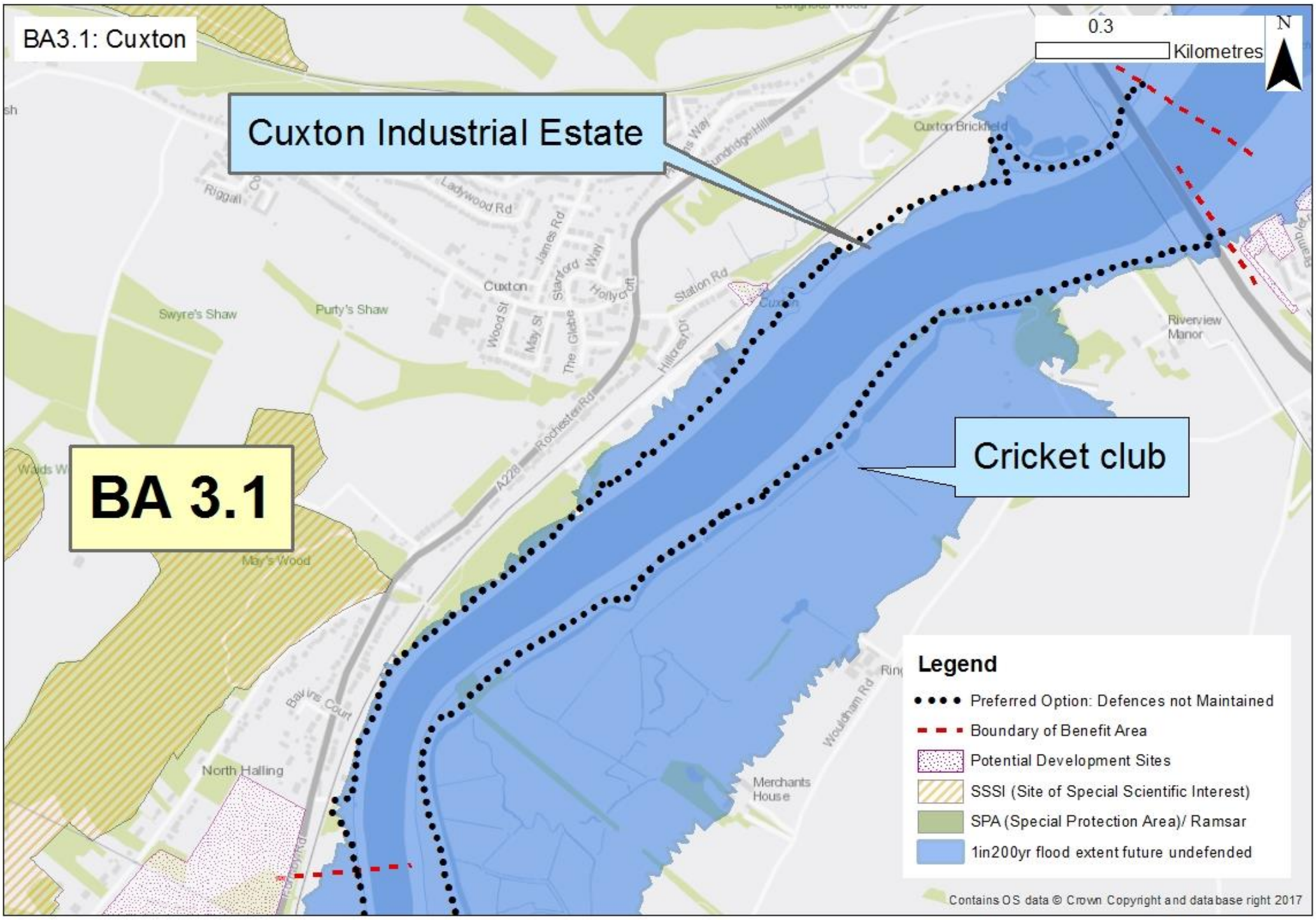
Benefit Area Name	3 - Upper Medway
Benefit Unit Name	3.1 - Medway Bridge to North Halling
Frontage Length	2.7 km
Defence Structure Type	Embankments, concrete wall, raised embankments, rock revetment
Min Standard of Protection (AEP%)	0.5
Residual Life (years)	20

	0-20 years	**20-50 years**	**50-100 years**
SMP Policy	HTL	HTL	HTL
Aiming to comply with policy	Agree with SMP		
Comment	Agree with SMP: HTL for all epochs due to assets at risk – namely railway, road and residential/commercial properties.		



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	1
Commercial & Industrial	1	10	11	13
Agricultural (Ha)	5	5	5	6
Key Infrastructure	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations
Social and Environmental Considerations	None	None	None	None

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 embankment, wall and flood gates	c) Maintain SOP (capital) embankments, walls and revetments	d) Raise (sustain SOP) embankments, walls and revetments	e) Raise (upgrade SOP) embankments, walls and revetments
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. Low residual life and SoP of defences so defences would not last for full 100 years.	Y= as baseline. Following year 25 a Don nothing scenario would occur due to failure of the defences.	Y= defences require capital maintenance. Existing defence SOP and residual life low.	Y= Existing defence variable and could be increased with sea level rise.	N= current defences are low but land elevation increases so few assets at immediate risk.

Long List of Options			
	f) Construct new setback embankment at identified managed realignment sites. Maintain SOP (capital) of existing embankments, walls and revetments around other areas.	g) Construct new setback embankment at identified managed realignment sites. Raise (sustain SOP) of existing embankments, walls and revetments around other areas.	h) Construct new setback embankment at identified managed realignment sites. Raise (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	TBC	TBC	TBC
Comment and decision on whether taken forward to shortlist	Y= defences require capital maintenance. Concern was raised over the MR site at Medway Bridge, however it wall remain in the shortlist to help address the requirements to compensate against coastal squeeze.	Y = Improvements required to defences with very low SOP and residual life to protect assets with sea level rise. Concern was raised over the MR site at Medway Bridge, however it wall remain in the shortlist to help address the requirements to compensate against coastal squeeze.	N= current defences are low but land elevation increases so few assets at immediate risk.

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

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

*This MR option was screened out following consultation with environmental stakeholders

Assessment of Short List				
Option	**a) Do nothing**	**b) Do minimum**	**b) Maintain (capital) embankments, walls and revetments**	**c) Raise (sustain) embankments, walls and revetments**
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.	Defences have 20 years residual life.	Defences have 20 years residual life.	Defences have 20 years residual life.
Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 25	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.	The SOP provided by the defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This option will maintain the required SOP provided by the defences by keeping pace with sea level rise.
SOP Provided (% AEP)	>50%	>50%	50%	0.5%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 1,398,430	£ 2,997,601
PV Maintenance Costs	£ -	£ 137,500	£ 244,014	£ 322,762
PV Other Costs	£ -	£ -	£ 173,317	£ 340,822
Total Cost (including Optimism Bias) (PV)	£ -	£ 220,000	£ 2,905,217	£ 5,857,894
Value of Benefits	£ -	£ 1,103	£ 3,141	£ 673,376
Benefit Cost Ratio (BCR)	0.0	0.0	0.0	0.1
PF Score	0%	0%	0%	1%
Further funding required to achieve 100% PF	£ -	£ 220,000	£ 2,903,201	£ 5,825,785
Flood/ erosion impacts				
Number of Residential Properties at risk under	1	1	1	1
Number of Commercial properties at risk under	12	12	12	1
PV Value of Properties (Total including AAD,	£ 745,665	£ 745,475	£ 747,189	£ 96,369
Critical Infrastructure	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations	Railway line at risk (toe of embankment floods) but currently not included in benefit calculations
PV Value of Impacts on road and rail	-	-	-	-
PV Value of Tourism and Recreation Impacts	-	-	-	-
PV Value of Agriculture Impacts	£26,196 Worst case scenario 5ha of Grade 3 agricultural land flooded and 1ha of Grade 4 flooded	£25,282 Worst case scenario 5ha of Grade 3 agricultural land flooded and 1ha of Grade 4 flooded	£21,531 Worst case scenario 5ha of Grade 3 agricultural land flooded and 1ha of Grade 4 flooded	£2,115 Worst case scenario 0.2ha of Grade 3 agricultural land flooded and 1ha of Grade 4 flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments	No specific comments
Landowners	No specific comments	No specific comments	No specific comments	No specific comments
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 deterioration of HMWB but uncontrolled	2 Some deterioration of HMWB 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	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
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 Property, essential infrastructure and jobs at risk from flooding once the defences fail in year 20	1 Property, essential infrastructure and jobs at risk from flooding once the defences fail in year 25	2 Property, essential infrastructure and jobs at risk from flooding over time due to increased risk of overtopping with sea level rise.	5 Property, essential infrastructure and jobs at reduced risk from flooding due to improvement to defences.
Impact on plans/ programmes	1 Proposed development sites potentially at risk from flooding once the defences fail in year 20	1 Proposed development sites potentially at risk from flooding once the defences fail in year 25	2 Proposed development site potentially at risk from flooding over time with increased risk of overtopping due to sea level rise	4 Potential development sites within the benefit area at reduced risk from flooding
Freshwater Biodiversity	1 Impact on freshwater habitat and associated species as defences at risk of failure from year 20. SSSI on other side of River so effects on SSSI would be minimal, however the agricultural land does provide habitat for waders and provides connectivity and additional habitat for birds using the SSSI	1 Impact on freshwater habitat and associated species as defences at risk of failure from year 25. SSSI on other side of River so effects on SSSI would be minimal, however the agricultural land does provide habitat for waders and provides connectivity and additional habitat for birds using the SSSI	2 Gradual impact on the freshwater habitat and associated species from overtopping.	5 Reduced impact on freshwater habitat and associated species as the defences are improved.
Saline Biodiversity	4 Potential for intertidal habitat creation once the defences fail	4 Potential for intertidal habitat creation once the defences fail	3 Potential for gradual intertidal habitat creation due to overtopping of the defences with sea level rise	2 Defences improved so no opportunity for intertidal habitat creation
Soil	1 Degradation of soils following the failure of defences	1 Degradation of soils following the failure of defences	2 Degradation of soils over time	3 No impact
Groundwater	1 Risk to groundwater once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks.	1 Risk to groundwater once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks.	2 Potential impacts on groundwater over time as risk of overtopping increases with sea level rise.	4 Groundwater at reduced risk.
Landscape (visual impact)	4 Change after the defences fail but reverting to natural processes is assumed a benefit	4 Change after the defences fail but reverting to natural processes is assumed a benefit	3 Very gradual change as the risk of overtopping increases with sea level rise	3 Incremental change as the height of the wall is increased in phases

Carbon Storage	2 Once the defences fail (year 20) there will be a loss of carbon storage in marshland as it is converted to mudflat	2 Once the defences fail (year 25) there will be a loss of carbon storage in marshland as it is converted to mudflat	3 Gradual loss of carbon storage in marshland, as the risk of overtopping increases with sea level rise and converts marshland to mudflat	1 Loss of carbon storage in marshland as it is converted to mudflat. Carbon cost from construction
Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-17	-17	-19	-6
Comments	Degradation in many ES (e.g. natural hazard regulation, erosion regulation, tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in many ES (e.g. natural hazard regulation, erosion regulation, tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in many ES (e.g. natural hazard regulation, erosion regulation, tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in some ES (e.g. genetic resources, climate regulation, fishery habitat) slightly 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	Y	Y

Environmental Scores				
100 = best option, 0 = worst option				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and revetments (Do minimum)**	**d) Raise (sustain) embankments, walls and revetments**
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	50	50	50	50
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	50	50	50	50
Habitat Connectivity	50	50	50	50
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	0	0	25	50
Impact on plans/ programmes	0	0	25	75
Freshwater Biodiversity	0	0	25	100
Saline Biodiversity	75	75	50	25
Soil	0	0	25	50
Groundwater	0	0	25	75
Landscape (visual impact)	75	75	50	50
Carbon Storage	25	25	50	0
Total	**450**	**450**	**525**	**675**

Summary of Results				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and revetments (Do minimum)**	**d) Raise (sustain) embankments, walls and revetments**
Costs	£ -	£ 220,000	£ 2,905,217	£ 5,857,894
Benefits	£ -	£ 1,103	£ 3,141	£ 673,376
NPV	£ -	-£ 218,897	-£ 2,902,076	-£ 5,184,518
BCR	0.0	0.0	0.0	0.1
Environmental Scoring	450	450	525	675

Preferred Option Decision Making		
DLO	**Leading Option at DLO Stage**	**Justification for Leading Option**
DLO1 - Economic Assessment	No Active Intervention (NAI)	The BCR is less than one for all the options, so there is no economically viable option.
DLO2 - Economic Sensitivities		
DLO3 - Review of Compensatory Intertidal Habitat Requirements		
DLO4 - Review of Compensatory Freshwater Habitat Requirements		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name

No Active Intervention (NAI).

Preferred Option

All maintenance will be ceased and the current defences will not be maintained. There will be an increased risk of overtopping and the defences will be at risk from failure from year 20 causing increased risk of overflow flooding.

