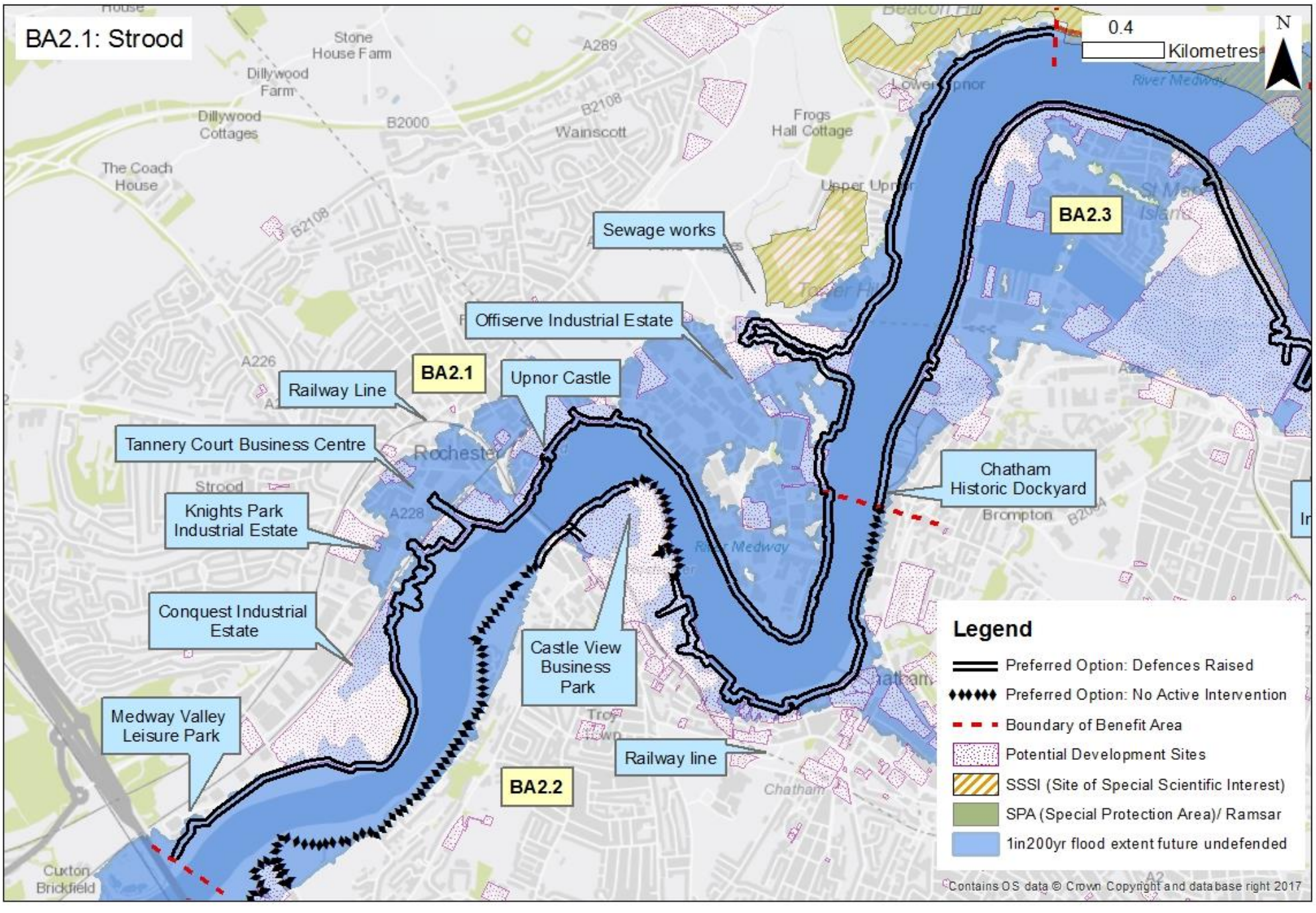
Benefit Area Name	2 - Medway Towns
Benefit Unit Name	2.1 - Lower Upnor to Medway Bridge
Frontage Length	9.2 km
Defence Structure Type	Concrete walls, earth embankments, masonry walls, rock revetments, sheet pile walls
Min Standard of Protection (AEP%)	50%
Residual Life (years)	20

	0-20 years	**20-50 years**	**50-100 years**
SMP Policy	HTL	HTL	HTL
Aiming to comply with policy?	Yes - agree with SMP		
Comment	Agree with SMP: HTL for all epochs due to assets protected and future regeneration as part of Local Plan.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		**0.5% AEP (undefended)**	
	Current Year	**100 year**	**Current Year**	**100 Years**
Residential	0	90	157	445
Commercial & Industrial	7	175	203	729
Agricultural (Ha)	6	11	12	50
Key Infrastructure	None	Tannery Court Business Centre, Conquest Industrial Estate, B2002, Strood Station and railway, Railway line between Strood & Rochester, Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert)	Tannery Court Business Centre, Conquest Industrial Estate, B2002, Strood Station and railway, Railway line between Strood & Rochester, Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert)	As previous plus: Offiserve Industrial Estate, Knights Park Industrial Estate, Frindsbury Peninsula Historic Landfill (inert) Land Adjacent To Antony's Way Historic Landfill (inert), Temple Marsh Historic Landfill (inert, industrial)
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	Y	Take forward - public access and interaction with the river front is required. Demountable defences could support local regeneration plans. However potential increased cost
	Install temporary defences	N	Exclude - temporary defences are not suitable in an urban area as a long-term protection method especially due to aims of local development plan.
	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	N/A - no timber structures to maintain.
	Construct a tidal barrier	N	Exclude- likely to have significant environmental impacts, including on water quality (WFD), change in sedimentation in Estuary with wider impacts (environment, dredging, maintenance, navigation etc.). In addition likely to have significant costs.
Non-Structural	Implement monitoring	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Implement flood warning system	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Land use planning	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Adaptation measures	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Development control	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Emergency response plans	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Monitoring for health and safety only	N	Not suitable as a single measure to implement the SMP policy.

