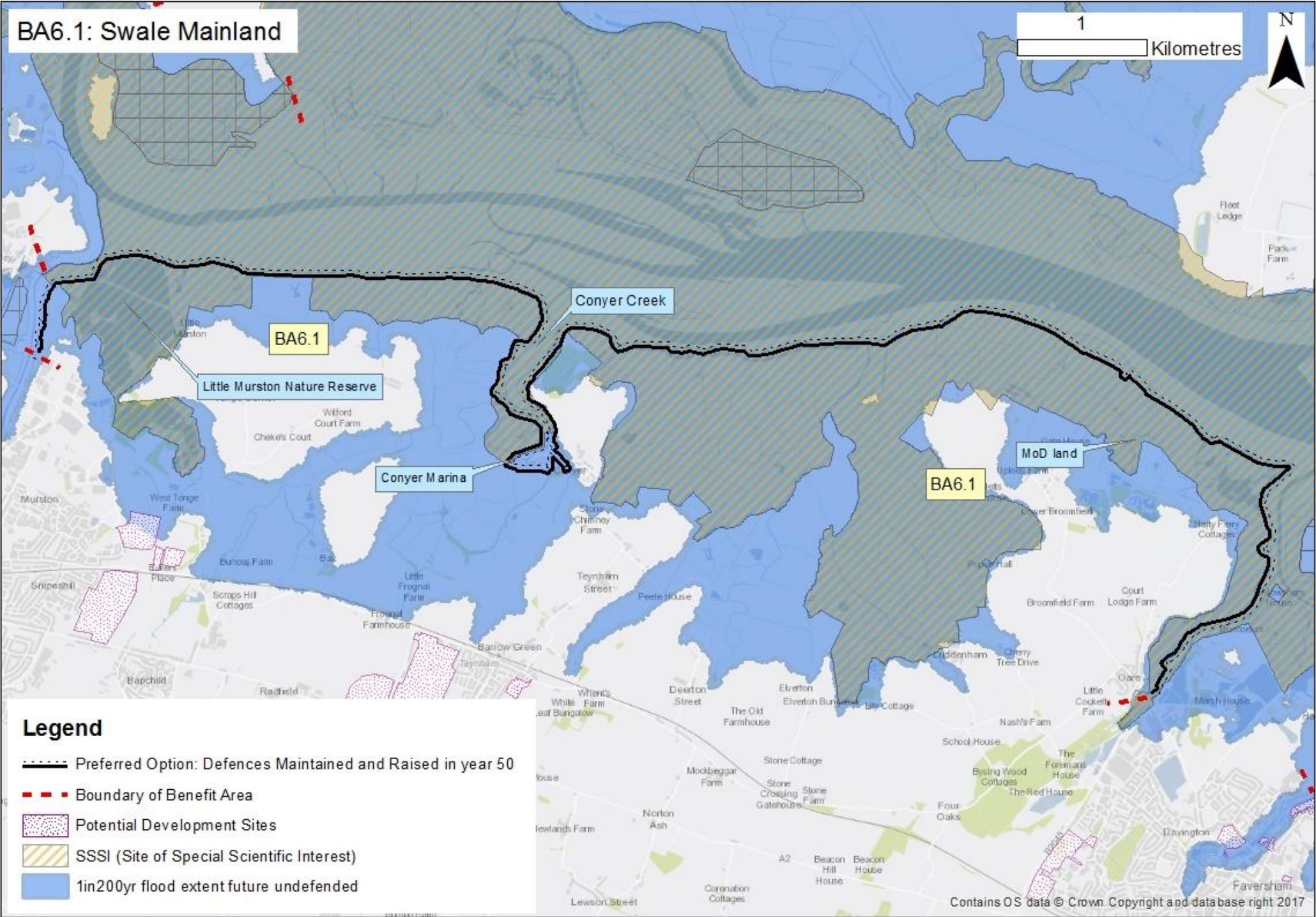


Benefit Area Name	6 - Swale Mainland
Benefit Unit Name	6.1 - Murston Pits to Faversham (Murston Pits to Oare Creek only) - MR site covers Little Murston and Tonge (Site 24)
Frontage Length	16.5 km
Defence Structure Type	Embankment, High ground and flood gate
Min Standard of Protection (AEP%)	0.5
Residual Life (years)	20

	0-20 years	20-50 years	50-100 years
SMP Policy	HTL	MR with localised HTL	MR with localised HTL
Aiming to comply with policy	No- suggest alternative considerations		
Comment	The SMP policy suggests HTL for the first epoch, followed by ‘MR with localised HTL’ for the last 2 epochs. Localised HTL is recommended at Conyer, the MOD land near Oare Creek and landfill areas around Oare Creek		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	6	11	13	65
Commercial & Industrial	3	6	7	32
Agricultural (Ha)	497	638	787	1391
Key Infrastructure	Conyer Marina, MoD land, Milton Creek Works Historic Landfill, Harty Pit No.2 Historic Landfill (inert)	Conyer Marina, MoD land, Milton Creek Works Historic Landfill, Harty Pit No.2 Historic Landfill (inert), Harty Pit No.1 Historic Landfill (inert)	Conyer Marina, MoD land, Milton Creek Works Historic Landfill, Harty Pit No.2 Historic Landfill (inert), Harty Pit No.1 Historic Landfill (inert)	Conyer Marina, MoD land, Milton Creek Works Historic Landfill, Harty Pit No.2 Historic Landfill (inert), Harty Pit No.1 Historic Landfill (inert), Deerton Street, Conyer Road
Social and Environmental Considerations	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward), Oare Marshes LNR (landward), Little Murston Nature Reserve.	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward), Oare Marshes LNR (landward), Little Murston Nature Reserve.	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward), Oare Marshes LNR (landward), Little Murston Nature Reserve.	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward and landward), Oare Marshes LNR (landward), Little Murston Nature Reserve.

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	Exclude - limited benefits in constructing a wall where high ground and embankments are currently present.
	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 revetment currently present
	Construct rock revetment	N	Exclude - limited benefits in constructing a revetment where high ground and embankments are currently present and will not significantly reduce flood risk. Also the foreshore is mudflat/ saltmarsh and so technically unviable and potentially environmentally damaging in SPA habitat
	Install demountable defences	Y	Take forward - public access and interaction with the river front is required. However potential increased cost compared to existing defences needs further consideration.
	Install temporary defences	N	Exclude - significant resources to implement and potentially not the most efficient use of FDGiA funding compared to sustaining existing defences. This would need to be discussed with asset owners at OBC stage.
	Beach recharge (sand or shingle)	N	Exclude - not appropriate for this location
	Construct rock groynes	N	Exclude - not appropriate for this location
	Maintain rock groynes	N	Exclude - not appropriate for this location
	Construct timber structures	N	Exclude - not appropriate for this location
	Maintain timber structures	N	Exclude - not appropriate for this location
	Construct a tidal barrier	N	Exclude- likely to have significant environmental impacts, including on water quality (WFD), change in sedimentation in Estuary with wider impacts (environment, dredging, maintenance, navigation etc.). In addition likely to have significant costs.
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	c) Maintain SOP (capital) embankments (including demountable)	d) Raise (sustain SOP) embankments (including demountable)	e) Raise (upgrade SOP) embankments (including demountable)
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 = baseline (min SOP very low and min residual life low (min SOP = 2)).	Y - as Baseline. Following year 25 a do nothing scenaria would occur due to failure of the defences.	Y = minimum SOP very low and residual life low therefore capital maintenance needed to maintain the defences.	Y= SOP low, therefore SOP could be increased with sea level rise.	N= SOP low but limited assets at risk so unlikely to be economically viable.