Justification

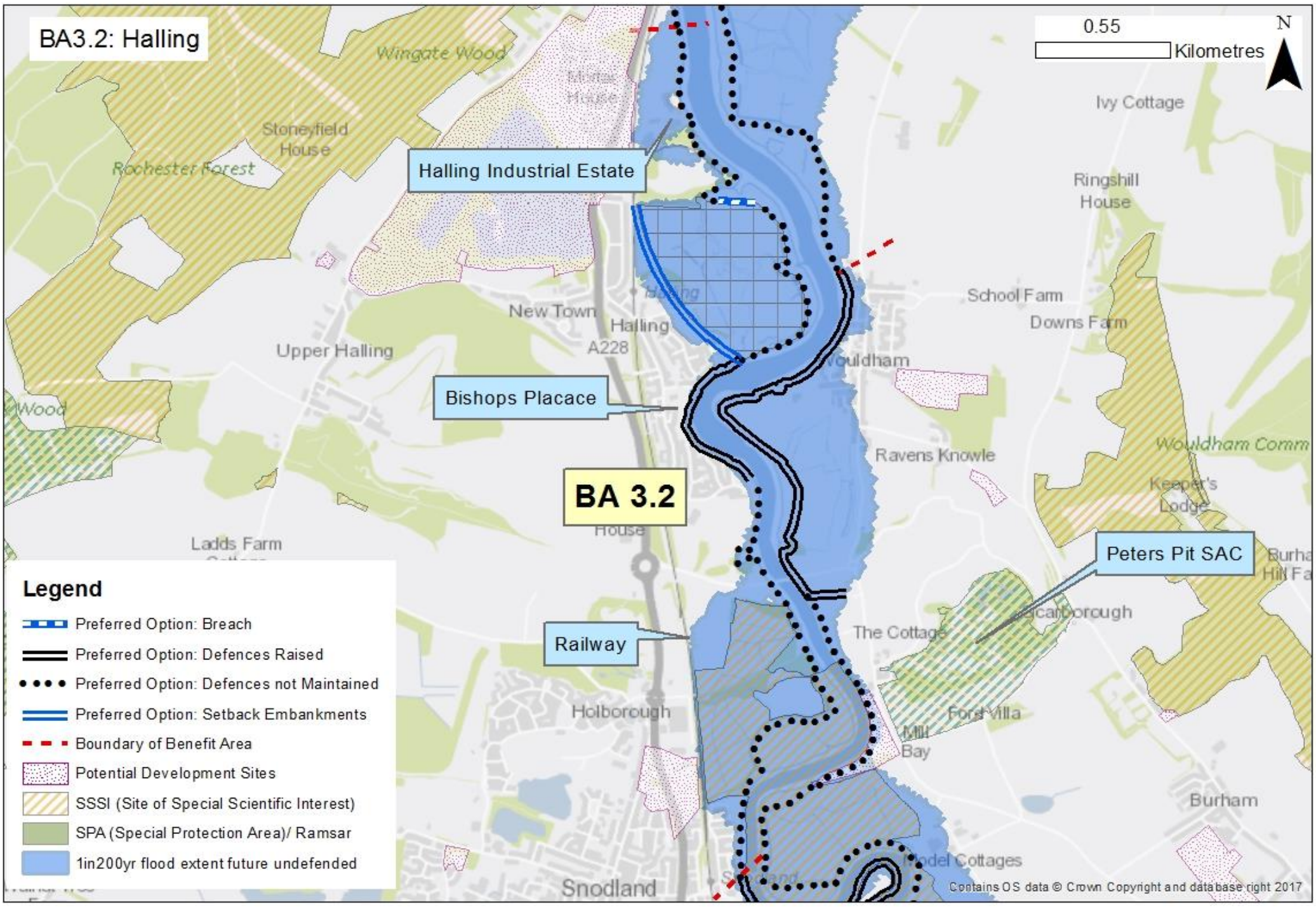
No short listed options were identified with BCRs above one which provided increased protection. There are limited assets at risk from flood damages in the area.

Preferred Option Costs

Cost	Benefits	BCR	PF Score
N/A	**N/A**	**N/A**	**N/A**

Benefit Area Name	3 - Upper Medway
Benefit Unit Name	3.2 - North Halling to Snodland - MR site at Halling (site 4)
Frontage Length	5.0 km
Defence Structure Type	Embankments, concrete flood walls, flood, flood gates, sheet pile walls
Min Standard of Protection (AEP%)	0.5
Residual Life (years)	25

	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	No- suggest alternative considerations		
Comment	The SMP suggests 'MR with localised HTL' for all three epochs. However the current HTL defences are in a good condition and will remain for the first epoch.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		**0.5% AEP (undefended)**	
	Current Year	**100 year**	**Current Year**	**100 Years**
Residential	2	18	22	24
Commercial & Industrial	0	1	4	7
Agricultural (Ha)	59	62	65	70
Key Infrastructure	None	None	Halling Industrial Estate	Halling Industrial Estate, Halling Cement Works Historic Landfill (inert)
Social and Environmental Considerations	Holborough to Burnham Marshes SSSI (seaward and landward)	Holborough to Burnham Marshes SSSI (seaward and landward)	Holborough to Burnham Marshes SSSI (seaward and landward)	Holborough to Burnham Marshes 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	Y	Take forward - rock revetment currently present
	Construct rock revetment	Y	Take forward - rock revetment currently present
	Install demountable defences	Y	Take forward - public access and interaction with the river front is required. Demountable defences could support local regeneration plans. However potential increased cost compared to existing defences needs further consideration.
	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 embankment, wall and flood gates	c) Maintain SOP (capital) embankments, walls and flood gates	d) Raise (sustain SOP) embankments, walls and flood gates	e) Raise (upgrade SOP) embankments, walls and flood gates
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. Low SoP and residual life of defences so defences would not last for full 100 years.	Y= as baseline. Following year 30 a Do nothing scenario would occur due to the failure of the defences.	Y= defences require capital maintenance. Existing defence SOP and residual life low.	Y= Existing defence variable and could be increased with sea level rise.	Y= Existing defence variable and could be increased with sea level rise.

Long List of Options (continued)				
	f) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and flood gates around other areas.	g) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and flood gates around other areas.	h) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and flood gates around other areas.	i) Construct new setback embankment at identified managed realignment sites. Maintain SOP (capital) of existing embankments, walls and revetments around other areas.
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N	N	N	Y
2 - Natura 2000 sites	Y	Y	Y	Y
3- Reduce maintenance	TBC*	TBC*	TBC*	TBC*
4 - WFD	TBC	TBC	TBC	TBC
5 - Local Plans	TBC	TBC	TBC	TBC
Comment and decision on whether taken forward to shortlist	N= Very low standard of protection and residual life, therefore unlikely to be economically viable to undertake capital maintenance now then realigning later on.	N= Very low standard of protection and residual life, therefore unlikely to be economically viable to undertake capital maintenance now then realigning later on.	N= Very low standard of protection and residual life, therefore unlikely to be economically viable to undertake capital maintenance now then realigning later on.	N= Defences have a low RL, therefore a risk of damage to assets under a maintain scenario along the areas where current defence line held.

Long List of Options (continued)		
	j) Construct new setback embankment at identified managed realignment sites. Raise (sustain SOP) of existing embankments, walls and revetments around other areas.	**k) Construct new setback embankment at identified managed realignment sites. Raise (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
2 - Natura 2000 sites	Y	Y
3- Reduce maintenance	TBC*	TBC*
4 - WFD	TBC	TBC
5 - Local Plans	TBC	TBC
Comment and decision on whether taken forward to shortlist	Y= Defences have a low RL and SOP therefore works will need to be taken to improve the defences. The MR site will help meet the objective to deliver compensatory Coastal Squeeze habitat. The impact on environmentally designated sites to be investigated further.	Y= Defences have a low RL and SOP therefore works will need to be taken to improve the defences. The MR site will help meet the objective to deliver compensatory Coastal Squeeze habitat. The impact on environmentally designated sites to be investigated further.

* - 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, walls and flood gates
d) Raise (sustain) embankments, walls and flood gates
e) Raise (upgrade) embankments, walls and flood gates
f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.
g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.

Assessment of Short List				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**
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 25 years residual life. Halling Cement Works Historic Landfill (inert) potentially at risk	Defences have 25 years residual life. Halling Cement Works Historic Landfill (inert) potentially at risk	Defences have 25 years residual life. Halling Cement Works Historic Landfill (inert) potentially at risk	Defences have 25 years residual life. Halling Cement Works Historic Landfill (inert) potentially at risk
Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 30.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.	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	£ -	£ -	£ 1,983,686	£ 6,234,557
PV Maintenance Costs	£ -	£ 232,500	£ 350,430	£ 377,874
PV Other Costs	£ -	£ -	£ 217,235	£ 517,551
Total Cost (including Optimism Bias) (PV)	£ -	£ 372,000	£ 4,082,161	£ 11,407,971
Value of Benefits	£ -	£ 102,000	£ 102,087	£ 3,030,697
Benefit Cost Ratio (BCR)	0.0	0.3	0.0	0.3
PF Score	0%	2%	1%	4%
Further funding required to achieve 100% PF Score	£ -	£ 366,000	£ 4,031,767	£ 10,905,652
Flood/ erosion impacts				
Number of Residential Properties at risk under 0.1% AEP	50	50	50	1
Number of Commercial properties at risk under 0.1% AEP	11	11	10	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 2,767,714	£ 2,622,713	£ 2,665,678	£ 59,548
Critical Infrastructure	No assets at risk	No assets at risk	No assets at risk	No assets at risk

Assessment of Short List			
Option	**e) Raise (upgrade) embankments, walls and flood gates**	**f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.**	**g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.**
Description	Capital works are undertaken to improve the current defences	Development of MR site. Capital works undertaken to improve the remaining defences	Development of MR site. Capital works undertaken to improve the remaining defences
Technical Issue	Defences have 25 years residual life. Halling Cement Works Historic Landfill (inert) potentially at risk	Current defences have 25 years residual life. Potential increase in defence length due to construction of setback defences. Based on current sea levels the MR site would create 8ha of saltmarsh and 19ha of mudflat. With 100 years sea level rise there could be 1ha of saltmarsh and 28ha of mudflat. The site is not internationally designated so no compensatory habitat legally required. Impacts on historic landfill (inert) will need to be considered at the next stage.	Current defences have 25 years residual life. Potential increase in defence length due to construction of setback defences. Based on current sea levels the MR site would create 8ha of saltmarsh and 19ha of mudflat. With 100 years sea level rise there could be 1ha of saltmarsh and 28ha of mudflat. The site is not internationally designated so no compensatory habitat legally required. Impacts on historic landfill (inert) will need to be considered at the next stage.
Assumptions/ Uncertainties	The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.	MR site to provide at least 5%AEP SOP. The SOP provided by the remaining defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This will maintain the required SOP provided by the defences by keeping pace with sea level rise.	MR site to provide at least 5%AEP SOP. The SOP provided by the remaining defences is increased. The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.
SOP Provided (% AEP)	5%	5%	5%
Value of Economics			
PV Capital Costs	£ 8,076,821	£ 7,653,207	£ 9,073,750
PV Maintenance Costs	£ 442,033	£ 355,590	£ 389,552
PV Other Costs	£ 650,673	£ 598,034	£ 650,673
Total Cost (including Optimism Bias) (PV)	£ 14,671,242	£ 13,770,928	£ 16,182,359
Value of Benefits	£ 3,089,903	£ 3,073,913	£ 3,132,780
Benefit Cost Ratio (BCR)	0.2	0.2	0.2
PF Score	3%	14%	12%
Further funding required to achieve 100% PF Score	£ 14,165,634	£ 11,882,597	£ 14,290,758
Flood/ erosion impacts			
Number of Residential Properties at risk under 0.1% AEP	1	1	1
Number of Commercial properties at risk under 0.1% AEP	0	0	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 681	£ 59,548	£ 681
Critical Infrastructure	No assets at risk	No assets at risk	No assets at risk

PV Value of Impacts on road and rail	£271,593 Rail Cuxton to Snodland	£271,593 Rail Cuxton to Snodland	£271,593 Rail Cuxton to Snodland	-
PV Value of Tourism and Recreation Impacts	-	-	-	-
PV Value of Agriculture Impacts	£94,153 Worst case scenario 2ha of Grade 2 agricultural land flooded and 78ha of Grade 4 flooded	£94,154 Worst case scenario 2ha of Grade 2 agricultural land flooded and 78ha of Grade 4 flooded	£94,102 Worst case scenario 2ha of Grade 2 agricultural land flooded and 78ha of Grade 4 flooded	£43,216 Worst case scenario 2ha of Grade 2 agricultural land flooded and 62ha of Grade 4 flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	Prefer option to improve defences as work has been undertaken to encourage freshwater/ brackish habitat	Prefer option to improve defences as work has been undertaken to encourage freshwater/ brackish habitat	Option preferred, although potential still some overtopping which might impact on the freshwater/ brackish habitat	Option preferred to protect habitat
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 deterioration of HMWB but uncontrolled	2 Some deterioration of HMWB 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	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.