Long List of Options					
	a) Do nothing	b) Ongoing maintenance of embankments, walls, flood gates and revetments	c) Maintain SOP (capital) embankments, walls, flood gates and revetments	d) Raise (sustain SOP) embankments, walls, flood gates and revetments (including demountable defences)	e) Raise (upgrade SOP) embankments, walls, flood gates and revetments (including demountable defences)
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	NA*	NA*	NA*	NA*	NA*
3- Reduce maintenance	Y	N	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. Very low residual life of defences (min SOP=2, min residual life=0 years).	Y= as baseline. Following year 25 a Do nothing scenario would occur due to the failure of the defences.	Y= SOP and residual life very low, therefore defences would require capital maintenance over 100 years. HTL options required in line with the SMP to protect the significant assets at risk.	Y= SOP and residual life very low, therefore defences would require capital maintenance over 100 years. HTL options required in line with the SMP to protect the significant assets at risk.	Y= SOP and residual life very low, therefore defences would require capital maintenance over 100 years. HTL options required in line with the SMP to protect the significant assets at risk.

* no Natura 2000 sites present

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

Assessment of Short List					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates 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 maintain the current defences.	Capital works are undertaken to maintain the current defences.
Technical Issue	Defences have 20 years residual life. Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert), and Temple Marsh Historic Landfill (inert, industrial) potentially at risk.	Defences have 20 years residual life. Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert), and Temple Marsh Historic Landfill (inert, industrial) potentially at risk.	Defences have 20 years residual life. Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert), and Temple Marsh Historic Landfill (inert, industrial) potentially at risk.	Defences have 20 years residual life. Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert), and Temple Marsh Historic Landfill (inert, industrial) potentially at risk.	Defences have 20 years residual life. Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert), and Temple Marsh Historic Landfill (inert, industrial) potentially at risk.
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.	The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.
SOP Provided (% AEP)	>50%	>50%	50%	1.0%	1.0%
Value of Economics					
PV Capital Costs	£ -	0	£ 7,413,145	£ 10,313,399	£ 18,316,686
PV Maintenance Costs	£ -	£ 540,000	£ 905,202	£ 1,076,254	£ 1,551,160
PV Other Costs	£ -	£ -	£ 388,647	£ 725,868	£ 650,673
Total Cost (including Optimism Bias) (PV)	£ -	£ 864,000	£ 13,931,191	£ 19,384,834	£ 32,829,630
Value of Benefits	£ -	£ 276,000	£ 10,472,242	£ 38,819,879	£ 40,747,416
Benefit Cost Ratio (BCR)	0.0	0.3	0.8	2.0	1.2
PF Score	0%	2%	6%	15%	9%

Further funding required to achieve 100% PF Score	£ -	£ 849,000	£ 13,133,836	£ 16,468,401	£ 29,806,111
Flood/ erosion impacts					
Number of Residential Properties at risk under 0.1% AEP	487	487	475	0	0
Number of Commercial properties at risk under 0.1% AEP	917	917	908	0	6
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 39,471,085	£ 38,327,061	£ 29,016,922	£ 1,712,678.40	£ 2,747.05
Critical Infrastructure	Tannery Court Business Centre, Conquest Industrial Estate, B2002, Strood Station and railway, Railway line between Strood & Rochester	Tannery Court Business Centre, Conquest Industrial Estate, B2002, Strood Station and railway, Railway line between Strood & Rochester	Infrastructure at risk over time with sea level rise	Some risk to infrastructure towards end of first phase of works	Infrastructure protected
PV Value of Impacts on road and rail	£1,262,377 A289 (leading to Medway Tunnel) A226 (leading to High Street) Rail to Isle of Grain	£1,247,806 A289 (leading to Medway Tunnel) A226 (leading to High Street) Rail to Isle of Grain	£1,247,806 A289 (leading to Medway Tunnel) A226 (leading to High Street) Rail to Isle of Grain	£217,471 A226 (leading to High Street) Rail to Isle of Grain	-
PV Value of Tourism and Recreation Impacts	-	£ 882,938	-	-	-
PV Value of Agriculture Impacts	£23,530 Worst case scenario 2ha of Grade 1 agricultural land flooded, 14ha of Grade 3 flooded, 0.3ha of Grade 4 flooded, and 42ha of Grade 5 flooded	£23,326 Worst case scenario 2ha of Grade 1 agricultural land flooded, 14ha of Grade 3 flooded, 0.3ha of Grade 4 flooded, and 42ha of Grade 5 flooded	£20,021 Worst case scenario 2ha of Grade 1 agricultural land flooded, 14ha of Grade 3 flooded, and 42ha of Grade 5 flooded	£6,964 Worst case scenario 4.33ha of Grade 3 agricultural land flooded, 0.3ha of Grade 4 flooded, and 10ha of Grade 5 fllooded	£6,828 Worst case scenario 1.6ha of Grade 3 agricultural land flooded, 0.3ha of Grade 4 flooded, and 3.5ha of Grade 5 flooded
Stakeholders Feedback					
Statutory Stakeholders/ SEG	Development sites not protected	Development sites not protected	Development sites not protected overtime	Option preferred to protect the development sites in the area	Option preferred to protect the development sites in the area
Landowners	No specific comments	No specific comments	No specific comments	No specific comments	No specific comments
Technical Feasibility					
Site Specific	n/a	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)					
Compliance assessment outcome	2 Some deterioration of Heavily Modified Water Body (HMWB) but uncontrolled	2 Some deterioration of Heavily Modified Water Body (HMWB) but uncontrolled	1 Heavily Modified Water Body (HMWB) maintained	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.	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	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	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.	3 No impacts, either beneficial or adverse.
SEA (Strategic Environmental Assessment)					
Historic Environment	1 Some assets within floodplain at risk following the failure of the defences in year 20. Majority of assets not in floodplain but would affect setting and visitor access	1 Some assets within floodplain at risk following the failure of the defences in year 25. Majority of assets not in floodplain but would affect setting and visitor access	2 Risk to assets within floodplain overtime due to increased risk of overtopping from sea level rise. Majority not in floodplain but would affect setting and visitor access	4 Protection of historic assets due to improvements to defences	4 Protection of historic assets due to improvements to defences
Effects on population	1 Community at risk following the failure of defences in year 20 due to potential loss of community facilities, affecting human health	1 Community at risk following the failure of defences in year 25 due to potential loss of community facilities, affecting human health	2 Community at risk overtime due to potential loss of community facilities, affecting human health	4 Reduced risk for community due to protection of community facilities in line with climate change	5 Reduced risk for community due to protection of community facilities in line with climate change
Impact on plans/ programmes	1 Potential development sites within the benefit area will be at risk of flooding following the failure of the defences in year 20.	1 Potential development sites within the benefit area will be at risk of flooding following the failure of the defences in year 25.	2 Potential development sites within the benefit area may be at risk from flooding overtime with the increased risks from overtopping.	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 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation
Saline Biodiversity	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation
Soil	1 Loss of agricultural land following the failure of the defences in year 20 (including grade 1 agricultural land).	1 Loss of agricultural land following the failure of the defences in year 25 (including grade 1 agricultural land).	2 Potential gradual risk to agricultural land due to increased risk from overtopping in line with sea level rise.	4 Agricultural land protected as the defences are improved.	5 Agricultural land protected immediately