Long List of Options (continued)					
	f) Construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments around rest of frontage.	g) Construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments around rest of frontage.	h) Construct new setback embankments at identified managed realignment sites. Raise (upgrade SOP) existing embankments around rest of frontage.	i) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments around rest of frontage.	j) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments around rest of frontage.
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	Y	Y	Y	N	N
2 - Natura 2000 sites	Y	Y	Y	Y	Y
3- Reduce maintenance	TBC*	TBC*	TBC*	TBC*	TBC*
4 - WFD	TBC	TBC	TBC	TBC	TBC
5 - Local Plans	TBC	TBC	TBC	TBC	TBC
Comment and decision on whether taken forward to shortlist	N = the RL of the embankments is quite high therefore the defences can be maintained for the first 20 years.	N = as above	N= as above	Y = realignment site is designated (SPA) but still needs consideration at short list stage for compensation requirements. The overtopping risk will also need to be considered.	Y = realignment site is designated (SPA) but still needs consideration at short list stage for compensation requirements. The overtopping risk will also need to be considered.

Long List of Options (continued)	
	k) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (upgrade SOP) existing embankments around rest of frontage.
To what extent does the option meet the objectives?	
1- Reduce Flood Risk	N
2 - Natura 2000 sites	Y
3- Reduce maintenance	TBC*
4 - WFD	TBC
5 - Local Plans	TBC
Comment and decision on whether taken forward to shortlist	N = not significant assets to warrant upgrading the defences.

* Maintenance requirements currently unknown, as will depend on the MR sites taken forwards

Short List of Options	
a)	Do nothing
b)	Do minimum
c)	Maintain (capital) embankments
d)	Raise (sustain) embankments
e)	Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments around rest of frontage.
f)	Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments around rest of frontage.

Assessment of Short List					
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments	d) Raise (sustain) embankments	e) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments around rest of frontage. MR site covers Little Murston and Tonge (Site 24).
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.	Defences maintained for the first 20 years due to their residual life. In year 20 development of MR site. Capital works undertaken on remaining defences 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. Milton Creek Works Historic Landfill and Harty Pit No.2 Historic Landfill (inert) potentially at risk.	Defences have 25 years residual life. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere. Designated habitat and therefore compensatory habitat is required. Milton Creek Works Historic Landfill and Harty Pit No.2 Historic Landfill (inert) potentially at risk.	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. Milton Creek Works Historic Landfill and Harty Pit No.2 Historic Landfill (inert) potentially at risk over time.	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. Milton Creek Works Historic Landfill and Harty Pit No.2 Historic Landfill (inert) potentially at risk over time.	Current defences have 20 years residual life. The MR site ties back into high ground and is undesignated. Based on current sea levels the MR site would create 76.5ha of saltmarsh and 113.7ha of mudflat. With 100 years sea level rise there could be 36.2ha of saltmarsh and 171.5ha of mudflat. The site is internationally designated so compensatory habitat legally required. Impacts on Milton Creek Works Historic Landfill will need to be considered at the next stage.

Assessment of Short List	
Option	<p>f) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments around rest of frontage. MR site covers Little Murston and Tonge (Site 24).</p>
Description	<p>Defences maintained for the first 20 years due to their residual life. In year 20 development of MR site Capital works undertaken to improve the remaining defences.</p>
Technical Issue	<p>Current defences have 20 years residual life. The MR site ties back into high ground and is undesignated. Based on current sea levels the MR site would create 76.5ha of saltmarsh and 113.7ha of mudflat. With 100 years sea level rise there could be 36.2ha of saltmarsh and 171.5ha of mudflat.</p> <p>The site is internationally designated so compensatory habitat legally required.</p> <p>Impacts on Milton Creek Works Historic Landfill will need to be considered at the next stage.</p>

Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 25.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.	The SOP provided by the defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This option will maintain the required SOP provided by the defences by keeping pace with sea level rise.	MR site to provide 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. Cost for compensatory habitat not included.
SOP Provided (% AEP)	>50%	>50%	50%	1%	50% (with 5% at MR site)
Value of Economics					
PV Capital Costs	£ -	£ -	£ 6,961,233	£ 15,954,052	£ 6,814,339
PV Maintenance Costs	£ -	£ 163,125	£ 752,526	£ 741,649	£ 695,735
PV Other Costs	£ -	£ -	£ 370,467	£ 692,718	£ 313,914
Total Cost (including Optimism Bias) (PV)	£ -	£ 261,000	£ 12,934,761	£ 27,821,469	£ 12,518,381
Value of Benefits	£ -	£ 532,000	£ 2,113,072	£ 6,025,416	£ 2,775,504
Benefit Cost Ratio (BCR)	0.0	2.0	0.2	0.2	0.2
PF Score	0%	11%	1%	2%	89%
Further funding required to achieve 100% PF Score	£ -	£ 231,000	£ 12,785,564	£ 27,389,543	£ 1,392,097
Flood/ erosion impacts					
Number of Residential Properties at risk under 0.1% AEP	92	92	73	0	73
Number of Commercial properties at risk under 0.1% AEP	73	73	50	0	50
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 3,043,302	£ 2,625,282	£ 2,008,709	£ 21,888	£ 2,008,709
Critical Infrastructure	No assets at risk	No assets at risk	No assets at risk	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	£1,426,501 Rail Sittingbourne to Teynham	£ 1,385,227	£973,209 Rail Sittingbourne to Teynham	-	£973,209 Rail Sittingbourne to Teynham
PV Value of Tourism and Recreation Impacts	£19,976 Oare Nature Reserve	£ 18,290	£11,069 Oare Nature Reserve	£51 Oare Nature Reserve	£11,069 Oare Nature Reserve
PV Value of Agriculture Impacts	£1,681,037 Worst case scenario 403ha Grade 1 agricultural land flooded and 59ha Grade 3 flooded 1059ha Grade 4 flooded	£ 1,610,258	£1,064,758 Worst case scenario 366ha Grade 1 agricultural land flooded and 56ha Grade 3 flooded 1054ha Grade 4 flooded	£123,461 Worst case scenario 7.6ha Grade 1 agricultural land flooded and 4.3ha Grade 3 flooded 405ha Grade 4 flooded	£402,325 Worst case scenario 220ha Grade 1 agricultural land flooded and 34ha Grade 3 flooded 632ha Grade 4 flooded
Stakeholders Feedback					

Assumptions/ Uncertainties	MR site to provide 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. Cost for compensatory habitat not included.
SOP Provided (% AEP)	1% (with 5% at MR site)
Value of Economics	
PV Capital Costs	£ 9,081,186
PV Maintenance Costs	£ 692,607
PV Other Costs	£ 396,071
Total Cost (including Optimism Bias) (PV)	£ 16,271,782
Value of Benefits	£ 4,827,511
Benefit Cost Ratio (BCR)	0.3
PF Score	69%
Further funding required to achieve 100% PF Score	£ 5,010,441
Flood/ erosion impacts	
Number of Residential Properties at risk under 0.1% AEP	0
Number of Commercial properties at risk under 0.1% AEP	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 21,888
Critical Infrastructure	No assets at risk
PV Value of Impacts on road and rail	-
PV Value of Tourism and Recreation Impacts	£51 Oare Nature Reserve
PV Value of Agriculture Impacts	£286,556 Worst case scenario 5ha Grade 1 agricultural land flooded and 2ha Grade 3 flooded 243ha Grade 4 flooded
Stakeholders Feedback	

Statutory Stakeholders/ SEG	HTL preferred to maintain the freshwater environments.	HTL preferred to maintain the freshwater environments.	HTL preferred to maintain the freshwater environments.	HTL preferred to maintain the freshwater environments.	Freshwater habitat is a nesting area for birds and used for fishing etc. Some groups could object to MR in this area but NE have said that this MR site may not have an impact on the SPA.
Landowners	Potential animal welfare issues if the agricultural areas were to flood.	Potential animal welfare issues if the agricultural areas were to flood.	Potential animal welfare issues if the agricultural areas were to flood.	Preferred option to maintain the viability of the agricultural business.	Landowner currently has a negative view of MR, but is open to working constructively to understand the potential innovation at the site.
Technical Feasibility					
Site Specific	n/a	n/a	n/a	n/a	Approx. 80% flooded on the modelled Spring tide. Potential 2,581m decrease in defence line due to the MR site tying into high ground. MR site would create 76.5ha of saltmarsh and 113.7ha of mudflat. With 100 years sea level rise there could be 36.2ha of saltmarsh and 171.5ha of mudflat.
Strategy Wide	n/a	n/a	n/a	n/a	Sites are completely flooded during extreme events. An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.
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	2 Heavily Modified Water Body (HMWB) maintained	4 Some return to natural processes over time
HRA (Habitats Regulation Assessment)					