PV Value of Impacts on road and rail	-	-	-
PV Value of Tourism and Recreation Impacts	-	-	-
PV Value of Agriculture Impacts	£42,876 Worst case scenario 2ha of Grade 2 agricultural land flooded and 42ha of Grade 4 flooded	N/A Land compensation provided	N/A Land compensation provided
Stakeholders Feedback			
Statutory Stakeholders/ SEG	Option preferred to protect habitat	Potential impact on the freshwater habitat. MR sites could be favourable in this area but further site specific studies would need to be undertaken at the next stage.	Potential impact on the freshwater habitat. MR sites could be favourable in this area but further site specific studies would need to be undertaken at the next stage.
Landowners	No specific comments	No specific comments	No specific comments
Technical Feasibility			
Site Specific	n/a	Very limited flooding under Spring conditions. Engineering of the site probably required to create some creeks and channels or to lower the site elevation. Potential 118m increase in defence length due to construction of setback defences. MR site would create 10ha of saltmarsh and 19ha of mudflat. With 100 years sea level rise there could be 1ha of saltmarsh and 28ha of mudflat.	Very limited flooding under Spring conditions. Engineering of the site probably required to create some creeks and channels or to lower the site elevation. Potential 118m increase in defence length due to construction of setback defences. MR site would create 10ha of saltmarsh and 19ha of mudflat. With 100 years sea level rise there could be 1ha of saltmarsh and 28ha of mudflat.
Strategy Wide	n/a	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	1 Heavily Modified Water Body (HMWB) maintained	4 Some removal of HMWB	4 Some removal of HMWB
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 Following the creation of the MR site the development of intertidal habitat will mitigate against the effects of coastal squeeze. However, it is noted that this location is further from the main estuary and SPA/Ramsar area and therefore may not provide the full functionality required from compensation.	3 Following the creation of the MR site the development of intertidal habitat will mitigate against the effects of coastal squeeze. However, it is noted that this location is further from the main estuary and SPA/Ramsar area and therefore may not provide the full functionality required from compensation.
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.

SEA (Strategic Environmental Assessment)				
Historic Environment	3 No observable historical assets at risk	3 No observable historical assets at risk	3 No observable historical assets at risk	3 No observable historical assets at risk
Effects on population	1 Flood risk to population, homes and jobs from year 25	1 Flood risk to population, homes and jobs from year 30	2 Population, homes and jobs at risk from flooding at risk over time as risk of overtopping increases with sea level rise	4 Population, homes and jobs at a reduced risk from flooding
Impact on plans/ programmes	1 Proposed development sites potentially at risk from flooding once the defences fail in year 25.	1 Proposed development sites potentially at risk from flooding once the defences fail in year 30.	2 Proposed development site potentially at risk from flooding over time with increased risk of overtopping due to sea level rise	4 Potential development sites within the benefit area at reduced risk from flooding
Freshwater Biodiversity	1 Change to habitat type in the SSSI due to uncontrolled saline intrusion once the defences fail in year 25. A variety of habitats are present including extensive reed beds, open water, fen, grassland, scrub and woodland. The many different habitats support a wide variety of breeding birds and the site is also important for wintering wildfowl and waders. A number of scarce wetland plants occur and it is also a locality of a rare moth, a rare beetle, and 3 are bee species. The area has nationally important GCN populations.	1 Change to habitat type in the SSSI due to uncontrolled saline intrusion once the defences fail in year 30. A variety of habitats are present including extensive reed beds, open water, fen, grassland, scrub and woodland. The many different habitats support a wide variety of breeding birds and the site is also important for wintering wildfowl and waders. A number of scarce wetland plants occur and it is also a locality of a rare moth, a rare beetle, and 3 are bee species. The area has nationally important GCN populations.	2 Gradual change to habitat type in the SSSI due to saline intrusion GCN habitat could be lost.	4 Reduced risk of overtopping due to improvement of defences
Saline Biodiversity	4 Potential for intertidal habitat creation once the defences fail	4 Potential for intertidal habitat creation once the defences fail	3 Potential for gradual intertidal habitat creation due to overtopping of the defences with sea level rise	2 Defences improved so no opportunity for intertidal habitat creation
Soil	1 Degradation of soils following the failure of defences	1 Degradation of soils following the failure of defences	2 Degradation of soils over time	3 No impact
Groundwater	1 Risk to groundwater once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Also risk of release of contaminants from the flooding of the landfill sites.	1 Risk to groundwater once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Also risk of release of contaminants from the flooding of the landfill sites.	2 Potential impacts on groundwater and release of contaminants from landfill over time as risk of overtopping increases with sea level rise.	4 Groundwater at reduced risk. Reduced risk of release of contaminants from landfill.

SEA (Strategic Environmental Assessment)			
Historic Environment	3 No observable historical assets at risk	3 No observable historical assets at risk	3 No observable historical assets at risk
Effects on population	5 Population, homes and jobs at a reduced risk from flooding immediately	4 Population and homes protected but there is the potential for impacts on agricultural livelihoods with the development of the MR site.	4 Population and homes protected but there is the potential for impacts on agricultural livelihoods with the development of the MR site.
Impact on plans/ programmes	5 Potential development sites within the benefit area at reduced risk from flooding immediately	4 MR site does not affect the potential development sites. Potential development sites within the benefit area at reduced risk from flooding	5 MR site does not affect the potential development sites. Potential development sites within the benefit area at reduced risk from flooding immediately
Freshwater Biodiversity	5 Reduced risk of overtopping immediately	1 MR will convert some of the freshwater habitat to intertidal habit. This could have impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants, a rare moth, a rare beetle, and 3 rare bee species could be at risk.	1 MR will convert some of the freshwater habitat to intertidal habit. This could have impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants, a rare moth, a rare beetle, and 3 rare bee species could be at risk.
Saline Biodiversity	2 Defences improved so no opportunity for intertidal habitat creation	4 Development of MR site will lead to the creation of new intertidal habitat.	4 Development of MR site will lead to the creation of new intertidal habitat.
Soil	3 No impact	1 Loss of agricultural land	1 Loss of agricultural land
Groundwater	4 Groundwater at reduced risk immediately. Reduced risk of release of contaminants from landfill.	1 Risk to groundwater is high where the MR site is created. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Limited risk of release of contaminants from the landfill site as the defences are improved.	1 Risk to groundwater is high where the MR site is created. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Limited risk of release of contaminants from the landfill site as the defences are improved.

Landscape (visual impact)	4 Change after the defences fail but reverting to natural processes is assumed a benefit	4 Change after the defences fail but reverting to natural processes is assumed a benefit	3 Very gradual change as the risk of overtopping increases with sea level rise	3 Incremental change as the height of the wall is increased in phases
Carbon Storage	2 Loss of woodland carbon in north of benefit area once the defences fail	2 Loss of woodland carbon in north of benefit area once the defences fail	2 Gradual loss of woodland carbon due to increased risk of overtopping of the defences due to sea level rise.	2 Incremental increase in carbon cost from construction
Ecosystem Services				
Qualitative Score from Ecosystem Services	-33	-33	-32	-18
Comments	Degradation in many ES (e.g. freshwater provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in many ES (e.g. freshwater provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in many ES (e.g. freshwater provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Degradation in certain ES (e.g. climate regulation, aesthetic value, habit provision for conservation and fishery habitat) outweigh limited enhancement opportunities (e.g. 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	Y	Y

Landscape (visual impact)	2 Visual impact from increase in wall height	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 Immediate increase in carbon cost from construction	2 Incremental increase in carbon cost from construction	1 Immediate increase in carbon cost from construction
Ecosystem Services			
Qualitative Score from Ecosystem Services Assessment	-20	35	35
Comments	Degradation in certain ES (e.g. climate regulation, aesthetic value, habit provision for conservation and fishery habitat) outweigh limited enhancement opportunities (e.g. natural hazard regulation)	Enhancement for many ES (e.g. climate regulation, water flow regulation natural hazard protection, recreation and tourism, fishery habitat) outweigh degradation risk in limited number of ES (e.g. freshwater provision, water purification)	Enhancement for many ES (e.g. climate regulation, water flow regulation natural hazard protection, recreation and tourism, fishery habitat) outweigh degradation risk in limited number of ES (e.g. freshwater provision, water purification)
To what extent does the option meet the objectives?			
1- Reduce Flood Risk	Y	Y	Y
2 - Natura 2000 sites	N	Y	Y
3- Reduce maintenance	Y	Y	Y
4 - WFD	N	Y	Y
5 - Local Plans	Y	Y	Y

Environmental Scores				
100 = best option, 0 = worst option				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	50	50	50	50
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	50	50	50	50
Habitat Connectivity	50	50	50	50
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	0	0	25	75
Impact on plans/ programmes	0	0	25	75
Freshwater Biodiversity	0	0	25	75
Saline Biodiversity	75	75	50	25
Soil	0	0	25	50
Groundwater	0	0	25	75
Landscape (visual impact)	75	75	50	50
Carbon Storage	25	25	25	25
Total	**450**	**450**	**500**	**700**

Environmental Scores			
100 = best option, 0 = worst option			
Option	**e) Raise (upgrade) embankments, walls and flood gates**	**f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.**	**g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.**
WFD (Water Framework Directive)			
Compliance assessment outcome	0	75	75
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	50	50	50
Impacts on freshwater habitats	50	50	50
Impacts on intertidal habitats	50	50	50
Habitat Connectivity	50	50	50
SEA (Strategic Environmental Assessment)			
Historic Environment	50	50	50
Effects on population	100	75	75
Impact on plans/ programmes	100	75	100
Freshwater Biodiversity	100	0	0
Saline Biodiversity	25	75	75
Soil	50	0	0
Groundwater	75	0	0
Landscape (visual impact)	25	0	0
Carbon Storage	0	25	0
Total	**725**	**575**	**575**

Summary of Results				
Option	**a) Do nothing**	**b) Do nothing**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**
Costs	£ -	£ 372,000	£ 4,082,161	£ 11,407,971
Benefits	£ -	£ 102,000	£ 102,087	£ 3,030,697
NPV	£ -	-£ 270,000	-£ 3,980,074	-£ 8,377,274
BCR	0.0	0.3	0.0	0.3
Environmental Scoring	450	450	500	700

Summary of Results			
Option	**e) Raise (upgrade) embankments, walls and flood gates**	**f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.**	**g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.**
Costs	£ 14,671,242	£ 13,770,928	£ 16,182,359
Benefits	£ 3,089,903	£ 3,073,913	£ 3,132,780
NPV	-£ 11,581,339	-£ 10,697,015	-£ 13,049,580
BCR	0.2	0.2	0.2
Environmental Scoring	725	575	575

Preferred Option Decision Making

DLO	Leading Option at DLO Stage	Justification for Leading Option
DLO1 - Economic Assessment	No Active Intervention (NAI).	The BCR is less than one for all the options, so there is no economically viable option.
DLO2 - Economic Sensitivities	Raise (sustain) embankments, walls and flood gates in localised areas	It can be justified to HTL in small sections where there is a concentration of assets at risk. NAI would be applied in the other sections.
DLO3 - Review of Compensatory Intertidal Habitat Requirements	Construct new setback embankments at Halling Marshes. Raise (sustain) embankments, walls and flood gates in localised areas.	It can be justified to HTL in small sections where there is a concentration of assets at risk. MR site at Halling Marshes from year 5. The hectares are required to help compensate for coastal squeeze across the Strategy in the first epoch.
DLO4 - Review of Compensatory Freshwater Habitat Requirements		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name

Construct new setback embankments at Halling Marshes. Raise (sustain) embankments, walls and flood gates in localised areas.

Preferred Option

Localised raising of the defences to protect properties and assets at risk of flooding around Halling against a 5%AEP with sea level rise. The localised defences will be raised in year 10 to 5.1m AOD and then in year 50 to 6.1m AOD to continue to provide protection in line with sea level rise. The rest of the BA will have a NAI approach and management will cease on the defences.
Additionally, construction of a MR site from year 5 at Halling marsh to help compensate for the strategy wide coastal squeeze impacts. Setback embankments would be constructed to manage tidal water and a breach in the current defences created.

Justification

Localised HTL sensitivity provides the only option with a BCR above 1 and a positive NPV, and will provide protection to all residential properties at risk of flooding to at least a 5% AEP. In the NAI areas there is limited assets at risk due to the rising ground.
MR site at Halling Marshes 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.