Groundwater	1 Risk to groundwater is high once the defences fail in year 20. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally potential release of contaminants from the landfill sites once the defences fail	1 Risk to groundwater is high once the defences fail in year 25. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally potential release of contaminants from the landfill sites once the defences fail.	2 Gradual increase in the risk to groundwater due to overtopping of defences with sea level rise. A detailed understanding of the links between surface and groundwater would be required to mitigate risks. Additionally increasing risk of release of contaminants as the defences are at increased risk	4 Groundwater and landfill sites should not be at risk	5 Groundwater and landfill sites should not be at risk, and protected from increased SOP immediately
Landscape (visual impact)	2 Potential loss of current townscape character once the defences fail	2 Potential loss of current townscape character once the defences fail	3 Potential gradual loss of current townscape character due to increased risk of overtopping overtime	2 Protection of current townscape character. Effects also depend on height and materials chosen to raise the walls which may affect the historical setting	2 Protection of current townscape character. Effects also depend on height and materials chosen to raise the walls which may affect the historical setting
Carbon Storage	3 No impact	3 No impact	2 Some carbon cost generated from maintenance	2 Some carbon cost generated from maintenance and construction, but this is phased throughout the 100 year life of the scheme	1 Some carbon cost generated from maintenance and construction depending on defence height
Ecosystem Services					
Qualitative Score from Ecosystem Services Assessment	-47	-47	-32	-3	-4
Comments	Major degradation in certain ES (e.g. freshwater provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in certain ES (e.g. freshwater provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate degradation in certain ES (e.g. freshwater provision, water flow regulation, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) roughly balance with risks of minor degradation in many services (e.g. genetic resource provision, climate regulation, aesthetic value, provision of habitat for conservation and fisheries habitat)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) roughly balance with risks of minor degradation in many services (e.g. genetic resource provision, climate regulation, aesthetic value, provision of habitat for conservation and fisheries habitat)
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	N	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y	Y
4 - WFD	N	N	N	N	N
5 - Local Plans	N	N	Y	Y	Y

Environmental Scores					
100 = best option, 0 = worst option					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates and revetments**
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	75	75
Effects on population	0	0	25	75	75
Impact on plans/ programmes	0	0	25	75	100
Freshwater Biodiversity	50	50	50	50	50
Saline Biodiversity	50	50	50	50	50
Soil	0	0	25	75	100
Groundwater	0	0	25	75	100
Landscape (visual impact)	25	25	50	25	25
Carbon Storage	50	50	25	25	0
Total	**400**	**400**	**500**	**725**	**775**

Summary of Results					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates and revetments**
Costs	£ -	£ 864,000	£ 13,931,191	£ 19,384,834	£ 32,829,630
Benefits	£ -	£ 276,000	£ 10,472,242	£ 38,819,879	£ 40,747,416
NPV	£ -	£ 588,000	-£ 3,458,950	£ 19,435,044	£ 7,917,786
BCR	0.0	0.3	0.8	2.0	1.2
Environmental Scoring	400	400	500	725	775

Preferred Option Decision Making		
DLO	**Leading Option at DLO Stage**	**Justification for Leading Option**
DLO1 - Economic Assessment	Raise (sustain) embankments, walls, flood gates and revetments.	This option has the highest BCR, however there is still a significant amount of contributions that will be required to allow the scheme to progress. It is also ranked second environmentally.
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
Raise (sustain) embankments, walls, flood gates and revetments.

Preferred Option
This option involves improving the current SoP provided by the defences to 1% AEP SoP with sea level rise; in year 9 to 5.1m AOD and then in year 50 to 6.2m AOD to continue to provide protection in line with sea level rise.