Statutory Stakeholders/ SEG	Freshwater habitat is a nesting area for birds and used for fishing etc. Some groups could object to MR in this area, but NE have said that this MR site may not have an impact on the SPA.
Landowners	Landowner currently has a negative view of MR, but is open to working constructively to understand the potential innovation at the site.
Technical Feasibility	
Site Specific	<p>Approx. 80% flooded on the modelled Spring tide.</p> <p>Potential 2,581m decrease in defence line due to the MR site tying into high ground.</p> <p>MR site would create 76.5ha of saltmarsh and 113.7ha of mudflat. With 100 years sea level rise there could be 36.2ha of saltmarsh and 171.5ha of mudflat.</p>
Strategy Wide	<p>Sites are completely flooded during extreme events.</p> <p>An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.</p>
WFD (Water Framework Directive)	
Compliance assessment outcome	<p>4</p> <p>Some return to natural processes over time</p>
HRA (Habitats Regulation Assessment)	

Impact on SPA/ Ramsar qualifying features	<p>1</p> <p>There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze until the defences fail in year 20. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat until at least yr. 20 when failing defences will allow saltmarsh and mudflat habitats to begin to form behind the current defence line. At this point, there will be impacts on the designated freshwater habitats and those qualifying feature species that use the freshwater habitat. This would include duck species to the western end where the area is managed for wildfowling, and other species using the (often over-grazed) grazing marsh for roosting.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze until the defences fail in year 25. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat until at least yr. 25 when failing defences will allow saltmarsh and mudflat habitats to begin to form behind the current defence line. At this point, there will be impacts on the designated freshwater habitats and those qualifying feature species that use the freshwater habitat. This would include duck species to the western end where the area is managed for wildfowling, and other species using the (often over-grazed) grazing marsh for roosting.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of intertidal habitat. However with sea level rise, the risk of overtopping will increase so there will be impacts on the designated freshwater habitats and those qualifying feature species that use the freshwater habitat as above.</p>	<p>1</p> <p>There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of intertidal habitat. However designated freshwater grazing marsh will be retained.</p>	<p>1</p> <p>There may be potential significant effects on the freshwater Swale SPA and its constituent qualifying features due to the intrusion of works into Designated freshwater areas. Where the defences are held coastal squeeze will lead to a loss of intertidal habitat. In the MR site (after year 20) saltmarsh / mudflat habitats will begin to reform, reducing the impacts of coastal squeeze. However at this point, there will be impacts on the designated freshwater habitats and those qualifying feature species that use. Additionally in the areas where the defences are held, there may be increased overtopping overtime which will impact on the designated freshwater habitat. This would include duck species to the western end where the area is managed for wildfowling, and other species using the (often over-grazed) grazing marsh for roosting.</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. Compensatory habitat would be required in advance of overtopping of the defences, to compensate for the loss of freshwater grazing marsh. Likely to be later than the Do Nothing option.</p>	<p>3</p> <p>No. The current defences will be improved so the risk of overtopping/ inundation of the freshwater habitat is reduced.</p>	<p>1</p> <p>Yes, compensatory freshwater habitat will be required to compensate for the loss of freshwater grazing marsh and associated habitats. Compensatory habitat will also be required in areas where the defences are held due to the risk of overtopping with sea level rise.</p>
Impacts on intertidal habitats	<p>2</p> <p>Yes risk of coastal squeeze, until defences are predicted to fail (from year 20). Development of tidal habitats once defences fail will begin to mitigate for coastal squeeze.</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>Yes risk of coastal squeeze, until defences are predicted to fail (from year 20). Development of tidal habitats once defences fail will begin to mitigate for coastal squeeze.</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 risk of coastal squeeze, 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 risk of coastal squeeze as the defences are held.</p>	<p>5</p> <p>Following the creation of the MR site in year 20, the development of intertidal habitat will mitigate against the effects of coastal squeeze.</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>

Impact on SPA/ Ramsar qualifying features	<div>1</div> <p>There may be potential significant effects on the freshwater Swale SPA and its constituent qualifying features due to the intrusion of works into Designated freshwater areas.</p> <p>Where the defences are held coastal squeeze will lead to a loss of intertidal habitat. In the MR site (after year 20) saltmarsh / mudflat habitats will begin to reform, reducing the impacts of coastal squeeze. However at this point, there will be impacts on the designated freshwater habitats and those qualifying feature species that use. This would include duck species to the western end where the area is managed for wildfowling, and other species using the (often over-grazed) grazing marsh for roosting.</p>
Impacts on freshwater habitats	<div>1</div> <p>Yes, compensatory freshwater habitat will be required to compensate for the change of freshwater grazing marsh and associated habitats to intertidal habitats with the creation of the MR sites.</p>
Impacts on intertidal habitats	<div>5</div> <p>Following the creation of the MR site in year 20, the development of intertidal habitat will mitigate against the effects of coastal squeeze.</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 Slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before defences fail. Loss of linear freshwater grazing marsh habitat along the Swale once defences fail, although estuarine habitat connectivity should begin to open up again. As the replacement of the freshwater habitat with intertidal habitat is uncontrolled it means that overall slight negative impacts are predicted.	2 Slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before defences fail. Loss of linear freshwater grazing marsh habitat along the Swale once defences fail, although estuarine habitat connectivity should begin to open up again. As the replacement of the freshwater habitat with intertidal habitat is uncontrolled it means that overall slight negative impacts are predicted.	2 Slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before defences fail. Loss of linear freshwater grazing marsh habitat along the Swale once defences fail, although estuarine habitat connectivity should begin to open up again. The time taken until overtopping is predicted to happen regularly, and the time then for habitats to establish, means that overall slight negative impacts are predicted.	2 Slight negative impact on connectivity due to loss of linear saltmarsh/mudflat habitat from coastal squeeze.	5 Yes, major benefits to habitat connectivity after year 20, once MR triggers the reforming of saltmarsh and mudflat, and compensatory freshwater habitat has become established. The size of the site, the advanced compensation freshwater habitat, and the managed nature of the changes to habitat would mean that connectivity through the SPA would benefit.
SEA (Strategic Environmental Assessment)					
Historic Environment	1 Natural England Coastal Path (Saxon Shore Way) will need roll back following the failure of the defences. Listed buildings at risk once the defences fail in year 20.	2 Natural England Coastal Path (Saxon Shore Way) will need roll back following the failure of the defences. Listed buildings at risk once the defences fail in year 25.	2 Natural England Coastal Path (Saxon Shore Way) will need roll back once the defences overtop regularly with sea level rise. Listed buildings at risk over time with increased risk of overtopping due to sea level rise.	4 Natural England Coastal Path (Saxon Shore Way) and listed buildings at reduced risk from flooding	2 Roll back of Coastal Path required, some listed buildings may still be at risk due to the risk of overtopping of the HTL defences with sea level rise.
Effects on population	1 Potential loss of amenity and agricultural land associated with Grade 1 agricultural land following the failure of the defences	2 Potential loss of amenity and agricultural land associated with Grade 1 agricultural land following the failure of the defences	2 Potential loss of amenity and livelihoods associated with Grade 1 agricultural land. Risk increases over time with increased risk of overtopping due to sea level rise.	5 Improvement of defences provides protection for the population	2 Potential impact on livelihoods associated with loss of agricultural land
Impact on plans/ programmes	1 Proposed development site at imminent risk from flooding following the failure of the defences in year 20	1 Proposed development site at imminent risk from flooding following the failure of the defences in year 25.	2 Proposed development site at risk from flooding over time with increased risk of overtopping due to sea level rise.	5 Proposed development site at reduced risk from flooding	3 MR site unlikely to impact on development sites, but where the defences are help the proposed development site at risk from flooding over time with increased risk of overtopping due to sea level rise.