Preferred Option Costs

Cost	Benefits	BCR	PF Score
£ 1,725,147	**£ 2,789,076**	**1.6**	**28%**

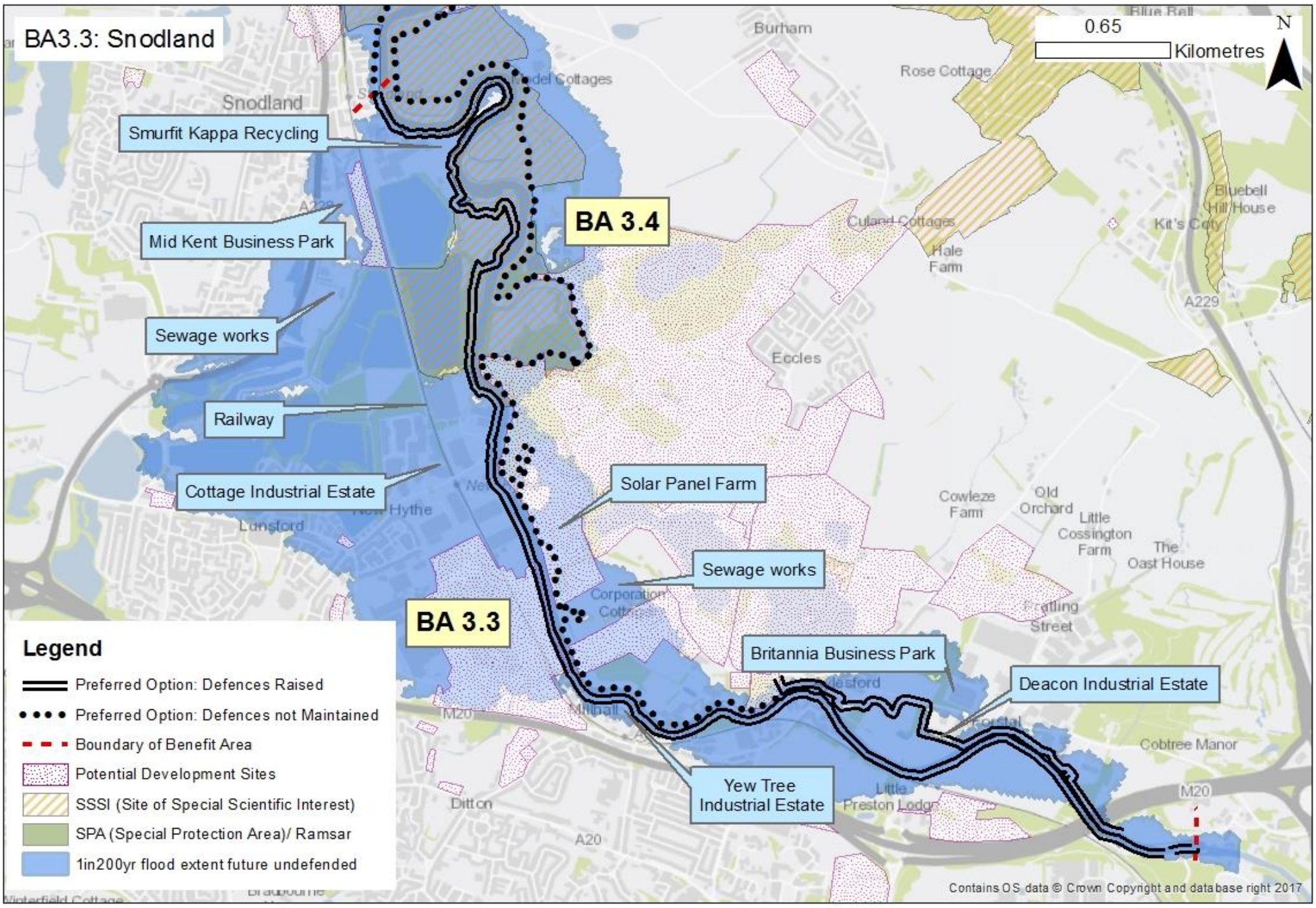
Managed Realignment

Managed Realignment site proposed at Halling in Year 5

PV Cost	Hectares of saltmarsh created
£ 3,961,250	**10.2 ha**

Benefit Area Name	3 - Upper Medway
Benefit Unit Name	3.3 - Snodland to Allington Lock
Frontage Length	8.1 km
Defence Structure Type	Embankments, concrete walls, gabions, masonry wall, steel sheet piling
Min Standard of Protection (AEP%)	0.5
Residual Life (years)	25

	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	Agree with SMP		
Comment	Agree with SMP: HTL for the first epoch but suggest HTL with MR for the second two epochs (for same reason as above that there is more HTL length of defences than MR). A couple of different options for MR sites.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	21	274	368	808
Commercial & Industrial	8	95	139	227
Agricultural (Ha)	53	80	111	221
Key Infrastructure	None	Smurfit Kappa Recycling Cottage Industrial Estate Yew Tree Industrial Estate New Hythe Railway and line Station road Aylesford line, New Hythe Lane Historic Landfill (inert)	Smurfit Kappa Recycling Cottage Industrial Estate Yew Tree Industrial Estate New Hythe Railway and line Station road Aylesford line, New Hythe Lane Historic Landfill (inert)	As previous plus: Mid Kent Business Park Sewage works A228, New Hythe Lane Historic Landfill (inert), Ham Hill Historic Landfill (inert), Brook Lane Historic Landfill (inert), Sharnal Lane Historic Landfill
Social and Environmental Considerations	Holborough to Burnham Marshes SSSI (seaward and landward)	Holborough to Burnham Marshes SSSI (seaward and landward)	Holborough to Burnham Marshes SSSI (seaward and landward)	Holborough to Burnham Marshes 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	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 embankment, wall and flood gates	c) Maintain SOP (capital) embankments, walls and flood gates	d) Raise (sustain SOP) embankments, walls and flood gates	e) Raise (upgrade SOP) embankments, walls and flood gates
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	Y	Y	Y	Y
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. Standard of protection of defences very low and residual life of defences low.	Y= as baseline. Following year 30 a Do nothing scenario would occur due to failure of the defences.	Y= defences require capital maintenance. Existing defence SOP and residual life low.	Y= Existing defence SOP variable and could be increased with sea level rise.	Y= Existing defence SOP variable and could be increased with sea level rise.

Long List of Options (continued)				
	f) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and flood gates around other areas.	g) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and flood gates around other areas.	h) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and flood gates around other areas.	i) Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and flood gates around other areas.
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N*	N*	N*	Y
2 - Natura 2000 sites	Y	Y	Y	Y
3- Reduce maintenance	TBC**	TBC**	TBC**	TBC**
4 - WFD	TBC	TBC	TBC	TBC
5 - Local Plans	TBC	TBC	TBC	TBC
Comment and decision on whether taken forward to shortlist	N= defences have very low standard of protection and low residual life so unlikely to be cost effective to undertake capital maintenance for first epoch and then realign.	N= defences have very low standard of protection and low residual life so unlikely to be cost effective to undertake capital maintenance for first epoch and then realign.	N= defences have very low standard of protection and low residual life so unlikely to be cost effective to undertake capital maintenance for first epoch and then realign.	N= Defences have a low RL, therefore a risk of damage to assets under a maintain scenario along the areas where current defence line held.

Long List of Options (continued)		
	j) Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and flood gates around other areas.	**k) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and flood gates around other areas.**
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	Y	Y
3- Reduce maintenance	TBC**	TBC**
4 - WFD	TBC	TBC
5 - Local Plans	TBC	TBC
Comment and decision on whether taken forward to shortlist	Y= Defences have a low RL and SOP therefore works will need to be taken to improve the defences. The MR site will help meet the objective to deliver compensatory Coastal Squeeze habitat. The impact on environmentally designated sites to be investigated further.	Y= Defences have a low RL and SOP therefore works will need to be taken to improve the defences. The MR site will help meet the objective to deliver compensatory Coastal Squeeze habitat. The impact on environmentally designated sites to be investigated further.

* - property at risk in the first 20 years as no capital works proposed

** - 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, walls and flood gates
d) Raise (sustain) embankments, walls and flood gates
e) Raise (upgrade) embankments, walls and flood gates
f) *Construct new setback embankments at identified managed realignment sites in year 20 and sustain embankments, walls and flood gates around other
g) *Construct new setback embankments at identified managed realignment sites in year 20 and upgrade embankments, walls and flood gates around other

*This MR option was screened out following consultation with environmental stakeholders

Assessment of Short List			
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**
Description	Used as an economic baseline to compare the other options against.	Used as an economic baseline to compare the other options against.	Capital works are undertaken to maintain the current defences
Technical Issue	Defences have 25 years residual life. New Hythe Lane Historic Landfill (inert), Ham Hill Historic Landfill (inert), Brook Lane Historic Landfill (inert) and Sharnal Lane Historic Landfill potentially at risk.	Defences have 25 years residual life. New Hythe Lane Historic Landfill (inert), Ham Hill Historic Landfill (inert), Brook Lane Historic Landfill (inert) and Sharnal Lane Historic Landfill potentially at risk.	Defences have 25 years residual life. New Hythe Lane Historic Landfill (inert), Ham Hill Historic Landfill (inert), Brook Lane Historic Landfill (inert) and Sharnal Lane Historic Landfill potentially at risk.
Assumptions/ Uncertainties	Assumes that all management is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 30.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.
SOP Provided (% AEP)	>50%	>50%	50%
Value of Economics			
PV Capital Costs	£ -	£ -	£ 4,671,638
PV Maintenance Costs	£ -	£ 370,000	£ 530,610
PV Other Costs	£ -	£ -	£ 358,780
Total Cost (including Optimism Bias) (PV)	£ -	£ 592,000	£ 8,897,645
Value of Benefits	£ -	£ 17,398,000	£ 205,958,366
Benefit Cost Ratio (BCR)	0.0	29.4	23.1
PF Score	0%	163%	145%
Further funding required to achieve 100% PF	£ -	£ -	£ -
Flood/ erosion impacts			
Number of Residential Properties at risk under 0.1% AEP	1020	1020	339
Number of Commercial properties at risk under 0.1% AEP	251	251	104
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency	£ 213,447,646	£ 196,054,642	£ 7,533,244
Critical Infrastructure	Smurfit Kappa Recycling Cottage Industrial Estate Yew Tree Industrial Estate New Hythe Railway and line Station road Aylesford line	Smurfit Kappa Recycling Cottage Industrial Estate Yew Tree Industrial Estate New Hythe Railway and line Station road Aylesford line	Infrastructure at increasing risk with sea level rise
PV Value of Impacts on road and rail	£1,516,381 A228 Rail to Snodland to Maidstone Barracks	£1,516,245 A228 Rail to Snodland to Maidstone Barracks	£1,514,383 A228 Rail to Snodland to Maidstone Barracks
PV Value of Tourism and Recreation Impacts	-	-	-
PV Value of Agriculture Impacts	£164,039 Worst case scenario 18ha of Grade 2 agricultural land flooded, 11ha of Grade 3 flooded, and 221ha of Grade 4 flooded	£158,983 Worst case scenario 18ha of Grade 2 agricultural land flooded, 11ha of Grade 3 flooded, and 221ha of Grade 4 flooded	£122,074 Worst case scenario 18ha of Grade 2 agricultural land flooded, 6ha of Grade 3 flooded, and 104ha of 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

Assessment of Short List		
Option	**d) Raise (sustain) embankments, walls and flood gates**	**e) Raise (upgrade) embankments, walls and flood gates**
Description	Capital works are undertaken to improve the current defences	Capital works are undertaken to improve the current defences
Technical Issue	Defences have 25 years residual life. New Hythe Lane Historic Landfill (inert), Ham Hill Historic Landfill (inert), Brook Lane Historic Landfill (inert) and Sharnal Lane Historic Landfill potentially at risk.	Defences have 25 years residual life. New Hythe Lane Historic Landfill (inert), Ham Hill Historic Landfill (inert), Brook Lane Historic Landfill (inert) and Sharnal Lane Historic Landfill potentially at risk.
Assumptions/ Uncertainties	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)	0.1%	0.1%
Value of Economics		
PV Capital Costs	£ 9,881,133	£ 14,539,580
PV Maintenance Costs	£ 594,680	£ 741,013
PV Other Costs	£ 747,092	£ 639,144
Total Cost (including Optimism Bias) (PV)	£ 17,956,648	£ 25,471,579
Value of Benefits	£ 215,079,184	£ 215,079,243
Benefit Cost Ratio (BCR)	12.0	8.4
PF Score	75%	53%
Further funding required to achieve 100% PF Score	£ 4,532,430	£ 12,047,358
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	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 Impacts	-	-
PV Value of Agriculture Impacts	£48,883 Worst case scenario 2ha of Grade 2 agricultural land flooded, 3ha of Grade 3 flooded, and 11ha of Grade 4 flooded	£48,824 Worst case scenario 2ha of Grade 2 agricultural land flooded, 3ha of Grade 3 flooded, and 11ha of Grade 4 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 possible	2 Some return to natural processes possible	1 Heavily Modified Water Body (HMWB) maintained
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
SEA (Strategic Environmental Assessment)			
Historic Environment	1 Scheduled monuments and listed buildings at risk following failure of the defences in year 25	1 Scheduled monuments and listed buildings at risk following failure of the defences in year 30	2 Scheduled monuments and listed buildings at risk over time with increased risk of overtopping due to sea level rise
Effects on population	1 Homes, infrastructure and jobs at risk following failure of the defences in year 25	1 Homes, infrastructure and jobs at risk following failure of the defences in year 30	2 Homes, infrastructure and jobs at risk over time with increased risk of overtopping
Impact on plans/ programmes	1 Proposed development sites potentially at risk from flooding following failure of defences	1 Proposed development sites potentially at risk from flooding following failure of defences	2 Proposed development site potentially at risk from flooding over time with increased risk of overtopping due to sea level rise
Freshwater Biodiversity	1 Following the failure of the defences there will be impacts on the freshwater species (including SSSI). Potential effects on Great Crested Newt populations and wild orchids.	1 Following the failure of the defences there will be impacts on the freshwater species (including SSSI). Potential effects on Great Crested Newt populations and wild orchids.	2 Gradual change to habitat type in SSSI due to increasing risk of overtopping with sea level rise. Effects on Great Crested Newt populations and wild orchids.
Saline Biodiversity	4 Potential creation of intertidal habitat once the defences fail	4 Potential creation of intertidal habitat once the defences fail	3 Gradual creation of intertidal habitat arising from overtopping of the defences with sea level rise. This might lead to the natural rollback of the freshwater habitat.
Soil	1 Loss of agricultural land following the failure of the defences.	1 Loss of agricultural land following the failure of the defences.	2 Degradation of agricultural land over time with the increased risk of overtopping
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. Also risk of release of contaminants from the flooding of 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. Also risk of release of contaminants from the flooding of the landfill sites.	3 Potential impacts on groundwater, and release of contaminates from landfill over time as risk of overtopping increases with sea level rise.