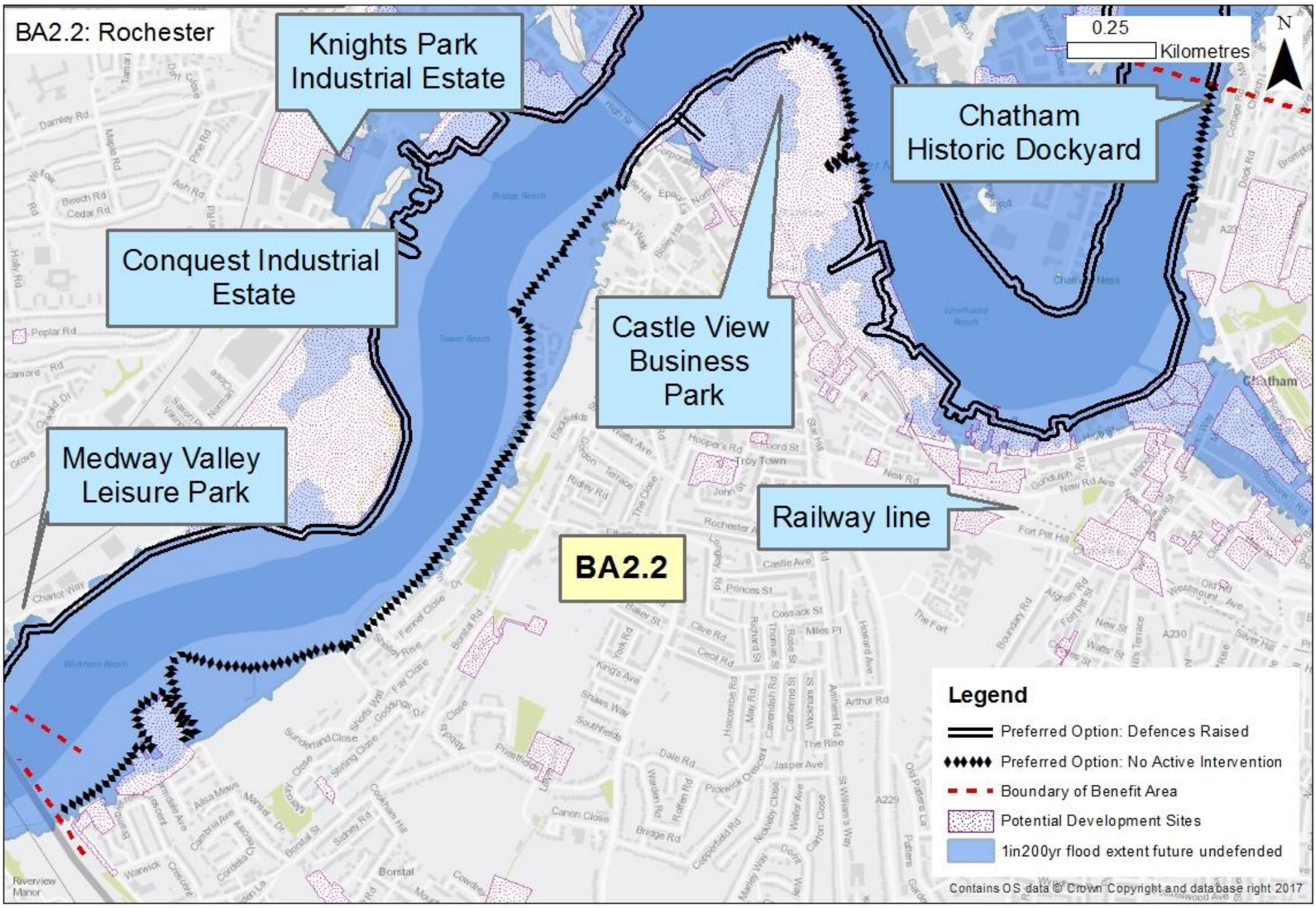
Justification
This option has the highest BCR, NPV and a high incremental BCR, However it is to be noted that there is still a significant amount of contributions that will be required to allow the scheme to progress. It has one of the highest environmental ranking from the short list of options. There is a higher economic justification for raising the defences in the short term rather than waiting for defences to reach their residual life to provide increased flood risk protection in the short term.

Preferred Option Costs

Cost	Benefits	BCR	PF Score
£ 20,534,505	**£ 38,819,879**	**1.89**	**14%**

Benefit Area Name	2 - Medway Towns
Benefit Unit Name	2.2 - Medway Bridge to West St Mary's Island
Frontage Length	6.6 km
Defence Structure Type	Pilled walls, raised embankments, concrete wall, raised wall defence, flood gates, rock armour and concrete revetment
Min Standard of Protection (AEP%)	50%
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 nature of assets protected.		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		**0.5% AEP (undefended)**	
	Current Year	**100 year**	**Current Year**	**100 Years**
Residential	12	97	126	205
Commercial & Industrial	7	19	39	257
Agricultural (Ha)	0	0	0	0
Key Infrastructure	none	Castle View Business Park	Castle View Business Park	Castle View Business Park, Dock Road
Social and Environmental Considerations	Baty's Marsh Local Nature Reserve (landward)	Baty's Marsh Local Nature Reserve (landward)	Baty's Marsh Local Nature Reserve (landward)	Baty's Marsh Local Nature Reserve (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 - temporary defences are not suitable in an urban area as a long-term protection method especially due to aims of local development plan.
	Beach recharge (sand or shingle)	N	Exclude - not appropriate for this location.
	Construct rock groynes	N	Exclude - not appropriate for this location.
	Maintain rock groynes	N	Exclude - not appropriate for this location.
	Construct timber structures	N	Exclude - not appropriate for this location.
	Maintain timber structures	N	Exclude - not appropriate for this location.
	Construct a tidal barrier	N	Exclude- likely to have significant environmental impacts, including on water quality (WFD), change in sedimentation in Estuary with wider impacts (environment, dredging, maintenance, navigation etc.). In addition likely to have significant costs.
Non-Structural	Implement monitoring	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Implement flood warning system	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Land use planning	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Adaptation measures	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Development control	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Emergency response plans	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures.
	Monitoring for health and safety only	N	Not suitable as a single measure to implement the SMP policy.

Long List of Options					
	a) Do nothing	**b) Ongoing maintenance of embankments, walls, flood gates and revetments**	**c) Maintain SOP (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain SOP) embankments, walls, flood gates and revetments (including demountable defences)**	**e) Raise (upgrade SOP) embankments, walls, flood gates and revetments (including demountable defences)**
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	NA*	NA*	NA*	NA*	NA*
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 (min SOP=2) but defences would not last for full 100 years.	Y= as baseline. Following year 25 a Do nothing scenario would occur due to failure of the defences.	Y= some residual life of defences but others would require capital maintenance. Existing defence SOP variable. HTL options required in line with the SMP to protect the significant assets at risk.	Y= some residual life of defences but others would require capital maintenance. Existing defence SOP variable. HTL options required in line with the SMP to protect the significant assets at risk.	Y= some residual life of defences but others would require capital maintenance. Existing defence SOP variable. HTL options required in line with the SMP to protect the significant assets at risk.