Habitat Connectivity	<p>5</p> <p>Yes, major benefits to habitat connectivity after year 20, once MR triggers the reforming of saltmarsh and mudflat, and compensatory freshwater habitat has become established.</p> <p>The size of the site, the advanced compensation freshwater habitat, and the managed nature of the changes to habitat would mean that connectivity through the SPA would benefit.</p>
SEA (Strategic Environmental Assessment)	
Historic Environment	<p>4</p> <p>Roll back of Coastal Path required. Listed buildings mostly protected</p>
Effects on population	<p>2</p> <p>Potential impact on livelihoods associated with loss of agricultural land</p>
Impact on plans/ programmes	<p>5</p> <p>Managed realignment unlikely to impact on development sites. Therefore proposed development sites at reduced risk of flooding</p>

Freshwater Biodiversity	2 Loss of SPA and Ramsar habitats once the defences fail. Additionally the Little Murston Nature Reserve (flooded clay pits) are at risk of inundation. Potential impact on aquatic birds that use the site. Also impact on the habitat in the east of the BA. This is grazing marsh which is generally overgrazed and low quality, but still used by birds.	2 Loss of SPA and Ramsar habitats once the defences fail. Additionally the Little Murston Nature Reserve (flooded clay pits) are at risk of inundation. Potential impact on aquatic birds that use the site. Also impact on the habitat in the east of the BA. This is grazing marsh which is generally overgrazed and low quality, but still used by birds.	3 Loss of SPA and Ramsar habitats overtime with the increased risk of overtopping. Additionally the Little Murston Nature Reserve (flooded clay pits) are at risk of inundation overtime. Potential impact on aquatic birds that use the site. Also impact overtime on the habitat in the east of the BA. This is grazing marsh which is generally overgrazed and low quality, but still used by birds.	5 Protection of freshwater habitat with climate change	1 Loss of freshwater habitat at Little Murston Nature Reserve (flooded clay pits) when MR developed. Impacts on habitats for aquatic birds that use the site. In the areas where the defences are held there is still a risk of overtopping over time, with the impacts being similar to the maintain option.
Saline Biodiversity	4 Loss of intertidal habitat resulting from coastal squeeze until the defences fail in year 20. After this there may be the development of new intertidal habitat but this is uncontrolled.	5 Loss of intertidal habitat resulting from coastal squeeze until the defences fail in year 25. After this there may be the development of new intertidal habitat but this is uncontrolled.	1 Loss of intertidal habitat resulting from coastal squeeze, although with sea level rise there may be the increased risk of overtopping which will allow the uncontrolled development of intertidal habitat behind the defences, although this is likely to be poor quality.	1 Loss of intertidal habitat resulting from coastal squeeze as the defences are held.	5 In the areas where the MR site is developed new intertidal habitat will be developed, although this will be at the expense of the freshwater habitat and result in changing the nature of SPA
Soil	1 Degradation of soils once the defences fail (year 20). Potential impact on Grade 1 agricultural soil	2 Degradation of soils once the defences fail (year 25). Potential impact on Grade 1 agricultural soil	2 Degradation over time as the risk of overtopping increases with sea level rise. Potential impact on grade 1 agricultural soils.	5 Soils protected as the defences are improved.	1 Loss of soils in the MR site, and degradation over time of remaining soils as the risk of overtopping increases with sea level rise. Loss of Grade 1 agricultural land in MR site
Groundwater	2 Variable groundwater vulnerability within benefit area however mostly minor aquifer and therefore impacts unlikely. However uncertainties associated with regard to historic landfill sites and MOD sites with the potential for released contaminants once the defences fail in year 20.	3 Variable groundwater vulnerability within benefit area however mostly minor aquifer and therefore impacts unlikely. However uncertainties associated with regard to historic landfill sites and MOD sites with the potential for released contaminants once the defences fail in year 25.	2 Variable groundwater vulnerability within benefit area however mostly minor aquifer and therefore impacts unlikely. However uncertainties associated with regard to historic landfill sites and MOD sites with the potential for released contaminants as the risk of overtopping increases.	3 No impacts to groundwater predicted	2 Groundwater vulnerability is variable within the BA, however mostly minor aquifer and therefore impacts unlikely. A detailed understanding of the links between surface and groundwater would be required to mitigate risks at detailed design stage

Freshwater Biodiversity	<div>2</div> <div>Loss of freshwater habitat at Little Murston Nature Reserve (flooded clay pits) when MR developed. Impacts on habitats for aquatic birds that use the site. In the areas where the defences are held the freshwater habitat is protected against inundation.</div>
Saline Biodiversity	<div>6</div> <div>In the areas where the MR site is developed new intertidal habitat will be developed, although this will be at the expense of the freshwater habitat and result in changing the nature of SPA</div>
Soil	<div>1</div> <div>Loss of soils in the MR site, including Grade 1 agricultural land. Remaining soils protected.</div>
Groundwater	<div>3</div> <div>Groundwater vulnerability is variable within the BA, however mostly minor aquifer and therefore impacts unlikely. A detailed understanding of the links between surface and groundwater would be required to mitigate risks at detailed design stage</div>

Landscape (visual impact)	4 Change but reverting to natural processes once the defences fail in year 20	5 Change but reverting to natural processes once the defences fail in year 25	3 Change overtime as the defences are overtopped, but reverting to natural processes	2 Visual impact increase with increased defence heights	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors.
Carbon Storage	1 Loss of carbon storage once the freshwater habitat is converted to intertidal habitat	2 Loss of carbon storage once the freshwater habitat is converted to intertidal habitat	3 No overall loss or gain	2 Loss of carbon storage from coastal squeeze some carbon cost generation from construction	1 Carbon cost generated from construction
Ecosystem Services					
Qualitative Score from Ecosystem Services Assessment	-63	-63	-39	-4	29
Comments	Major degradation in many ES (e.g. food provision, water flow regulation, natural hazard regulation, water purification, erosion regulation, cultural heritage, recreation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in many ES (e.g. food provision, water flow regulation, natural hazard regulation, water purification, erosion regulation, cultural heritage, recreation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in many ES (e.g. food provision, water flow regulation, natural hazard regulation, water purification, erosion regulation, cultural heritage, recreation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Balance of opportunities for enhancing some ES (e.g. erosion regulation, natural hazard regulation) with risks of degrading some ES (e.g. climate regulation, aesthetic value, fisheries habitat)	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, aesthetic value, recreation and tourism, fishery habitat) outweigh degradation risk in some ES (e.g. food provision, freshwater provision, water purification, conservation 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	Y
3- Reduce maintenance	Y	Y	Y	Y	Y
4 - WFD	N	N	N	N	Y
5 - Local Plans	Y	Y	Y	Y	Y

Landscape (visual impact)	2 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors.
Carbon Storage	1 Carbon cost generated from construction
Ecosystem Services	
Qualitative Score from Ecosystem Services Assessment	38
Comments	Enhancement for many ES (e.g. natural hazard regulation, erosion regulation, recreation and tourism, fishery habitat) outweigh degradation risk in some ES (e.g. food provision, freshwater provision, water purification, conservation habitat)
To what extent does the option meet the objectives?	
1- Reduce Flood Risk	Y
2 - Natura 2000 sites	Y
3- Reduce maintenance	Y
4 - WFD	Y
5 - Local Plans	Y

Environmental Scores					
100 = best option, 0 = worst option					
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments	d) Raise (sustain) embankments	e) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments around rest of frontage.
WFD (Water Framework Directive)					
Compliance assessment outcome	25	25	0	0	75
HRA (Habitats Regulation Assessment)					
Impact on SPA/ Ramsar qualifying features	0	0	0	0	0
Impacts on freshwater habitats	0	0	0	50	0
Impacts on intertidal habitats	25	25	0	0	100
Habitat Connectivity	25	25	25	25	100
SEA (Strategic Environmental Assessment)					
Historic Environment	0	0	25	75	25
Effects on population	0	0	25	100	25
Impact on plans/ programmes	0	0	25	100	50
Freshwater Biodiversity	25	25	50	100	0
Saline Biodiversity	75	75	0	0	100
Soil	0	0	25	100	0
Groundwater	25	25	25	50	25
Landscape (visual impact)	75	75	50	25	0
Carbon Storage	0	0	50	25	0
Total	275	275	300	650	500