WFD (Water Framework Directive)		
Compliance assessment outcome	1 Heavily Modified Water Body (HMWB) maintained	1 Heavily Modified Water Body (HMWB) maintained
HRA (Habitats Regulation Assessment)		
Impact on SPA/ Ramsar qualifying features	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
SEA (Strategic Environmental Assessment)		
Historic Environment	5 Historic assets at reduced risk from flooding	5 Historic assets at reduced risk from flooding
Effects on population	4 Homes, infrastructure and jobs at reduced risk	5 Homes, infrastructure and jobs at reduced risk immediately
Impact on plans/ programmes	4 Potential development sites within the benefit area at reduced risk from flooding	5 Potential development sites within the benefit area at reduced risk from flooding immediately
Freshwater Biodiversity	3 No impact. Freshwater habitat protected	3 No impact. Freshwater habitat protected
Saline Biodiversity	2 No opportunity for the creation of intertidal habitat. Potential for coastal squeeze if the defences are held, but the intertidal habitat is not designated.	2 No opportunity for the creation of intertidal habitat. Potential for coastal squeeze if the defences are held, but the intertidal habitat is not designated.
Soil	3 No impact as the defences are improved.	3 No impact as the defences are improved.
Groundwater	4 Groundwater and release of contaminants from the landfill at reduced risk	4 Groundwater and release of contaminants from the landfill at reduced risk

Landscape (visual impact)	4 Change to landscape type once the defences fail but reverting to natural processes from overtopping-assumed a benefit	4 Change to landscape type once the defences fail but reverting to natural processes from overtopping-assumed a benefit	3 Very gradual change to landscape type with overtopping of defences,
Carbon Storage	2 Potential loss of woodland carbon in north of benefit area once the defences fail in year 25.	2 Potential loss of woodland carbon in north of benefit area once the defences fail in year 30.	3 Gradual loss of woodland carbon
Ecosystem Services			
Qualitative Score from Ecosystem Services Assessment	-44	-44	-31
Comments	Major degradation in certain ES (e.g. food provision, freshwater provision, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in certain ES (e.g. food provision, freshwater provision, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate gradual degradation in certain ES (e.g. food provision, freshwater provision, water flow regulation, natural hazard regulation and tourism) 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	Y
2 - Natura 2000 sites	N	N	N
3- Reduce maintenance	Y	Y	Y
4 - WFD	N	N	N
5 - Local Plans	N	N	Y

Landscape (visual impact)	2 Change to visual impact incremental over years as height of wall raised	2 Change to visual impact as height of wall raised immediately
Carbon Storage	2 Incremental increase in carbon cost from construction	1 Immediate increase in carbon cost from construction
Ecosystem Services		
Qualitative Score from Ecosystem Services Assessment	-8	-8
Comments	Degradation in various ES (e.g. climate regulation, aesthetic value, fisheries habitat) outweigh limited enhancement opportunities (e.g. erosion regulation, natural hazard regulation)	Degradation in various ES (e.g. climate regulation, aesthetic value, fisheries habitat) outweigh limited enhancement opportunities (e.g. erosion regulation, natural hazard regulation)
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	N	N
3- Reduce maintenance	Y	Y
4 - WFD	N	N
5 - Local Plans	Y	Y

Environmental Scores					
100 = best option, 0 = worst option					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**	**e) Raise (upgrade) embankments, walls and flood gates**
WFD (Water Framework Directive)					
Compliance assessment outcome	25	25	0	0	0
HRA (Habitats Regulation Assessment)					
Impact on SPA/ Ramsar qualifying features	50	50	50	50	50
Impacts on freshwater habitats	50	50	50	50	50
Impacts on intertidal habitats	50	50	50	50	50
Habitat Connectivity	50	50	50	50	50
SEA (Strategic Environmental Assessment)					
Historic Environment	0	0	25	100	100
Effects on population	0	0	25	75	100
Impact on plans/ programmes	0	0	25	75	100
Freshwater Biodiversity	0	0	25	50	50
Saline Biodiversity	75	75	50	25	25
Soil	0	0	25	50	50
Groundwater	25	25	50	75	75
Landscape (visual impact)	75	75	50	25	25
Carbon Storage	25	25	50	25	0
Total	**425**	**425**	**525**	**700**	**725**

Summary of Results					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**	**e) Raise (upgrade) embankments, walls and flood gates**
Costs	£ -	£ 592,000	£ 8,897,645	£ 17,956,648	£ 25,471,579
Benefits	£ -	£ 17,398,000	£ 205,958,366	£ 215,079,184	£ 215,079,243
NPV	£ -	£ 16,806,000	£ 197,060,721	£ 197,122,536	£ 189,607,664
BCR	0.0	29.4	23.1	12.0	8.4
Environmental Scoring	425	425	525	700	725

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

Preferred Option Name

Raise (sustain) embankments, walls and flood gates from year 20.

Preferred Option

Maintenance of the current defences (embankment, seawall and rock revetment) for the first 20 years. Following this the defences will be raised to 6m AOD and then raised again in year 50 to 7.4m AOD to ensure a 0.1% SoP in 100 years taking account of sea level rise.

Justification

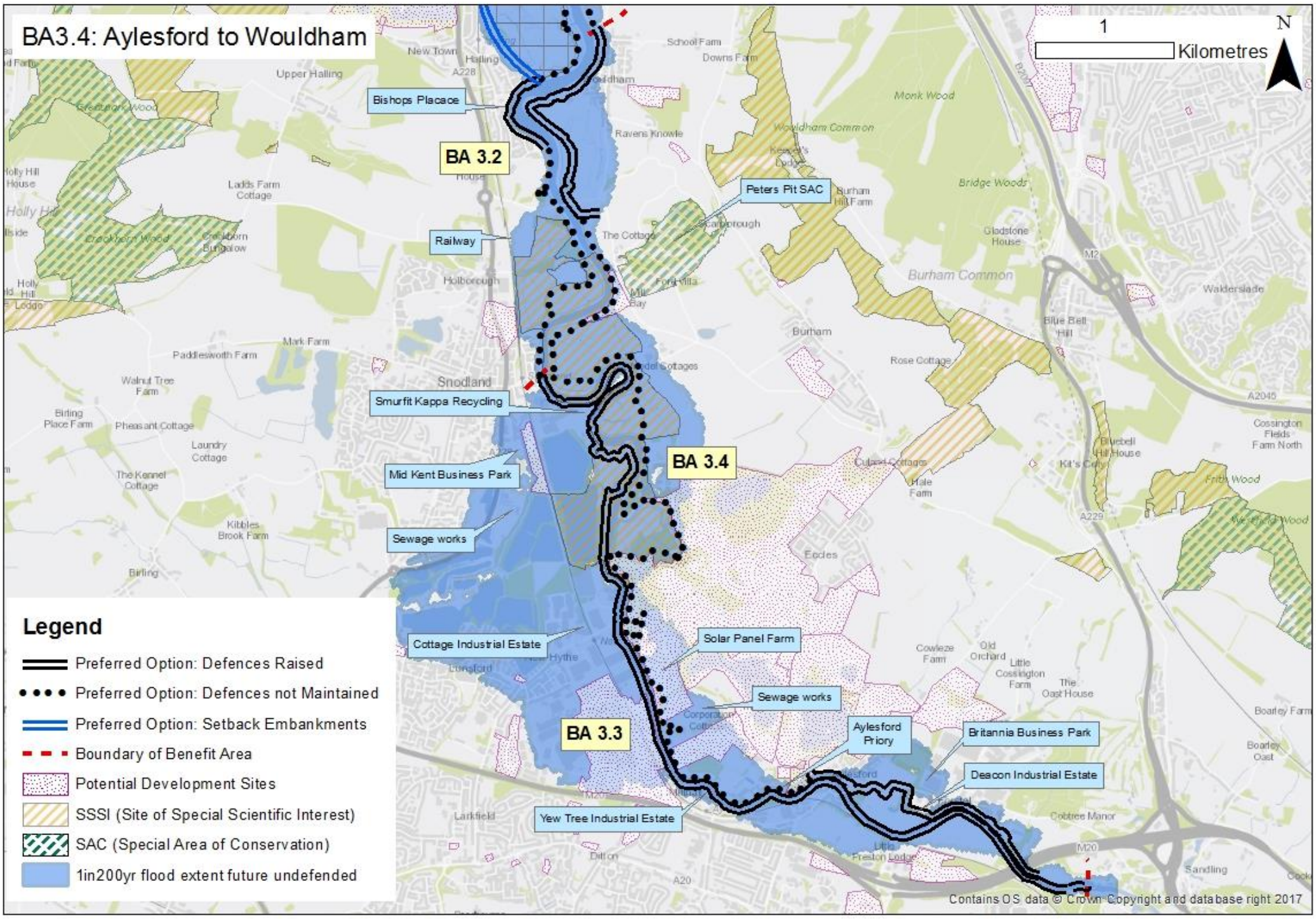
Maintain (capital) option has the highest benefits following the Do Minimum and an incremental BCR greater than 1. However, the Sustain option protects over 440 additional properties and therefore much better meets the Strategy objectives. Under local choices, the Sustain Option will be preferred and would require and additional £2.4m funding over 100 years.

Preferred Option Costs

Cost	Benefits	BCR	PF Score
£ 17,628,382	£ 213,623,524	12.01	75%

Benefit Area Name	3 - Upper Medway
Benefit Unit Name	3.4 - Allington Lock to North Wouldham - MR site at Burham (Site 8)
Frontage Length	11.2 km
Defence Structure Type	Concrete and masonry wall, concrete revetments, earth embankment, sheet pile walls, flood gates
Min Standard of Protection (AEP%)	0.5
Residual Life (years)	25

	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	Agree with SMP		
Comment	Agree with SMP: HTL for the first epoch. Potentially HTL with MR (rather than MR with HTL) for the second two epochs.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		**0.5% AEP (undefended)**	
	Current Year	**100 year**	**Current Year**	**100 Years**
Residential	28	98	119	248
Commercial & Industrial	27	50	52	76
Agricultural (Ha)	145	181	192	215
Key Infrastructure	Forestall Road	Forestall Road, Solar Panel farm, Old Aylesford Pit Historic Landfill (inert)	Forestall Road, Solar Panel farm, Sewage works, Old Aylesford Pit Historic Landfill (inert)	As previous plus: Britannia Business Park, Old Aylesford Pit Historic Landfill (inert) Burham Tips Historic Landfill (inert)
Social and Environmental Considerations	Holborough to Burnham Marshes SSSI (seaward and landward). Grade 1 agricultural land.	Holborough to Burnham Marshes SSSI (seaward and landward). Grade 1 agricultural land.	Holborough to Burnham Marshes SSSI (seaward and landward). Grade 1 agricultural land.	Holborough to Burnham Marshes SSSI (seaward and landward). Grade 1 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	Y	Take forward - rock revetment currently present
	Construct rock revetment	Y	Take forward - rock revetment currently present
	Install demountable defences	Y	Take forward - public access and interaction with the river front is required. Demountable defences could support local regeneration plans. However potential increased cost compared to existing defences needs further consideration.
	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 embankment, wall and flood gates	c) Maintain SOP (capital) embankments, walls and flood gates	d) Raise (sustain SOP) embankments, walls and flood gates	e) Raise (upgrade SOP) embankments, walls and flood gates
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 30 a Do nothing scenario would occur due to the failure of the defences.	Y= defences require capital maintenance. Existing defence SOP and residual life low.	Y= Existing defence SOP variable and could be increased with sea level rise.	Y= as above. Significant assets at risk that would be protected under an upgrade option.