* no Natura 2000 sites present

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

Assessment of Short List					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates 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	Capital works are undertaken to improve the current defences
Technical Issue	Defences have 20 years residual life.	Defences have 20 years residual life.	Current defences have 20 years residual life.	Current defences have 20 years residual life.	Current defences have 20 years residual life.
Assumptions/ Uncertainties	Assumes that all management and maintenance 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.	The crest height and SOP provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.
SOP Provided (% AEP)	>50%	>50%	50%	0.1%	0.1%
Value of Economics					
PV Capital Costs	£ -	£ -	£ 8,181,629	£ 9,453,573	£ 20,427,502
PV Maintenance Costs	£ -	£ 534,375	£ 751,700	£ 867,272	£ 1,176,973
PV Other Costs	£ -	£ -	£ 418,707	£ 696,884	£ 650,673
Total Cost (including Optimism Bias) (PV)	£ -	£ 855,000	£ 14,963,257	£ 17,628,367	£ 35,608,235
Value of Benefits	£ -	£ 64,000	£ 1,273,231	£ 11,307,368	£ 11,307,368
Benefit Cost Ratio (BCR)	0.0	0.3	0.1	0.6	0.3
PF Score	0%	0%	2%	7%	4%
Further funding required to achieve 100% PF Score	£ -	£ 851,000	£ 14,653,989	£ 16,358,790	£ 34,338,658
Flood/ erosion impacts					
Number of Residential Properties at risk under 0.1% AEP	260	260	231	0	0
Number of Commercial properties at risk under 0.1% AEP	335	335	313	0	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 11,307,368	£ 11,243,630	£ 10,034,137	£ -	£ -
Critical Infrastructure	Castle View Business Park, Dock Road	Castle View Business Park, Dock Road	Risk to infrastructure increases with sea level rise	No assets at risk	No assets at risk
PV Value of Impacts on road and rail	-	-	-	-	-
PV Value of Tourism and Recreation Impacts	-	-	-	-	-
PV Value of Agriculture Impacts	-	-	-	-	-
Stakeholders Feedback					
Statutory Stakeholders/ SEG	Development sites not protected	Development sites not protected	Development sites not protected over time	Option preferred to protect the development sites in the area	Option preferred to protect the development sites in the area

Landowners	No specific comments	No specific comments	No specific comments	No specific comments	No specific comments
Technical Feasibility					
Site Specific	n/a	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)					
Compliance assessment outcome	2 Some deterioration of Heavily Modified Water Body (HMWB) but uncontrolled	2 Some deterioration of Heavily Modified Water Body (HMWB) but uncontrolled	1 Heavily Modified Water Body (HMWB) maintained	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.	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	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	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.	3 No impacts, either beneficial or adverse.
SEA (Strategic Environmental Assessment)					
Historic Environment	1 Scheduled monuments at risk following the failure of the defences in year 20.	1 Scheduled monuments at risk following the failure of the defences in year 25.	2 One scheduled monument potentially at risk over time due to the risk of overtopping increasing with sea level rise.	4 Reduced risk to scheduled monument as the defences are improved.	4 Reduced risk to scheduled monument as the defences are improved immediately.
Effects on population	1 Community at risk following the failure of the defences in year 20. Potential loss of community facilities, affecting human health	1 Community at risk following the failure of the defences in year 25. Potential loss of community facilities, affecting human health	2 Community at risk of increased overtopping over time. Potential loss of community facilities, affecting human health	4 Reduced risk to community due to protection of community facilities in line with climate change	5 Reduced risk for community due to protection of community facilities immediately
Impact on plans/ programmes	1 Multiple development sites within the benefit are at risk from flooding following the failure of the defences in year 20.	1 Multiple development sites within the benefit are at risk from flooding following the failure of the defences in year 25.	2 Multiple development sites within the benefit are potentially at risk from flooding over time due to the increased risk of overtopping.	4 Multiple development sites within the benefit are potentially at reduced risk from flooding due to improvement to the defences in line with sea level rise.	5 Multiple development sites within the benefit are potentially at reduced risk from flooding immediately
Freshwater Biodiversity	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation
Saline Biodiversity	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation
Soil	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present
Groundwater	1 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	1 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	2 Risk to groundwater overtime due to overtopping of defences with sea level rise. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	4 Groundwater at reduced risk due to improvements to defences.	5 Groundwater should not be at risk, and protected from increased SOP immediately
Landscape (visual impact)	3 Potential loss of current townscape character once the defences fail in year 20.	3 Potential loss of current townscape character once the defences fail in year 25.	3 Potential gradual loss of current townscape character due to increased risk of overtopping overtime	2 Protection of current townscape character. Effects also depend on height and materials chosen to raise the walls which may affect the historical setting	2 Protection of current townscape character. Effects also depend on height and materials chosen to raise the walls which may affect the historical setting

Carbon Storage	3 No impact	3 No impact	2 Some carbon cost generated from maintenance	2 Some carbon cost generated from maintenance and construction, but this is phased throughout the 100 year life of the scheme	1 Some carbon cost generated from maintenance and construction depending on defence height
Ecosystem Services					
Qualitative Score from Ecosystem Services Assessment	-45	-45	-31	-1	-2
Comments	Major degradation in certain ES (e.g. freshwater provision, cultural heritage and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in certain ES (e.g. freshwater provision, cultural heritage and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate degradation in certain ES (e.g. freshwater provision, cultural heritage and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) and risks degradation in other services (e.g. climate regulation, aesthetic value)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) and risks degradation in other services (e.g. climate regulation, aesthetic value)
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	N	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y	Y
4 - WFD	N	N	N	N	N
5 - Local Plans	N	N	Y	Y	Y

Environmental Scores					
100 = best option, 0 = worst option					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates and revetments**
WFD (Water Framework Directive)					
Compliance assessment outcome	25	25	0	0	0
HRA (Habitats Regulation Assessment)					
Impact on SPA/ Ramsar qualifying	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	75	75
Effects on population	0	0	25	75	100
Impact on plans/ programmes	0	0	25	75	100
Freshwater Biodiversity	50	50	50	50	50
Saline Biodiversity	50	50	50	50	50
Soil	50	50	50	50	50
Groundwater	0	0	25	75	100
Landscape (visual impact)	50	50	50	25	25
Carbon Storage	50	50	25	25	0
Total	**475**	**475**	**525**	**700**	**750**

Summary of Results					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates and revetments**
Costs	£ -	£ 855,000	£ 14,963,257	£ 17,628,367	£ 35,608,235
Benefits	£ -	£ 64,000	£ 1,273,231	£ 11,307,368	£ 11,307,368
NPV	£ -	-£ 791,000	-£ 13,690,026	-£ 6,320,999	-£ 24,300,867
BCR	0.0	0.1	0.1	0.6	0.3
Environmental Scoring	475	475	525	700	750

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, flood gates and revetments 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		
DLO4 - Review of Compensatory Freshwater Habitat Requirements		
DLO5 - Modelling of Leading Options		
DLO6 - Consultation Phase		