Environmental Scores	
100 = best option, 0 = worst option	
Option	f) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments around rest of frontage.
WFD (Water Framework Directive)	
Compliance assessment outcome	75
HRA (Habitats Regulation Assessment)	
Impact on SPA/ Ramsar qualifying features	0
Impacts on freshwater habitats	0
Impacts on intertidal habitats	100
Habitat Connectivity	100
SEA (Strategic Environmental Assessment)	
Historic Environment	75
Effects on population	25
Impact on plans/ programmes	100
Freshwater Biodiversity	25
Saline Biodiversity	100
Soil	0
Groundwater	50
Landscape (visual impact)	25
Carbon Storage	0
Total	675

Summary of Results					
Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments	d) Raise (sustain) embankments	e) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments around rest of frontage.
Costs	£ -	£ 261,000	£ 12,934,761	£ 27,821,469	£ 12,518,381
Benefits	£ -	£ 532,000	£ 2,113,072	£ 6,025,416	£ 2,775,504
NPV	£ -	£ 271,000	-£ 10,821,689	-£ 21,796,053	-£ 9,742,877
BCR	0.0	2.0	0.2	0.2	0.2
Environmental Scoring	275	275	300	650	500

Summary of Results	
Option	f) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments around rest of frontage.
Costs	£ 16,271,782
Benefits	£ 4,827,511
NPV	-£ 11,444,271
BCR	0.3
Environmental Scoring	675

Preferred Option Decision Making		
DLO	Leading Option at DLO Stage	Justification for Leading Option
DLO1 - Economic Assessment	Do minimum option -ongoing maintenance until Year 25, followed by NAI.	The current defences have a 25 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	Maintain embankments and upgrade SoP with sea level rise in year 50.	The current defences have a 25 year residual life. Following this, the cost to compensate the large area of freshwater habitat is much greater than the cost to maintain the defences with sea level rise. Therefore it is more cost-effective to maintain the defences and raise with sea level rise.
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name
Maintain embankments and upgrade SOP with sea level rise in year 50.

Preferred Option
Maintenance (with capital works) of the current defences, and raise in year 50, to maintain a minimum SoP of 0.5%AEP protection with sea level rise (which is the current SoP offered).

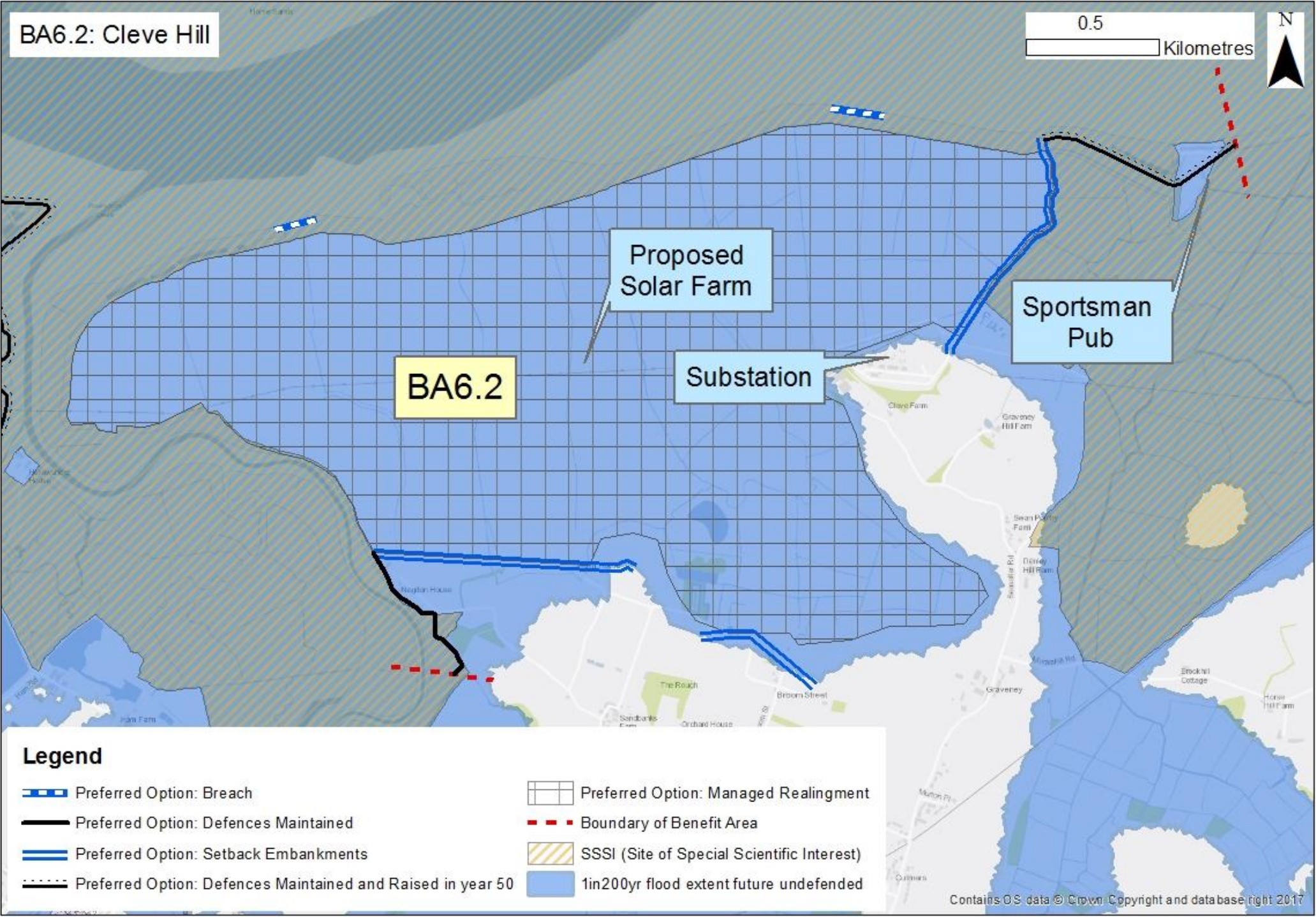
Justification
<p>Do minimum option is the only one with a BCR above 1. However, an option to raise the height of the defences with sea level rise is required as part of the legal obligations to cause no net loss of the designated freshwater habitat</p> <p>The current defences have a 25-year residual life. Following this, the cost to compensate the large area of freshwater habitat is much greater than the cost to maintain the defences with sea level rise. Therefore, it is more cost-effective to maintain the defences and raise with sea level rise. The defences are required to be raised with sea level rise as otherwise the frequency of inundation to the freshwater habitat would increase with sea level rise and compensation for this would be required in year 50.</p>

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

Impacts on freshwater designated habitat					
Ramsar and SPA habitat at risk from Year 21. Cost effectiveness analysis shows preferred management approach: Maintain defences and raise crest level in line with sea level rise to maintain current standard of protection					
	<table><tr><td>Cost of providing compensation for impacts</td><td>Cost of holding the line with SLR</td></tr><tr><td>£ 20,227,570</td><td>£ 14,282,659</td></tr></table>	Cost of providing compensation for impacts	Cost of holding the line with SLR	£ 20,227,570	£ 14,282,659
Cost of providing compensation for impacts	Cost of holding the line with SLR				
£ 20,227,570	£ 14,282,659				

Benefit Area Name	6 - Swale Mainland
Benefit Unit Name	6.2 - Faversham Creek to The Sportsman Pub - MR site covers the whole of Cleve Hill (Site 27)
Frontage Length	6.9 km
Defence Structure Type	Wall, Embankment and Beach
Min Standard of Protection (AEP%)	0.005
Residual Life (years)	20