Long List of Options (continued)				
	f) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and flood gates around other areas.	g) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and flood gates around other areas.	h) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and flood gates around other areas.	i) Construct new setback embankment at identified managed realignment sites. Maintain SOP (capital) of existing embankments, walls and revetments around other areas.
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N*	N*	N*	Y
2 - Natura 2000 sites	Y	Y	Y	Y
3- Reduce maintenance	TBC**	TBC**	TBC**	TBC**
4 - WFD	TBC	TBC	TBC	TBC
5 - Local Plans	TBC	TBC	TBC	TBC
Comment and decision on whether taken forward to shortlist	N= defences have very low standard of protection residual life so not economically viable to maintain for first epoch and then breaching.	N= defences have very low standard of protection residual life so not economically viable to maintain for first epoch and then breaching.	N= defences have very low standard of protection residual life so not economically viable to maintain for first epoch and then breaching.	N= Defences have a low RL, therefore a risk of damage to assets under a maintain scenario along the areas where current defence line held.

Long List of Options (continued)		
	j) Construct new setback embankment at identified managed realignment sites. Raise (sustain SOP) of existing embankments, walls and revetments around other areas.	**k) Construct new setback embankment at identified managed realignment sites. Raise (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
2 - Natura 2000 sites	Y	Y
3- Reduce maintenance	TBC**	TBC**
4 - WFD	TBC	TBC
5 - Local Plans	TBC	TBC
Comment and decision on whether taken forward to shortlist	Y= Defences have a low RL and SOP therefore works will need to be taken to improve the defences. The MR site will help meet the objective to deliver compensatory Coastal Squeeze habitat. The impact on environmentally designated sites to be investigated further.	Y= Defences have a low RL and SOP therefore works will need to be taken to improve the defences. The MR site will help meet the objective to deliver compensatory Coastal Squeeze habitat. The impact on environmentally designated sites to be investigated further.

* - property at risk in the first 20 years as no capital works proposed

* - 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, walls and flood gates
d) Raise (sustain) embankments, walls and flood gates
e) Raise (upgrade) embankments, walls and flood gates
f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.
g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.

Assessment of Short List				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**
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 25 year residual life. Old Aylesford Pit Historic Landfill (inert) and Burham Tips Historic Landfill (inert) potentially at risk.	Defences have 25 year residual life. Old Aylesford Pit Historic Landfill (inert) and Burham Tips Historic Landfill (inert) potentially at risk.	Current defences have 25 year residual life. Old Aylesford Pit Historic Landfill (inert) and Burham Tips Historic Landfill (inert) potentially at risk over time.	Current defences have 25 year residual life. Old Aylesford Pit Historic Landfill (inert) and Burham Tips 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 30.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the SOP as the sea level rises.	The SOP provided by the defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This option will maintain the required SOP provided by the defences by keeping pace with sea level rise.
SOP Provided (% AEP)	>50%	>50%	50%	0.1%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 3,637,687	£ 16,944,303
PV Maintenance Costs	£ -	£ 438,125	£ 655,644	£ 776,686
PV Other Costs	£ -	£ -	£ 315,937	£ 746,331
Total Cost (including Optimism Bias) (PV)	£ -	£ 701,000	£ 7,374,829	£ 29,547,711
Value of Benefits	£ -	£ 317,000	£ 3,644,841	£ 22,281,103
Benefit Cost Ratio (BCR)	0.0	0.5	0.5	0.8
PF Score	0%	3%	6%	6%
Further funding required to achieve 100% PF Score	£ -	£ 683,000	£ 6,947,940	£ 27,702,052
Flood/ erosion impacts				
Number of Residential Properties at risk under 0.1% AEP	315	315	302	59
Number of Commercial properties at risk under 0.1% AEP	93	93	81	5
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 21,406,752	£ 21,094,266	£ 17,776,837	£ 32,912
Critical Infrastructure	Forestall Road Solar Panel farm Sewage works	Forestall Road Solar Panel farm Sewage works	Impact on infrastructure increasing with sea level rise	Limited impacts
PV Value of Impacts on road and rail	-	-	-	-

Assessment of Short List			
Option	**e) Raise (upgrade) embankments, walls and flood gates**	**f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.**	**g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.**
Description	Capital works are undertaken to improve the current defences	Development of MR site. Capital works undertaken to improve the remaining defences	Development of MR site. Capital works undertaken to improve the remaining defences
Technical Issue	Current defences have 25 year residual life. Old Aylesford Pit Historic Landfill (inert) and Burham Tips Historic Landfill (inert) potentially at risk over time.	Current defences have 25 year residual life. The MR site ties back into high ground. Based on current sea levels the MR site would create 2ha of saltmarsh and 20ha of mudflat. With 100 years sea level rise there could be 2ha of saltmarsh and 20ha of mudflat. The site is designated so compensatory habitat legally required. Impacts on historic landfills (inert) will need to be considered at the next stage.	Current defences have 25 year residual life. The MR site ties back into high ground. Based on current sea levels the MR site would create 2ha of saltmarsh and 20ha of mudflat. With 100 years sea level rise there could be 2ha of saltmarsh and 20ha of mudflat. The site is designated so compensatory habitat legally required. Impacts on historic landfills (inert) will need to be considered at the next stage.
Assumptions/ Uncertainties	The crest height and SOP provided by the defences is increased. The crest height 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 2% AEP SOP to protect property etc. directly behind. The SOP provided by the remaining defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This will maintain the required SOP provided by the defences by keeping pace with sea level rise.	MR site to provide at least a 2% AEP SOP to protect property etc. directly behind. The SOP provided by the remaining defences is increased. The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.
SOP Provided (% AEP)	0.1%	2%	2.0%
Value of Economics			
PV Capital Costs	£ 26,645,633	£ 17,249,286	£ 26,456,879
PV Maintenance Costs	£ 1,054,096	£ 722,365	£ 857,964
PV Other Costs	£ 670,934	£ 746,686	£ 670,934
Total Cost (including Optimism Bias) (PV)	£ 45,393,061	£ 29,949,339	£ 44,777,245
Value of Benefits	£ 22,320,057	£ 22,430,973	£ 22,430,973
Benefit Cost Ratio (BCR)	0.5	0.7	0.5
PF Score	4%	10%	7%
Further funding required to achieve 100% PF Score	£ 43,545,239	£ 26,966,744	£ 41,794,650
Flood/ erosion impacts			
Number of Residential Properties at risk under 0.1% AEP	59	59	59
Number of Commercial properties at risk under 0.1% AEP	5	5	5
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 32,912	£ 32,912	£ 32,912
Critical Infrastructure	Limited impacts	Limited impacts	Limited impacts
PV Value of Impacts on road and rail	-	-	-

PV Value of Tourism and Recreation Impacts	-	-	-	-
PV Value of Agriculture Impacts	£1,057,133 Worst case scenario 95ha of Grade 2 agricultural land flooded, 16ha of Grade 3 flooded, and 118ha of Grade 4 flooded	£1,052,864 Worst case scenario 95ha of Grade 2 agricultural land flooded, 16ha of Grade 3 flooded, and 118ha of Grade 4 flooded	£1,042,207 Worst case scenario 95ha of Grade 2 agricultural land flooded, 16ha of Grade 3 flooded, and 118ha of Grade 4 flooded	£149,869 Worst case scenario 10ha of Grade 2 agricultural land flooded, 3ha of Grade 3 flooded, and 56ha of Grade 4 flooded
Stakeholders Feedback				
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments	No specific comments
Landowners	Option not suitable	Option not suitable	Option preferred by landowners to protect their property behind the proposed MR site. Also ensures that there is green space for the community	Option preferred by landowners to protect their property behind the proposed MR site. Also ensures that there is green space for the community
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 HWMB maintained	1 HWMB maintained
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA

PV Value of Tourism and Recreation Impacts	-	-	-
PV Value of Agriculture Impacts	£110,916 Worst case scenario 10ha of Grade 2 agricultural land flooded, 3ha of Grade 3 flooded, and 56ha of Grade 4 flooded	-	-
Stakeholders Feedback			
Statutory Stakeholders/ SEG	No specific comments	Potential favourable sites for MR but would require further site specific studies at the next stage.	Potential favourable sites for MR but would require further site specific studies at the next stage.
Landowners	Option preferred by landowners to protect their property behind the proposed MR site. Also ensures that there is green space for the community	Landowners concerned that MR might impact on the future business operations. Other landowner potentially interested in discussing MR further if required	Landowners concerned that MR might impact on the future business operations. Other landowner potentially interested in discussing MR further if required
Technical Feasibility			
Site Specific	n/a	The larger site floods very well during spring tide. Smaller site does not flood over the sprig tide. Potential 1,543m decrease in defence length MR site would create 2ha of saltmarsh and 20ha of mudflat. With 100 years sea level rise there could be 2ha of saltmarsh and 20ha of mudflat.	The larger site floods very well during spring tide. Smaller site does not flood over the sprig tide. Potential 1,543m decrease in defence length MR site would create 2ha of saltmarsh and 20ha of mudflat. With 100 years sea level rise there could be 2ha of saltmarsh and 20ha of mudflat.
Strategy Wide	n/a	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	2 HWMB maintained	2 Some return to natural processes	2 Some return to natural processes
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.
Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 Following the creation of the MR site the development of intertidal habitat will mitigate against the effects of coastal squeeze. However, it is noted that this location is further from the main estuary and SPA/Ramsar area and therefore may not provide the full functionality required from compensation.	3 Following the creation of the MR site the development of intertidal habitat will mitigate against the effects of coastal squeeze. However, it is noted that this location is further from the main estuary and SPA/Ramsar area and therefore may not provide the full functionality required from compensation.

Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
SEA (Strategic Environmental Assessment)				
Historic Environment	1 Historic environment including scheduled monument and listed buildings at risk once the defences fail in year 25.	1 Historic environment including scheduled monument and listed buildings at risk once the defences fail in year 30.	2 Historic environment including scheduled monument and listed buildings at risk from flooding over time with increased sea level rise	4 Historic environment including scheduled monument and listed buildings at reduced risk from flooding
Effects on population	1 Impact on homes, jobs and infrastructure immediately once the defences fail	1 Impact on homes, jobs and infrastructure immediately once the defences fail	2 Impact on homes, jobs and infrastructure over time	3 No impact, community protected
Impact on plans/ programmes	1 Proposed development sites potentially at risk from flooding once the defences fail in year 25.	1 Proposed development sites potentially at risk from flooding once the defences fail in year 30.	2 Proposed development site potentially at risk from flooding over time with increased risk of overtopping due to sea level rise	4 Potential development sites within the benefit area at reduced risk from flooding
Freshwater Biodiversity	1 Risk to the freshwater habitats which include extensive reed beds, open water, fen, grassland, scrub and woodland. This could have significant impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants will be lost and a rare moth, a rare beetle, and 3 rare bee species will be impacted.	1 Risk to the freshwater habitats which include extensive reed beds, open water, fen, grassland, scrub and woodland. This could have significant impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants will be lost and a rare moth, a rare beetle, and 3 rare bee species will be impacted.	2 Increasing risk overtime to the freshwater habitats which include extensive reed beds, open water, fen, grassland, scrub and woodland as the risk of overtopping increases with sea level rise. This could have impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants, a rare moth, a rare beetle, and 3 rare bee species could be at risk overtime.	3 No impact as defences improved and the risk of overtopping is reduced
Saline Biodiversity	4 Potential for intertidal habitat creation once the defences fail	4 Potential for intertidal habitat creation once the defences fail	3 Potential for gradual intertidal habitat creation due to overtopping of the defences with sea level rise	2 Defences improved so no opportunity for intertidal habitat creation
Soil	1 Imminent risk of degradation of agricultural land once the defences fail	1 Imminent risk of degradation of agricultural land once the defences fail	2 Gradual degradation of agricultural land as the risk of overtopping increases with sea level rise	3 No impact as the defences are improved
Groundwater	1 Potential imminent impacts on SPZ once the defences fail. A detailed hydrology and hydrogeological assessment will need to be completed to understand risks to groundwater. Also potential mobilisation of contaminants from the landfill sites once the defences fail.	1 Potential imminent impacts on SPZ once the defences fail. A detailed hydrology and hydrogeological assessment will need to be completed to understand risks to groundwater. Also potential mobilisation of contaminants from the landfill sites once the defences fail.	2 Potential for gradual impacts on SPZ as the risk of overtopping increases with sea level rise. A detailed hydrology and hydrogeological assessment will need to be completed to understand risks to groundwater. Also potential for increasing risk of release of contaminants from the landfill sites as the risk of overtopping increases.	3 SPZ in the area but no impact anticipated as the defences are improved. Also limited risk of release of contaminants from the landfill as the defences are improved.

Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
SEA (Strategic Environmental Assessment)			
Historic Environment	5 Historic environment including scheduled monument and listed buildings at reduced risk from flooding immediately	5 MR scheme should not impact on scheduled monument.	5 MR scheme should not impact on scheduled monument
Effects on population	3 No impact, community protected	2 Agricultural livelihoods potentially at risk, but the rest of the community protected	2 Agricultural livelihoods potentially at risk, but the rest of the community protected
Impact on plans/ programmes	5 Potential development sites within the benefit area at reduced risk from flooding immediately	4 MR site does not affect the potential development sites. Potential development sites within the benefit area at reduced risk from flooding	5 MR site does not affect the potential development sites. Potential development sites within the benefit area at reduced risk from flooding immediately
Freshwater Biodiversity	3 No impact as defences improved and the risk of overtopping is reduced	1 MR will convert some of the freshwater habitat to intertidal habit. This could have impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants, a rare moth, a rare beetle, and 3 rare bee species could be at risk.	1 MR will convert some of the freshwater habitat to intertidal habit. This could have impacts on breeding birds and wintering wildfowl and waders. Additionally a number of scarce wetland plants, a rare moth, a rare beetle, and 3 rare bee species could be at risk.
Saline Biodiversity	2 Defences improved so no opportunity for intertidal habitat creation	4 Development of MR site will lead to the creation of new intertidal habitat.	4 Development of MR site will lead to the creation of new intertidal habitat.
Soil	3 No impact as the defences are improved	1 Loss of arable land with development of MR site	1 Loss of arable land with development of MR site
Groundwater	3 SPZ in the area but no impact anticipated as the defences are improved. Also limited risk of release of contaminants from the landfill as the defences are improved.	1 Potential impacts on SPZ with the development of the MR site. A detailed hydrology and hydrogeological assessment will need to be completed to understand risks to groundwater. Limited risk of release of contaminants from the landfill site as the defences are improved.	1 Potential impacts on SPZ with the development of the MR site. A detailed hydrology and hydrogeological assessment will need to be completed to understand risks to groundwater. Limited risk of release of contaminants from the landfill site as the defences are improved.

Landscape (visual impact)	4 Change after the defences fail but reverting to natural processes is assumed a benefit	4 Change after the defences fail but reverting to natural processes is assumed a benefit	3 Very gradual change as the risk of overtopping increases with sea level rise	3 Incremental change as the height of the wall is increased in phases
Carbon Storage	2 Loss of woodland carbon in north of benefit area once the defences fail	2 Loss of woodland carbon in north of benefit area once the defences fail	2 Gradual loss of woodland carbon due to increased risk of overtopping of the defences due to sea level rise.	2 Incremental increase in carbon cost from construction
Ecosystem Services				
Qualitative Score from Ecosystem Services	-58	-58	-39	-8
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. climate regulation, aesthetic value, fisheries habitat) outweigh limited 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	Y	Y

Landscape (visual impact)	2 Visual impact from increase in wall height	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 Immediate increase in carbon cost from construction	2 Incremental increase in carbon cost from construction	1 Immediate increase in carbon cost from construction
Ecosystem Services			
Qualitative Score from Ecosystem Services Assessment	-10	33	31
Comments	Degradation in various ES (e.g. climate regulation, aesthetic value, fisheries habitat) outweigh limited enhancement opportunities (e.g. erosion regulation, natural hazard regulation)	Enhancement for many ES (e.g. climate regulation, water flow regulation natural hazard protection, recreation and tourism, fishery habitat) outweigh degradation risk in limited number of ES (e.g. freshwater provision, food provision)	Enhancement for many ES (e.g. climate regulation, water flow regulation natural hazard protection, recreation and tourism, fishery 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	Y
2 - Natura 2000 sites	N	Y	Y
3- Reduce maintenance	Y	Y	Y
4 - WFD	N	Y	Y
5 - Local Plans	Y	Y	Y

Environmental Scores				
100 = best option, 0 = worst option				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	0
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	50	50	50	50
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	50	50	50	50
Habitat Connectivity	50	50	50	50
SEA (Strategic Environmental Assessment)				
Historic Environment	0	0	25	75
Effects on population	0	0	25	50
Impact on plans/ programmes	0	0	25	75
Freshwater Biodiversity	0	0	25	50
Saline Biodiversity	75	75	50	25
Soil	0	0	25	50
Groundwater	0	0	25	50
Landscape (visual impact)	75	75	50	50
Carbon Storage	25	25	25	25
Total	**400**	**400**	**475**	**650**

Environmental Scores			
100 = best option, 0 = worst option			
Option	**e) Raise (upgrade) embankments, walls and flood gates**	**f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.**	**g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.**
WFD (Water Framework Directive)			
Compliance assessment outcome	25	25	25
HRA (Habitats Regulation Assessment)			
Impact on SPA/ Ramsar qualifying features	50	50	50
Impacts on freshwater habitats	50	50	50
Impacts on intertidal habitats	50	50	50
Habitat Connectivity	50	50	50
SEA (Strategic Environmental Assessment)			
Historic Environment	100	100	100
Effects on population	50	25	25
Impact on plans/ programmes	100	75	100
Freshwater Biodiversity	50	0	0
Saline Biodiversity	25	75	75
Soil	50	0	0
Groundwater	50	0	0
Landscape (visual impact)	25	0	0
Carbon Storage	0	25	0
Total	**675**	**525**	**525**

Summary of Results				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls and flood gates**	**d) Raise (sustain) embankments, walls and flood gates**
Costs	£ -	£ 701,000	£ 7,374,829	£ 29,547,711
Benefits	£ -	£ 317,000	£ 3,644,841	£ 22,281,103
NPV	£ -	-£ 384,000	-£ 3,729,989	-£ 7,266,607
BCR	0.0	0.5	0.5	0.8
Environmental Scoring	400	400	475	650

Summary of Results			
Option	**e) Raise (upgrade) embankments, walls and flood gates**	**f) Construct new setback embankment at identified managed realignment sites. Raise (sustain) embankments, walls and revetments around other areas.**	**g) Construct new setback embankment at identified managed realignment sites. Raise (upgrade) embankments, walls and revetments around other areas.**
Costs	£ 45,393,061	£ 29,949,339	£ 44,777,245
Benefits	£ 22,320,057	£ 22,430,973	£ 22,430,973
NPV	-£ 23,073,005	-£ 7,518,367	-£ 22,346,272
BCR	0.5	0.7	0.5
Environmental Scoring	675	525	525

Preferred Option Decision Making		
DLO	**Leading Option at DLO Stage**	**Justification for Leading Option**
DLO1 - Economic Assessment	No Active Intervention (NAI).	The BCR is less than one for all the options, so there is no economically viable option.
DLO2 - Economic Sensitivities	Raise (sustain) embankments, walls and flood gates in localised areas.	It can be justified to HTL in small sections where there is a concentration of assets at risk. NAI would be applied in the other sections.
DLO3 - Review of Compensatory Intertidal		
DLO4 - Review of Compensatory Freshwater		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name

Raise (sustain) embankments, walls and flood gates in localised areas.

Preferred Option

Localised raising of the defences around Aylesford and Wouldham to protect properties and assets at risk of flooding against a 1%AEP with sea level rise. The localised defences will be raised in year 8 to 5.0m AOD and then in year 50 to 6.0m AOD to continue to provide protection in line with sea level rise. The rest of the BA will have a NAI approach and management will cease on the defences.

Justification

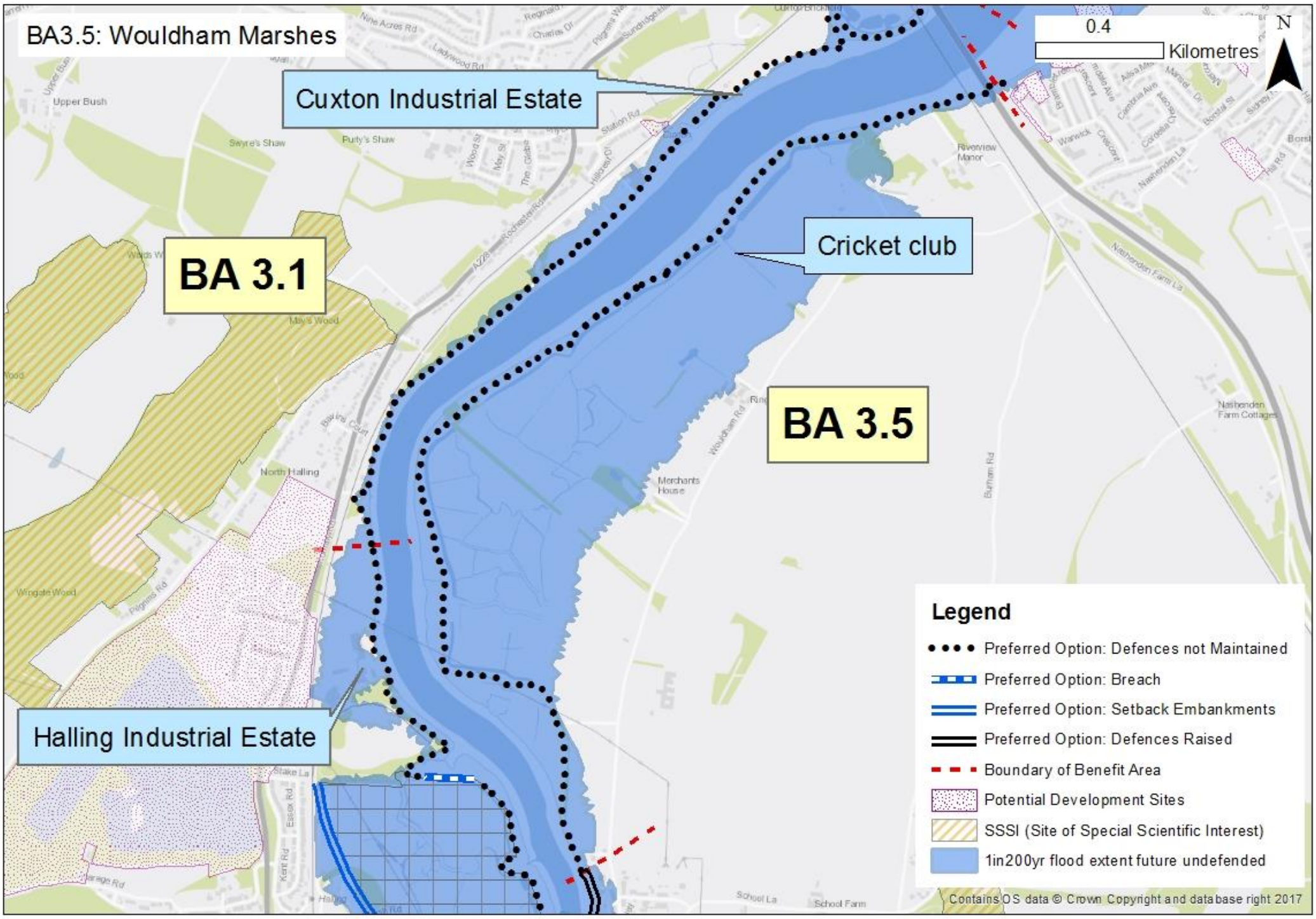
Localised HTL sensitivity provides the only short listed option with a positive NPV and a BCR above 1. This option will provide protection to all residential properties at risk of flooding to at least a 1% AEP. In the NAI areas there is limited assets at risk due to the rising ground.
There is a higher 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.

Preferred Option Costs

Cost	Benefits	BCR	PF Score
£ 10,708,345	**£ 21,242,659**	**1.98**	**16%**

Benefit Area Name	3 - Upper Medway
Benefit Unit Name	3.5 - Wouldham Marshes - MR site at Wouldham Marshes (site 12)
Frontage Length	3.7 km
Defence Structure Type	Earth embankment, masonry wall
Min Standard of Protection (AEP%)	0.5
Residual Life (years)	0

	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 suggests MR for all three epochs. This Policy Unit actually suggests MR with localised HTL for all epochs. HTL is around the northern section of the unit to protect the base of the Medway Bridge and farm in the flood bank, and in the southern section to protect the road which runs near to the edge of the river. Perhaps less stakeholder concern if it presented this way around.		



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	1
Commercial & Industrial	1	1	2	2
Agricultural (Ha)	118	125	127	131
Key Infrastructure	Brambletree Cottages Historic Landfill (inert)	Brambletree Cottages Historic Landfill (inert)	Brambletree Cottages Historic Landfill (inert)	Brambletree Cottages Historic Landfill (inert)
Social and Environmental Considerations	Cricket Club	Cricket Club	Cricket Club	Cricket Club

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
	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 embankment, wall and flood gates	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= Standard of protection of defences very low and residual life of defences low.	Y= as baseline. Following year 5 a Do nothing scenario would occur due to failure of the defences.	Y= low standard of protection and residual life of defences so capital works required.	N= no significant assets at risk to warrant improvement to defences.	N= no significant assets at risk to warrant upgrade.