Preferred Option Name

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

Preferred Option

Localised raising of the defences to protect properties and assets at risk of flooding around Rochester and Chatham against a 0.1% AEP with sea level rise. The localised defences will be raised in year 8 to 5.4m AOD and then in year 50 to 6.8m 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

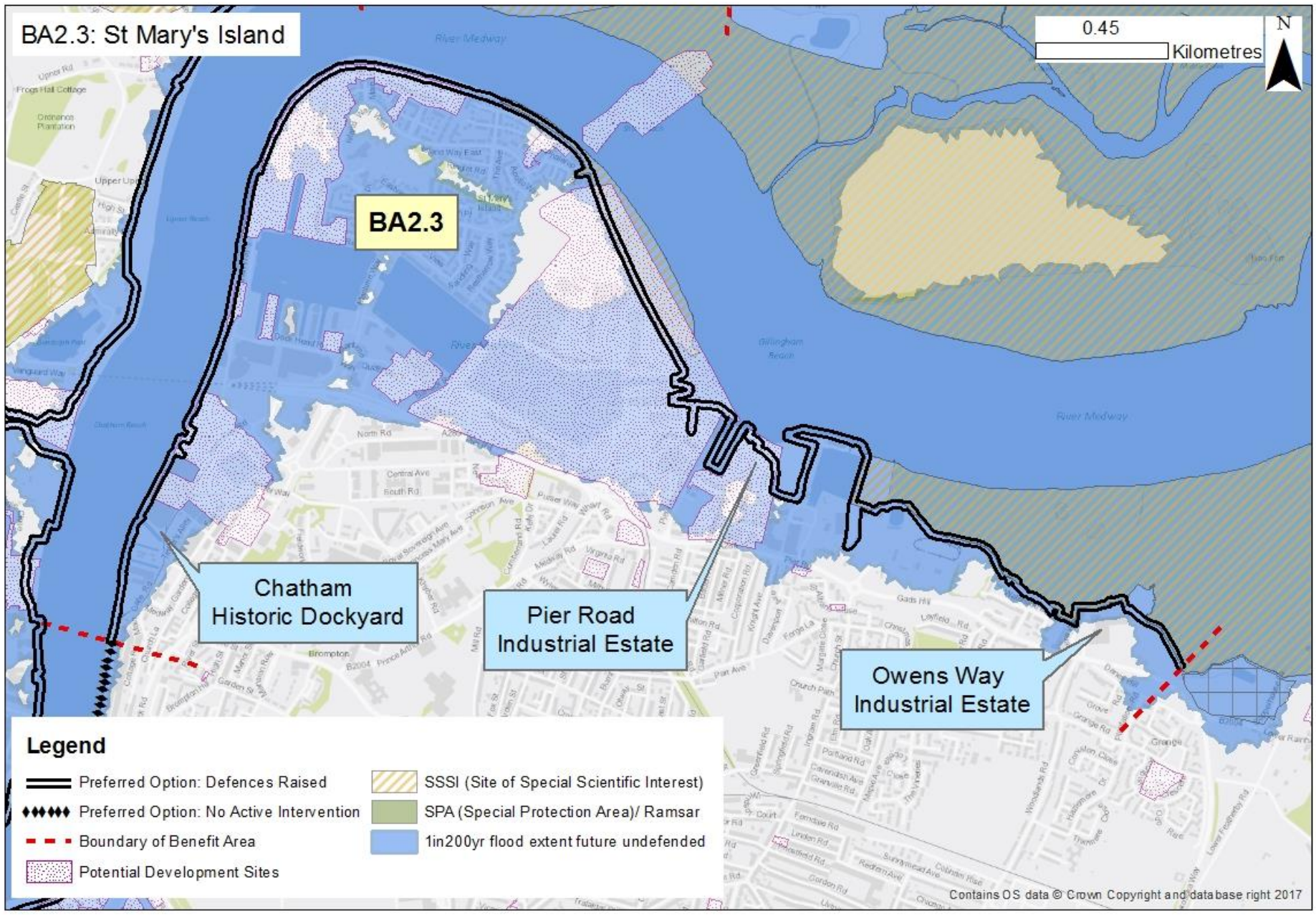
Localised HTL option is the only option which provides a BCR above 1. This option will still provide protection to all residential properties at risk of flooding to at least a 1% AEP. In the NAI areas there is limited assets at risk due to the rising ground.
There is a higher economic justification for 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
£ 5,416,626	**£ 6,037,292**	**1.1**	**18%**

Benefit Area Name	2 - Medway Towns
Benefit Unit Name	2.3 - St Mary's Island to the Strand
Frontage Length	6.6 km
Defence Structure Type	Embankments, concrete wall, flood gates, seawall with blockwork revetment
Min Standard of Protection (AEP%)	50%
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		



Do Nothing Assets at Risk (Flooding)				
	50% AEP (undefended)		0.5% AEP (undefended)	
	Current Year	100 year	Current Year	100 Years
Residential	1	336	693	1221
Commercial & Industrial	28	92	162	253
Agricultural (Ha)	0	0	0	0
Key Infrastructure	Pier Road Industrial Estate, Historic dockyard, Chatham Maritime Historic Landfill, AKZO Historic Landfill (inert) Parhams Historic Landfill (inert) Gas Works Historic Landfill (inert) Strand Historic Landfill (inert) Startrite Historic Landfill (inert) Overtons Historic Landfill (inert)	Pier Road Industrial Estate, Historic dockyard, Chatham Maritime Historic Landfill, AKZO Historic Landfill (inert) Parhams Historic Landfill (inert) Gas Works Historic Landfill (inert) Strand Historic Landfill (inert) Startrite Historic Landfill (inert) Overtons Historic Landfill (inert)	Pier Road Industrial Estate, Historic dockyard, A289, Gillingham Pier Historic Landfill (inert) Chatham Maritime Historic Landfill AKZO Historic Landfill (inert) Parhams Historic Landfill (inert) Gas Works Historic Landfill (inert) Strand Historic Landfill (inert) Startrite Historic Landfill (inert) Overtons Historic Landfill (inert)	As previous plus: Owens Way Industrial Estate, Gillingham Pier Historic Landfill (inert) Chatham Maritime Historic Landfill AKZO Historic Landfill (inert) Parhams Historic Landfill (inert) Gas Works Historic Landfill (inert) Strand Historic Landfill (inert) Startrite Historic Landfill (inert) Overtons Historic Landfill (inert)
Social and Environmental Considerations	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward)	Medway Estuary and Marshes SPA and SSSI (seaward)