	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 SMP suggests HTL for the first epoch. Then MR afterward. However the exact timing of the MR may vary.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	28	32	33	35
Commercial & Industrial	12	12	12	13
Agricultural (Ha)	562	579	583	599
Key Infrastructure	Seasalter Road, Railway between Faversham and Whitstable	Seasalter Road, Railway between Faversham and Whitstable, Graveney Landfill Historic Landfill (inert)	Seasalter Road, Railway between Faversham and Whitstable, Graveney Landfill Historic Landfill (inert)	Seasalter Road, Railway between Faversham and Whitstable, Graveney Landfill Historic Landfill (inert)
Social and Environmental Considerations	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward), South Bank of The Swale LNR (seaward and landward), Nagden Marshes, Sportsman Pub	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward), South Bank of The Swale LNR (seaward and landward), Nagden Marshes, Sportsman Pub	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward), South Bank of The Swale LNR (seaward and landward), Nagden Marshes, Sportsman Pub	Natural England Coastal Path (Saxon Shore Way), The Swale SPA and SSSI (seaward), South Bank of The Swale LNR (seaward and landward), Nagden Marshes, Sportsman Pub

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- wall currently present
	Maintain wall	Y	Take forward- wall currently present
	Raise wall (sustain)	Y	Take forward- wall currently present
	Raise wall (upgrade)	Y	Take forward- wall currently present
	Maintain rock revetment	N	Exclude - no revetment currently present
	Construct rock revetment	N	Exclude - limited benefits in constructing a revetment where embankments and walls are currently present and will not significantly reduce flood risk. Also the foreshore is mudflat/
	Install demountable defences	N	Exclude - relatively costly option which is not the most efficient use of FDGiA funding compared to sustaining existing defences. It would require significant man resources to
	Install temporary defences	N	Exclude - significant resources to implement and potentially not the most efficient use of FDGiA funding compared to sustaining existing defences. This would need to be discussed with asset owners at OBC stage.
	Beach recharge (sand or shingle)	N	Exclude - the foreshore is mudflat/ saltmarsh and so technically unviable and potentially environmentally damaging in SPA habitat
	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 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	Y	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 (min SOP= 200 and RL=20)	Y = high SOP and residual life of the defences. Suggest as Do Minimum	N = high SOP and residual life of the defences	Y = high SOP, but possible to increase with sea level rise	N = High SOP so no need to upgrade.

Long List of Options (continued)				
	f) Construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments and walls at the Sportsman Pub.	g) Construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments at the Sportsman Pub.	h) Construct new setback embankments at identified managed realignment sites. Raise (upgrade SOP) existing embankments at the Sportsman Pub.	i) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain SOP of existing embankments and walls.
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	Y	Y	Y	Y
2 - Natura 2000 sites	Y	Y	Y	Y
3- Reduce maintenance	Y*	Y*	Y*	Y*
4 - WFD	TBC	TBC	TBC	TBC
5 - Local Plans	-	-	-	-
Comment and decision on whether taken forward to shortlist	Y = high SOP and residual life of the defences but capital maintenance will help extend the lifetime of the defences. MR to be investigated in the first epoch to help provide inter-tidal objective (Obj 2).	Y = high SOP and residual life of the defences but capital maintenance will help extend the lifetime of the defences. MR to be investigated in the first epoch to help provide inter-tidal objective (Obj 2).	N = high SOP therefore no need to upgrade.	Y = high SOP and residual life of the defences but capital maintenance will help extend the lifetime of the defences

Long List of Options (continued)		
	j) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain SOP) existing embankments at the Sportsman Pub.	k) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (upgrade SOP) existing embankments at the Sportsman Pub.
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	TBC	TBC
5 - Local Plans	-	-
Comment and decision on whether taken forward to shortlist	Y = high SOP, but possible to increase with sea level rise	N = high SOP therefore no need to upgrade.

* Assumed that the MR sites will have natural topography

Short List of Options	
a)	Do nothing
b)	Do minimum
c)	Raise (sustain) embankments and walls
d)	Construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub.
e)	Construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub.
f)	Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub.
g)	Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub.

Assessment of Short List				
Option	a) Do nothing	b) Do minimum	c) Raise (sustain) embankments and walls	d) Construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)
Description	Used as an economic baseline to compare the other options against.	Patch repair to maintain the current defences	Capital works are undertaken to improve the current defences	Development of MR site. Capital works undertaken on remaining defences to maintain the current defences
Technical Issue	Defences have 20 years residual life. Graveney Landfill Historic Landfill (inert) potentially at risk. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	Current defences have 20 years residual life. Graveney Landfill Historic Landfill (inert) potentially at risk. Potential for coastal squeeze, therefore compensatory intertidal habitat will need to be created elsewhere.	Current defences have 20 years residual life. Graveney Landfill Historic Landfill (inert) potentially at risk. 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. The MR site ties back into high ground. The site is not internationally designated so no compensatory habitat legally required. Based on current sea levels the MR site would create 203ha of saltmarsh and 213ha of mudflat. With 100 years sea level rise there could be 28ha of saltmarsh and 394ha of mudflat. Impacts on Graveney Landfill Historic Landfill (inert) will need to be considered.
Assumptions/ Uncertainties	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.	MR site to provide at least 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.
SOP Provided (% AEP)	>50%	1%	0.5%	2.0%

Assessment of Short List			
Option	e) Construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)	f) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)	g) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)
Description	Development of MR site. Capital works undertaken to improve the remaining defences	Development of MR site in year 20, maintenance of the defences until then. Capital works undertaken on remaining defences to maintain the current defences	Development of MR site in year 20, maintenance of the defences until then. Capital works undertaken on remaining defences to maintain the current defences
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>The MR site ties back into high ground.</p> <p>The site is not internationally designated so no compensatory habitat legally required.</p> <p>Based on current sea levels the MR site would create 203ha of saltmarsh and 213ha of mudflat. With 100 years sea level rise there could be 28ha of saltmarsh and 395ha of mudflat.</p> <p>Impacts on Graveney Landfill Historic Landfill (inert) will need to be considered at the next stage.</p>	<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>The MR site ties back into high ground.</p> <p>The site is not internationally designated so no compensatory habitat legally required.</p> <p>Based on current sea levels the MR site would create 203ha of saltmarsh and 213ha of mudflat. With 100 years sea level rise there could be 28ha of saltmarsh and 395ha of mudflat.</p> <p>Impacts on Graveney Landfill Historic Landfill (inert) will need to be considered at the next stage.</p>	<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>The MR site ties back into high ground.</p> <p>The site is not internationally designated so no compensatory habitat legally required.</p> <p>Based on current sea levels the MR site would create 203ha of saltmarsh and 213ha of mudflat. With 100 years sea level rise there could be 28ha of saltmarsh and 394ha of mudflat.</p> <p>Impacts on Graveney Landfill Historic Landfill (inert) will need to be considered at the next stage.</p>
Assumptions/ Uncertainties	MR site to provide at least 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.	Defences to be maintained until year 20. MR site to be constructed in year 20 to provide at least 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.	Defences to be maintained until year 20. MR site to be constructed in year 20 to provide at least 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.
SOP Provided (% AEP)	2%	2.0%	2.0%