Long List of Options				
	f) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and flood gates around other areas.	g) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and sustain SOP of existing embankments, walls and flood gates around other areas.	h) Maintain embankments, walls and flood gates until year 20. Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and flood gates around other areas.	i) Construct new setback embankments at identified managed realignment sites and maintain SOP (capital) of existing embankments, walls and flood gates around other areas.
To what extent does the option meet the objectives?				
1- Reduce Flood Risk	N*	N*	N*	Y
2 - Natura 2000 sites	Y	Y	Y	Y
3- Reduce maintenance	TBC**	TBC**	TBC**	TBC**
4 - WFD	TBC	TBC	TBC	TBC
5 - Local Plans	-	-	-	-
Comment and decision on whether taken forward to shortlist	N= defences low zero residual life so unlikely to be economically viable to maintain for first epoch and then breach.	N= defences low zero residual life so unlikely to be economically viable to maintain for first epoch and then breach.	N= defences low zero residual life so unlikely to be economically viable to maintain for first epoch and then breach.	Y = realignment sites to be considered further.

Long List of Options		
	j) Construct new setback embankments at identified managed realignment sites and sustain embankments, walls and flood gates around other areas.	k) Construct new setback embankments at identified managed realignment sites and upgrade SOP of existing embankments, walls and flood gates around other areas.
To what extent does the option meet the objectives?		
1- Reduce Flood Risk	Y	Y
2 - Natura 2000 sites	Y	Y
3- Reduce maintenance	TBC**	TBC**
4 - WFD	TBC	TBC
5 - Local Plans	-	-
Comment and decision on whether taken forward to shortlist	N= no significant assets at risk to warrant improvement to defences.	N= no significant assets at risk to warrant upgrade.

** - 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 and walls
d) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas.

Assessment of Short List				
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments and walls**	**d) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas. MR site at Wouldham Marshes (site 12)**
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	Development of MR site. Capital works undertaken on remaining defences to maintain the current defences
Technical Issue	Defences have no residual life (0 years). Historic Landfill (inert) potentially at risk	Defences have no residual life (0 years). Historic Landfill (inert) potentially at risk	Defences have no residual life (0 years). Historic Landfill (inert) potentially at risk	Defences have no residual life (0 years) The MR site ties back into high ground and is undesignated. Based on current sea levels the MR site would create 37ha of saltmarsh and 40 ha of mudflat. The site is not internationally designated so no compensatory habitat legally required. Impacts on historic landfill (inert) will need to be considered at the next stage.
Assumptions/ Uncertainties	Assumes that all management and maintenance is ceased.	Ongoing maintenance. Maintenance not sufficient to reduce risk of failure after year 5.	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.	MR site to provide at least 5% 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%	>50%	50%	5%
Value of Economics				
PV Capital Costs	£ -	£ -	£ 1,336,043	£ 6,149,310
PV Maintenance Costs	£ -	£ 21,550	£ 182,220	£ 109,748
PV Other Costs	£ -	£ -	£ 600,000	£ 856,513
Total Cost (including Optimism Bias) (PV)	£ -	£ 34,480	£ 3,389,221	£ 11,384,913
Value of Benefits	£ -	£ 71,404	£ 159,644	£ 398,029
Benefit Cost Ratio (BCR)	0.0	2.1	0.0	0.0
PF Score	0%	12%	0%	33%
Further funding required to achieve 100% PF	£ -	£ 30,000	£ 3,380,352	£ 7,604,913
Flood/ erosion impacts				
Number of Residential Properties at risk under	6	6	2	2
Number of Commercial properties at risk under	2	2	2	2
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 53,099	£ 14,377	£ 39,303	£ 39,303
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	No assets at risk	No assets at risk	No assets at risk	No assets at risk
PV Value of Tourism and Recreation Impacts	No assets at risk	No assets at risk	No assets at risk	No assets at risk
PV Value of Agriculture Impacts	£384,232 Worst case scenario 27ha of Grade 2 agricultural land flooded and 107ha of Grade 4 flooded	£351,551 Worst case scenario 27ha of Grade 2 agricultural land flooded and 107ha of Grade 4 flooded	£238,385 Worst case scenario 27ha of Grade 2 agricultural land flooded and 107ha of Grade 4 flooded	0 Value of agricultural land included in cost for MR site

Stakeholders Feedback				
Statutory Stakeholders/ SEG	No specific comments	No specific comments	No specific comments	Potential favourable sites for MR but would require further site specific studies at the next stage.
Landowners	Landowners prefer HTL	Landowners prefer HTL	Landowners prefer HTL as the area produces their most profitable crops. Also although the site is not designated it provides connectivity with the surrounding designated areas	Landowners would not like MR in this area
Technical Feasibility				
Site Specific	n/a	n/a	n/a	The site floods well during spring tide. Potential 1,268m decrease in defence length. MR site would create 37ha of saltmarsh and 40ha of mudflat.
Strategy Wide	n/a	n/a	n/a	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	2 Some return to natural processes but uncontrolled	2 Some return to natural processes but uncontrolled	1 Heavily Modified Water Body (HMWB) maintained	4 Some return to natural processes
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.	3 This option is not predicted to have any direct or indirect impacts on any Natura 2000 sites and their constituent qualifying features.
Impacts on freshwater habitats	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 n/a - no designated freshwater habitats in the BA	3 The Managed Realignment is not over Natura 2000 sites, so compensatory habitat would not be required under this legislation.

Impacts on intertidal habitats	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 n/a - no designated intertidal habitats in the BA	3 Following the creation of the MR site the development of intertidal habitat will mitigate against the effects of coastal squeeze. However, it is noted that this location is further from the main estuary and SPA/Ramsar area and therefore may not provide the full functionality required from compensation.
Habitat Connectivity	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.	3 No impacts, either beneficial or adverse.
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 The historical interest within the site occurs in the Upper and Lower Culand Pits. However this site is outside of the flood risk area, so not affected by MR.
Effects on population	1 Loss of recreational asset (cricket club), loss of agricultural livelihoods when the defences fail	1 Loss of recreational asset (cricket club), loss of agricultural livelihoods when the defences fail	2 Gradual loss of recreational asset (cricket club), loss of agricultural livelihoods due to increased risk of overtopping	2 Potential loss or change to agricultural practices from the creation of the MR site
Impact on plans/ programmes	3 Benefit area does not coincide with any proposed development sites	3 Benefit area does not coincide with any proposed development sites	3 Benefit area does not coincide with any proposed development sites	3 Benefit area does not coincide with any proposed development sites
Freshwater Biodiversity	1 Impact on freshwater grazing marsh which support a number of rare and scarce species of plants and invertebrates (unprotected) once the defences fail	1 Impact on freshwater grazing marsh which support a number of rare and scarce species of plants and invertebrates (unprotected) once the defences fail	2 Impact over time on freshwater grazing marsh which support a number of rare and scarce species of plants and invertebrates due to increased risk from overtopping	1 creation of MR site will result in the conversion of freshwater habitat to intertidal habitat.
Saline Biodiversity	4 Potential creation of intertidal habitat once the defences fail	4 Potential creation of intertidal habitat once the defences fail	2 Potential coastal squeeze as the defences are held, but there is the potential for intertidal habitat to develop behind the defences as the risk of overtopping increases with sea level rise.	5 Potential creation of intertidal habitat
Soil	1 Imminent risk of degradation of agricultural land once the defences fail (year 0)	1 Imminent risk of degradation of agricultural land once the defences fail (year 5)	2 Degradation of agricultural land overtime due to increased risk of overtopping	1 MR site development will lead to the salinization of agricultural land
Groundwater	1 Potential imminent risk to the SPZ (defences fail in year 0). However a detailed hydrology and hydrogeological assessment will be required to confirm understanding.	1 Potential imminent risk to the SPZ (defences fail in year 5). However a detailed hydrology and hydrogeological assessment will be required to confirm understanding.	2 Potential impacts on SPZ overtime as the risk of overtopping increases. Detailed hydrology and hydrogeological assessment will be required to confirm understanding.	1 Potential risk to the SPZ following creation of MR site. A detailed hydrology and hydrogeological assessment will be required to confirm understanding.

Landscape (visual impact)	4 Gradual change to freshwater landscape type from intermittent overtopping positive or negative depending on nature of changes. Potential mobilisation of contaminants from small landfill site at the north of the BA.	4 Gradual change to freshwater landscape type from intermittent overtopping positive or negative depending on nature of changes. Potential mobilisation of contaminants from small landfill site at the north of the BA.	3 Very gradual change to freshwater landscape type from intermittent overtopping positive or negative depending on nature of changes. Potential mobilisation of contaminants from small landfill site at the north of the BA overtime.	1 Significant landscape change from managed realignment. Positive/ negative effects depending on view and visual receptors, but giving back to natural processes with landscape mitigation - assumed a benefit. Potential mobilisation of contaminants from small landfill site at the north of the BA.
Carbon Storage	2 Once the defences fail (year 0) there will be a loss of carbon storage in marshland as it is converted to mudflat	2 Once the defences fail (year 5) there will be a loss of carbon storage in marshland as it is converted to mudflat	3 Gradual loss of carbon storage in marshland, as the risk of overtopping increases with sea level rise and converts marshland to mudflat	1 Loss of carbon storage in marshland as it is converted to mudflat. Carbon cost from construction

Ecosystem Services				
Qualitative Score from Ecosystem Services Assessment	-37	-37	-24	8
Comments	Major degradation in ecosystem services including freshwater provision, water flow regulation, natural hazard regulation and tourism. This outweighs the limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in ecosystem services including freshwater provision, water flow regulation, natural hazard regulation and tourism. This outweighs the limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate degradation in ecosystem services including freshwater provision, water flow regulation, natural hazard regulation and tourism. This outweighs the limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Enhancement in certain ecosystem services e.g. climate regulation, water flow regulation, erosion regulation, aesthetic value, fisheries habitat. This outweighs the degradation risks for other ecosystem services e.g. freshwater provision, 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	Y
3- Reduce maintenance	Y	Y	Y	Y
4 - WFD	N	N	N	Y
5 - Local Plans	N	N	Y	Y

Environmental Scores

100 = best option, 0 = worst option

Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls	d) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas. MR site at Wouldham Marshes (site 12)
WFD (Water Framework Directive)				
Compliance assessment outcome	25	25	0	75
HRA (Habitats Regulation Assessment)				
Impact on SPA/ Ramsar qualifying features	50	50	50	50
Impacts on freshwater habitats	50	50	50	50
Impacts on intertidal habitats	50	50	50	50
Habitat Connectivity	50	50	50	50
SEA (Strategic Environmental Assessment)				
Historic Environment	50	50	50	50
Effects on population	0	0	25	25
Impact on plans/ programmes	50	50	50	50
Freshwater Biodiversity	0	0	25	0
Saline Biodiversity	75	75	25	100
Soil	0	0	25	0
Groundwater	0	0	25	0
Landscape (visual impact)	75	75	50	0
Carbon Storage	25	25	50	0
Total	**500**	**500**	**525**	**500**

Summary of Results

Option	a) Do nothing	b) Do minimum	c) Maintain (capital) embankments and walls	d) Construct new setback embankments at identified managed realignment sites and maintain (capital) embankments, walls and flood gates around other areas. MR site at Wouldham Marshes (site 12)
Costs	£ -	£ 34,480	£ 3,389,221	£ 11,384,913
Benefits	£ -	£ 71,404	£ 159,644	£ 398,029
NPV	£ -	£ 36,924	-£ 3,229,578	-£ 10,986,884
BCR	0.0	2.1	0.0	0.0
Environmental Scoring	500	500	525	500

Preferred Option Decision Making		
DLO	**Leading Option at DLO Stage**	**Justification for Leading Option**
DLO1 - Economic Assessment	No Active Intervention (NAI).	Do minimum only provides maintenance of defences for 5 years due to the low residual life of the existing embankments. Therefore overall policy in epoch 1 would be NAI.
DLO2 - Economic Sensitivities		
DLO3 - Review of Compensatory Intertidal Habitat Requirements	Construct new setback embankments at identified managed realignment site at North Wouldham Marshes and maintain (with capital works) embankments, walls and flood gates around other areas.	The high PF score prioritises this site to be taken forward. The hectares are required to help compensate for coastal squeeze across the Strategy in the first epoch.
DLO4 - Review of Compensatory Freshwater Habitat Requirements		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase	No Active Intervention (NAI).	Managed Realignment will not provide the required functionality for SPA/Ramsar compensation and therefore cannot be justified. No short listed options were identified which would provide increased protection and with BCRs above one.

Preferred Option Name

No Active Intervention (NAI).

Preferred Option

All maintenance will be ceased and the current defences will not be maintained. There will be an increased risk of overtopping and the defences will be at risk from failure from year 5 causing increased risk of overflow flooding.

Justification

Do minimum only provides maintenance of defences for 5 years due to the low residual life of the existing embankments. Therefore, overall policy in epoch 1 would be No Active Intervention.

Preferred Option Costs

Cost	Benefits	BCR	PF Score
N/A	N/A	N/A	N/A