Long List to Short List			
Potential Measures			
	Measures	**Selected**	**Reasoning**
Structural	Construct new embankment	Y	Take forward- embankments currently present
	Maintain embankment	Y	Take forward- embankments currently present
	Raise embankment (sustain)	Y	Take forward- embankments currently present
	Raise embankment (upgrade)	Y	Take forward- embankments currently present
	Construct new wall	Y	Take forward - walls currently present
	Maintain wall	Y	Take forward - walls currently present
	Raise wall (sustain)	Y	Take forward - walls currently present
	Raise wall (upgrade)	Y	Take forward - walls currently present
	Maintain rock revetment	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 - temporary defences are not suitable in an urban area as a long-term protection method especially due to aims of local development plan.
	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
	Adaptation measures	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Development control	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Emergency response plans	N	Not suitable as a single measure to implement the SMP policy. May be combined with structural measures
	Monitoring for health and safety only	N	Not suitable as a single measure to implement the SMP policy.

Long List of Options					
	a) Do nothing	b) Ongoing maintenance of embankments, walls, flood gates and revetments	c) Maintain SOP (capital) embankments, walls, flood gates and revetments	d) Raise (sustain SOP) embankments, walls, flood gates and revetments (including demountable defences)	e) Raise (upgrade SOP) embankments, walls, flood gates and revetments (including demountable defences)
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	NA*	NA*	NA*	NA*	NA*
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 (min SOP=2) but defences would not last for full 100 years.	Y= as baseline. Following year 25 a Do nothing scenario would occur due to failure of the defences.	Y= some residual life of defences but others would require capital maintenance. HTL options required in line with the SMP to protect the significant assets at risk.	Y= some residual life of defences but others would require capital maintenance. HTL options required in line with the SMP to protect the significant assets at risk.	Y= some residual life of defences but others would require capital maintenance. HTL options required in line with the SMP to protect the significant assets at risk.

* no Natura 2000 sites present

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

Assessment of Short List					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates 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	Capital works are undertaken to improve the current defences
Technical Issue	Defences have 20 years residual life. Gillingham Pier Historic Landfill (inert), Chatham Maritime Historic Landfill, AKZO Historic Landfill (inert), Parhams Historic Landfill (inert), Gas Works Historic Landfill (inert), Strand Historic Landfill (inert), and Startrite Historic Landfill (inert) potentially at risk.	Defences have 20 years residual life. Gillingham Pier Historic Landfill (inert), Chatham Maritime Historic Landfill, AKZO Historic Landfill (inert), Parhams Historic Landfill (inert), Gas Works Historic Landfill (inert), Strand Historic Landfill (inert), and Startrite Historic Landfill (inert) potentially at risk.	Defences have 20 years residual life. Frindsbury Peninsula Historic Landfill (inert), Land Adjacent To Antony's Way Historic Landfill (inert), and Temple Marsh Historic Landfill (inert, industrial) potentially at risk.	Current defences have 20 years residual life. Gillingham Pier Historic Landfill (inert), Chatham Maritime Historic Landfill, AKZO Historic Landfill (inert), Parhams Historic Landfill (inert), Gas Works Historic Landfill (inert), Strand Historic Landfill (inert), and Startrite Historic Landfill (inert) potentially at risk.	Current defences have 20 years residual life. Gillingham Pier Historic Landfill (inert), Chatham Maritime Historic Landfill, AKZO Historic Landfill (inert), Parhams Historic Landfill (inert), Gas Works Historic Landfill (inert), Strand Historic Landfill (inert), and Startrite 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 25.	The crest height of the defences remains the same as currently in place i.e. is not increased. Over time this will lead to a reduction in the Standard of Protection (SOP) as the sea level rises.	The Standard of Protection(SOP) provided by the defences is increased to the required standard over time. This option has a phased approach so the defences are raised in line with sea level rise at two phases i.e. capital works are undertaken in epoch 1 and again in year 50. This option will maintain the required Standard of Protection (SOP) provided by the defences by keeping pace with sea level rise.	The crest height and Standard of Protection (SOP) provided by the defences is increased. The crest heights will be raised to the level required to provide the SOP in 100 years time, i.e. the SOP will be greater than required during the first epoch, but this will decline over time with sea level rise but will still provide at least the SOP that the defence was upgraded to.
SOP Provided (% AEP)	>50%	>50%	50%	0.5%	0.5%
Value of Economics					
PV Capital Costs	£ -	£ -	£ 3,320,356	£ 7,690,634	£ 11,206,745
PV Maintenance Costs	£ -	£ 279,375	£ 491,571	£ 621,083	£ 808,763
PV Other Costs	£ -	£ -	£ 276,152	£ 598,270	£ 625,968
Total Cost (including Optimism Bias) (PV)	£ -	£ 447,000	£ 6,540,927	£ 14,255,978	£ 20,226,361
Value of Benefits	£ -	£ 1,317,000	£ 21,360,493	£ 63,083,714	£ 63,192,674
Benefit Cost Ratio (BCR)	0.0	2.9	3.3	4.4	3.1
PF Score	0%	16%	44%	37%	27%
Further funding required to achieve 100% PF Score	£ -	£ 374,000	£ 3,649,160	£ 8,915,502	£ 14,460,307