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Value of Economics			
PV Capital Costs	£ 13,181,881	£ 7,135,650	£ 7,120,710
PV Maintenance Costs	£ 240,534	£ 196,260	£ 195,762
PV Other Costs	£ 588,533	£ 324,478	£ 319,355
Total Cost (including Optimism Bias) (PV)	£ 22,417,517	£ 12,250,220	£ 12,217,324
Value of Benefits	£ 3,449,654	£ 3,389,756	£ 3,400,042
Benefit Cost Ratio (BCR)	0.2	0.3	0.3
PF Score	95%	174%	174%
Further funding required to achieve 100% PF Score	£ 1,146,807	£ -	£ -
Flood/ erosion impacts			
Number of Residential Properties at risk under 0.1% AEP	0	5	0
Number of Commercial properties at risk under 0.1% AEP	37	38	37
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 10,057	£ 20,342	£ 10,057
Critical Infrastructure	No assets at risk	Infrastructure at risk over time	Infrastructure protected
PV Value of Impacts on road and rail	-	-	-
PV Value of Tourism and Recreation Impacts	-	-	-
PV Value of Agriculture Impacts	0 Cost of agricultural land included in the option cost	0 Cost of agricultural land included in the option cost	0 Cost of agricultural land included in the option cost
Stakeholders Feedback			
Statutory Stakeholders/ SEG	Members of the SEG believe that MR in this area could be beneficial as the site is not designated	Members of the SEG believe that MR in this area could be beneficial as the site is not designated	Members of the SEG believe that MR in this area could be beneficial as the site is not designated
Landowners	Landowner is a business man. Willing to sell the land, however there are other potential business opportunities on the land which may prove to be more profitable.	Landowner is a business man. Willing to sell the land, however there are other potential business opportunities on the land which may prove to be more profitable. The phased approach could allow both opportunities to be undertaken	Landowner is a business man. Willing to sell the land, however there are other potential business opportunities on the land which may prove to be more profitable. The phased approach could allow both opportunities to be undertaken
Technical Feasibility			
Site Specific	Approx. 80% flooded on the modelled Spring tide. Potentially 1,334m decrease in defences length due to setback of defence line MR site would create 202.7ha of saltmarsh and 212.9ha of mudflat. With 100 years sea level rise there could be 27.6ha of saltmarsh and 394.1ha of mudflat.	Approx. 80% flooded on the modelled Spring tide. Potentially 1,334m decrease in defences length due to setback of defence line. MR site would create 202.7ha of saltmarsh and 212.9ha of mudflat. With 100 years sea level rise there could be 27.6ha of saltmarsh and 394.1ha of mudflat.	Approx. 80% flooded on the modelled Spring tide. Potentially 1,334m decrease in defences length due to setback of defence line. MR site would create 202.7ha of saltmarsh and 212.9ha of mudflat. With 100 years sea level rise there could be 27.6ha of saltmarsh and 394.1ha of mudflat.

Strategy Wide	n/a	n/a	n/a	Sites are completely flooded during extreme events. An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.
WFD (Water Framework Directive)				
Compliance assessment outcome	2 Some return to natural processes but uncontrolled	1 Heavily Modified Water Body (HMWB) maintained	1 Heavily Modified Water Body (HMWB) maintained	4 Some return to natural processes
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze until the defences fail in year 20. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat until at least yr. 20 when failing defences will allow estuarine habitats to begin to form. The loss of saltmarsh and mudflat habitats is likely to impact on populations of waders and wildfowl.	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat. However with sea level rise the risk of overtopping will increase which will allow estuarine habitats to begin to form behind the defences. The loss of saltmarsh and mudflat habitats is likely to impact on populations of waders and wildfowl.	1 There are potential significant effects on the intertidal Swale SPA and constituent qualifying features due to coastal squeeze. Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat. The loss of saltmarsh and mudflat habitats is likely to impact on populations of waders and wildfowl.	2 There may be potential significant effects on the Swale SPA and its constituent qualifying features due to coastal squeeze. However this is likely to be reduced by the development of a MR site across the majority of the BA.
Impacts on freshwater habitats	3 n/a - no designated freshwater sites in the BA	3 n/a - no designated freshwater sites in the BA	3 n/a - no designated freshwater sites in the BA	3 n/a - no designated freshwater sites in the BA
Impacts on intertidal habitats	2 Coastal squeeze until defences are predicted to fail (from year 20). Development of tidal habitats once defences fail will begin to mitigate for coastal squeeze. 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 Coastal squeeze, but with sea level rise the risk of overtopping will increase overtime. This may allow the creation of new intertidal habitat behind the 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 Defences improved so risk of coastal squeeze.	5 The development of 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.

Strategy Wide	<p>Sites are completely flooded during extreme events.</p> <p>An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.</p>	<p>Sites are completely flooded during extreme events.</p> <p>An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.</p>	<p>Sites are completely flooded during extreme events.</p> <p>An increase in the flood risk in the central Swale during extreme events is however observed when this sites are breached. This effect is not desirable.</p>
WFD (Water Framework Directive)			
Compliance assessment outcome	<p>4</p> <p>Some return to natural processes</p>	<p>4</p> <p>Some return to natural processes</p>	<p>4</p> <p>Some return to natural processes</p>
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	<p>2</p> <p>There may be potential significant effects on the Swale SPA and its constituent qualifying features due to coastal squeeze. However this is likely to be reduced by the development of a MR site across the majority of the BA.</p>	<p>2</p> <p>There may be potential significant effects on the Swale SPA and its constituent qualifying features due to coastal squeeze until year 20 when the MR site is developed. Once the MR site is developed the impacts will be reduced.</p> <p>Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat.</p> <p>The loss of saltmarsh and mudflat habitats is likely to impact on populations of waders and wildfowl.</p>	<p>2</p> <p>There may be potential significant effects on the Swale SPA and its constituent qualifying features due to coastal squeeze until year 20 when the MR site is developed. Once the MR site is developed the impacts will be reduced.</p> <p>Coastal squeeze will lead to a loss of saltmarsh and mudflat habitat.</p> <p>The loss of saltmarsh and mudflat habitats is likely to impact on populations of waders and wildfowl.</p>
Impacts on freshwater habitats	<p>3</p> <p>n/a - no designated freshwater sites in the BA</p>	<p>3</p> <p>n/a - no designated freshwater sites in the BA</p>	<p>3</p> <p>n/a - no designated freshwater sites in the BA</p>
Impacts on intertidal habitats	<p>5</p> <p>The development of 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>The development of 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>The development of 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 Slight negative impact on connectivity of saltmarsh/mudflat habitats due to loss of habitat from coastal squeeze before defences fail.	2 Slight negative impact on connectivity of saltmarsh/mudflat habitats. This might be mitigated slightly overtime with the overtopping of the defences but this is uncontrolled.	2 Slight negative impact on connectivity due to loss of habitat from coastal squeeze, with loss of linear saltmarsh/mudflat habitat.	4 Yes, over time, the created habitats should serve to maintain habitat connectivity across the estuary and the SPA, although the location at the edge of the estuary and SPA area is noted.
SEA (Strategic Environmental Assessment)				
Historic Environment	1 One listed building at risk following the failure of the defences in year 20	2 One listed building at risk overtime with increased risk of overtopping due to sea level rise.	5 Reduced flood risk to listed building	5 Reduced flood risk to listed building
Effects on population	1 Loss of amenity and minor infrastructure following the failure of the defences in year 20	2 Loss of amenity and minor infrastructure over time with increased risk of overtopping due to sea level rise.	5 Reduced risk to loss of amenity due to flooding	5 Reduced risk to loss of amenity due to 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	2 Loss of freshwater habitat following the failure of the defences in year 20 important overwintering habitat for Brent Geese	3 Change of freshwater habitat from intermittent overtopping, due to sea level rise, unlikely to affect overwintering populations	5 Reduced risk of saline intrusion	2 Loss of freshwater habitat - Cleeve Hill is important site for overwintering birds however it is considered by Natural England that overwintering populations could move elsewhere.
Saline Biodiversity	2 Loss of SPA and Ramsar from coastal squeeze until defences fail in year 20	2 Loss of SPA and Ramsar from coastal squeeze	1 Loss of SPA and Ramsar from coastal squeeze	5 Gain in intertidal habitat
Soil	1 Degradation of agricultural land once the defences fail (includes Grade 1 agricultural land).	2 Gradual degradation of agricultural land as the risk of overtopping increases with sea level rise (includes Grade 1 agricultural land)	5 Reduced risk of degradation to agricultural land from saline intrusion	1 Loss of agricultural land due to managed realignment
Groundwater	3 No impacts predicted	3 No impacts predicted	3 No impacts predicted	3 No impacts predicted
Landscape (visual impact)	4 Change but reverting to natural processes	3 Gradual change but reverting to natural processes	2 Some visual impact arising from increased defence heights	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but reverting to natural processes

Habitat Connectivity	4 Yes, over time, the created habitats should serve to maintain habitat connectivity across the estuary and the SPA, although the location at the edge of the estuary and SPA area is noted.	4 Yes, over time, the created habitats should serve to maintain habitat connectivity across the estuary and the SPA, although the location at the edge of the estuary and SPA area is noted.	4 Yes, over time, the created habitats should serve to maintain habitat connectivity across the estuary and the SPA, although the location at the edge of the estuary and SPA area is noted.
SEA (Strategic Environmental Assessment)			
Historic Environment	5 Reduced flood risk to listed building	5 Reduced flood risk to listed building	5 Reduced flood risk to listed building
Effects on population	5 Reduced risk to loss of amenity due to flooding	5 Reduced risk to loss of amenity due to flooding	5 Reduced risk to loss of amenity due to 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
Freshwater Biodiversity	2 Loss of freshwater habitat - Cleeve Hill is important site for overwintering birds however it is considered by Natural England that overwintering populations could move elsewhere.	2 Loss of freshwater habitat - Cleeve Hill is important site for overwintering birds however it is considered by Natural England that overwintering populations could move elsewhere.	2 Loss of freshwater habitat - Cleeve Hill is important site for overwintering birds however it is considered by Natural England that overwintering populations could move elsewhere.
Saline Biodiversity	5 Gain in intertidal habitat	5 Gain in intertidal habitat	5 Gain in intertidal habitat
Soil	1 Loss of agricultural land due to managed realignment	1 Loss of agricultural land due to managed realignment	1 Loss of agricultural land due to managed realignment
Groundwater	3 No impacts predicted	3 No impacts predicted	3 No impacts predicted
Landscape (visual impact)	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but reverting to natural processes	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but reverting to natural processes	1 Significant landscape change from managed realignment. Positive/negative effects depending on view and visual receptors, but reverting to natural processes

Carbon Storage	4 Some loss of carbon storage through loss of saltmarsh until the defences fail.	3 Some loss of carbon storage through loss of saltmarsh, but there may be the development of intertidal habitat overtime as the risk of overtopping increases.	2 Some loss of carbon storage through loss of saltmarsh due to coastal squeeze	1 Carbon cost from construction due to realignment
Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-41	-26	-9	18
Comments	Major degradation in many ES (e.g. climate regulation, water regulation, natural hazard regulation, erosion regulation, conservation habitat) outweigh limited enhancement opportunities (e.g. fishery habitats)	Degradation in many ES (e.g. natural hazard regulation and erosion regulation) outweigh limited enhancement opportunities (e.g. fishery habitat)	Degradation in various ES (e.g. climate regulation, fisheries, conservation habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation and erosion regulation)	Enhancements in some ES (e.g. natural hazard regulation, habitat conservation and fishery habitat) outweigh the degradation risk in various ES (e.g. food, freshwater, climate 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	Y
3- Reduce maintenance	Y	N	Y	Y
4 - WFD	N	N	N	Y
5 - Local Plans	Y	Y	Y	Y

Carbon Storage	1 Carbon cost from construction due to realignment	1 Carbon cost from construction due to realignment	1 Carbon cost from construction due to realignment
Ecosystem Services			
Qualitative Score from Ecosystem Services Assessment	27	18	28
Comments	Enhancement in various ES (e.g. natural hazard regulation, erosion regulation, habitat conservation and fishery habitat) outweigh the degradation risk in some ES (e.g. food and freshwater)	Enhancements in some ES (e.g. natural hazard regulation, habitat conservation and fishery habitat) outweigh the degradation risk in some ES (e.g. food, freshwater and climate regulation)	Enhancement in various ES (e.g. natural hazard regulation, erosion regulation, habitat conservation and fishery habitat) outweigh the degradation risk in some ES (e.g. food, climate regulation and water regulation)
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) Raise (sustain) embankments and walls	d) Construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)
WFD (Water Framework Directive)				
Compliance assessment outcome	25	0	0	75
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	0	0	0	25
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	25	25	0	100
Habitat Connectivity	25	25	25	75
SEA (Strategic Environmental Assessment)				
Historic Environment	0	25	100	100
Effects on population	0	25	100	100
Impact on plans/ programmes	50	50	50	50
Freshwater Biodiversity	25	50	100	25
Saline Biodiversity	25	25	0	100
Soil	0	25	100	0
Groundwater	50	50	50	50
Landscape (visual impact)	75	50	25	0
Carbon Storage	75	50	25	0
Total	425	450	625	750

Environmental Scores			
100 = best option, 0 = worst option			
Option	e) Construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)	f) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)	g) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)
WFD (Water Framework Directive)			
Compliance assessment outcome	75	75	75
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	25	25	25
Impacts on freshwater habitats	50	50	50
Impacts on intertidal habitats	100	100	100
Habitat Connectivity	75	75	75
SEA (Strategic Environmental Assessment)			
Historic Environment	100	100	100
Effects on population	100	100	100
Impact on plans/ programmes	50	50	50
Freshwater Biodiversity	25	25	25
Saline Biodiversity	100	100	100
Soil	0	0	0
Groundwater	50	50	50
Landscape (visual impact)	0	0	0
Carbon Storage	0	0	0
Total	750	750	750

Summary of Results				
Option	a) Do nothing	b) Do minimum	c) Raise (sustain) embankments and walls	d) Construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)
Costs	£ -	£ 747,779	£ 12,785,669	£ 14,295,217
Benefits	£ -	£ 3,114,824	£ 3,131,267	£ 3,439,369
NPV	£ -	£ 2,367,045	-£ 9,654,402	-£ 10,855,848
BCR	0.0	4.2	0.2	0.2
Environmental Scoring	425	450	625	750

Summary of Results			
Option	e) Construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)	f) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Maintain embankments and walls at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)	g) Maintain embankments until year 20. Then construct new setback embankments at identified managed realignment sites. Raise (sustain) embankments at the Sportsman Pub. MR site covers the whole of Cleve Hill (Site 27)
Costs	£ 22,417,517	£ 12,250,220	£ 12,217,324
Benefits	£ 3,449,654	£ 3,389,756	£ 3,400,042
NPV	-£ 18,967,863	-£ 8,860,464	-£ 8,817,282
BCR	0.2	0.3	0.3
Environmental Scoring	750	750	750

Preferred Option Name
Ongoing maintenance until year 20. Then construct new setback embankments at Cleve Hill managed realignment site. Maintain embankments and walls either side and at the Sportsman Pub.

Preferred Option
<p>The Cleve Hill MR site will be developed in year 20 to mitigate against the strategy wide impacts of coastal squeeze in the second epoch. The defences either side of the MR site will be maintained (capital), apart from the section of defences fronting the freshwater SPA habitat at the Sportsman Pub, where the defences will be raised in year 50 to continue to provide the same SoP with sea level rise (50%AEP) to the freshwater designated habitat.</p> <p>There are potential risks associated with the interaction with the electricity pylons and overhead lines for the MR site and this will need to be a careful consideration for the design stage.</p>

Justification
<p>Ongoing maintenance is the only short listed option with a BCR above 1 and a positive NPV. MR site at Cleve Hill is required to help compensate for coastal squeeze across the Strategy in the second epoch. The justification for the MR site is related to the Strategy wide requirement for coastal squeeze compensation. The defences will be raised in line with sea level rise near the Sportsman Pub as the cost to compensate the freshwater habitat is much greater than the cost to maintain the defences with sea level rise. This is justified through a cost effectiveness analysis.</p>

Preferred Option Costs			
Cost	Benefits	BCR	PF Score
£ 781	£ 3,389,756	4.3	8%

Managed Realignment	
Managed Realignment site proposed at Cleve Hill in Year 20	
PV Cost	Hectares of saltmarsh created
£ 11,777,907	202.7 ha

Impacts on freshwater designated habitat			
Ramsar and SPA habitat at risk from Year 20. Cost effectiveness analysis shows preferred management approach: Provide compensation by year 25.			
Cost of providing compensation for impacts		Cost of holding the line with SLR	
£	1,443,614	£	912,780