Flood/ erosion impacts					
Number of Residential Properties at risk under 0.1% AEP	1329	1329	1374	6	6
Number of Commercial properties at risk under 0.1% AEP	283	283	290	0	0
PV Value of Properties (Total including AAD, write-offs, vehicle damages and Emergency Services)	£ 63,170,253	£ 61,853,418	£ 41,811,599	£ 107,727.95	£ 2,604.00
Critical Infrastructure	Impact on industrial estates and historic dockyard	Impact on industrial estates and historic dockyard	Impact on infrastructure increasing over time	Slight impact on infrastructure towards end of first phase of works	No assets at risk
PV Value of Impacts on road and rail	£25,025 Corporation Street A289 from Medway Tunnel	£24,583 Corporation Street A289 from Medway Tunnel	£23,186 Corporation Street A289 from Medway Tunnel	£3,836 A289 from Medway Tunnel	-
PV Value of Tourism and Recreation Impacts	-	-	-	-	-
PV Value of Agriculture Impacts	-	-	-	-	-
Stakeholders Feedback					
Statutory Stakeholders/ SEG	Development sites not protected	Development sites not protected	Development sites not protected over time	Option preferred to protect the development sites in the area	Option preferred to protect the development sites in the area
Landowners	No specific comments	No specific comments	No specific comments	No specific comments	No specific comments
Technical Feasibility					
Site Specific	n/a	n/a	n/a	n/a	n/a
Strategy Wide	n/a	n/a	n/a	n/a	n/a
WFD (Water Framework Directive)					
Compliance assessment outcome	2 Some deterioration of Heavily Modified Water Body (HMWB) but uncontrolled	2 Some deterioration of Heavily Modified Water Body (HMWB) but uncontrolled	1 Heavily Modified Water Body (HMWB) maintained	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.	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	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	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.	3 No impacts, either beneficial or adverse.

SEA (Strategic Environmental Assessment)					
Historic Environment	1 Loss of historical assets and schedule monuments (Historic Dockyard) following the failure of defences in year 20. Majority of assets not in floodplain but would affect setting and visitor access	1 Loss of historical assets and schedule monuments (Historic Dockyard) following the failure of defences in year 25. Majority of assets not in floodplain but would affect setting and visitor access	2 Gradual risk to historical assets due to increased risk of overtopping with sea level rise. Could potential affect setting and visitor access	4 Reduced risk to historic assets due to protection with climate change. Effects also depend on height and materials affecting setting	4 Reduced risk to historic assets due to protection with climate change. Effects also depend on height and materials affecting setting
Effects on population	1 Following defence failure in year 20 there will be a loss of homes and livelihoods.	1 Following defence failure in year 25 there will be a loss of homes and livelihoods.	2 Gradual risk to homes and livelihoods due to the increased risk of overtopping with sea level rise.	4 Protecting community in line with climate change	5 Protecting community immediately
Impact on plans/ programmes	1 Multiple development sites within the benefit area are potentially at risk from flooding following failure of the defences in year 20.	1 Multiple development sites within the benefit area are potentially at risk from flooding following failure of the defences in year 25.	2 Multiple development sites within the benefit area are potentially at risk from flooding over time due to the increased risk of overtopping.	4 Multiple development sites within the benefit areas are at reduced risk from flooding	5 Multiple development sites within the benefit areas are at reduced risk from flooding immediately
Freshwater Biodiversity	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation
Saline Biodiversity	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation	3 Little impact on habitat or opportunity for habitat creation
Soil	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present	3 No agricultural/ woodland soil present
Groundwater	1 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	1 Risk to groundwater is high once the defences fail. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	2 Risk to groundwater overtime due to overtopping of defences with sea level rise. A detailed understanding of the links between surface and groundwater would be required to mitigate risks	4 Groundwater at reduced risk due to improvements to defences.	5 Groundwater should not be at risk, and protected from increased SOP immediately
Landscape (visual impact)	3 Potential loss of current townscape character once the defences fail in year 20.	3 Potential loss of current townscape character once the defences fail in year 25.	3 Potential gradual loss of current townscape character due to increased risk of overtopping overtime	2 Protection of current townscape character. Effects also depend on height and materials chosen to raise the walls which may affect the historical setting	2 Protection of current townscape character. Effects also depend on height and materials chosen to raise the walls which may affect the historical setting

Carbon Storage	3 No impact	3 No impact	2 Some carbon cost generated from maintenance	2 Some carbon cost generated from maintenance and construction, but this is phased throughout the 100 year life of the scheme	1 Some carbon cost generated from maintenance and construction depending on defence height
Ecosystem Services					
Qualitative Score from Ecosystem Services Assessment	-40	-40	-30	0	-1
Comments	Major degradation in certain ES (e.g. freshwater provision, cultural heritage, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Major degradation in certain ES (e.g. freshwater provision, cultural heritage, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Moderate degradation in certain ES (e.g. freshwater provision, cultural heritage, natural hazard regulation and tourism) outweigh limited enhancement opportunities (e.g. fishery habitats and aesthetic value)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) roughly balance with risks degradation (e.g. aesthetic value, provision of habitat for conservation and fisheries habitat)	Balance of opportunities for enhancement (e.g. natural hazard regulation, erosion regulation) roughly balance with risks degradation (e.g. aesthetic value, provision of habitat for conservation and fisheries habitat)
To what extent does the option meet the objectives?					
1- Reduce Flood Risk	N	N	Y	Y	Y
2 - Natura 2000 sites	N	N	N	N	N
3- Reduce maintenance	Y	Y	Y	Y	Y
4 - WFD	N	N	N	N	N
5 - Local Plans	N	N	Y	Y	Y

Environmental Scores					
100 = best option, 0 = worst option					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments (Do minimum)**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates and revetments**
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	75	75
Effects on population	0	0	25	75	100
Impact on plans/ programmes	0	0	25	75	100
Freshwater Biodiversity	50	50	50	50	50
Saline Biodiversity	50	50	50	50	50
Soil	50	50	50	50	50
Groundwater	0	0	25	75	100
Landscape (visual impact)	50	50	50	25	25
Carbon Storage	50	50	25	25	0
Total	**475**	**475**	**525**	**700**	**750**

Summary of Results					
Option	**a) Do nothing**	**b) Do minimum**	**c) Maintain (capital) embankments, walls, flood gates and revetments (Do minimum)**	**d) Raise (sustain) embankments, walls, flood gates and revetments**	**e) Raise (upgrade) embankments, walls, flood gates and revetments**
Costs	£ -	£ 447,000	£ 6,540,927	£ 14,255,978	£ 20,226,361
Benefits	£ -	£ 1,317,000	£ 21,360,493	£ 63,083,714	£ 63,192,674
NPV	£ -	£ 870,000	£ 14,819,566	£ 48,827,736	£ 42,966,313
BCR	0.0	2.9	3.3	4.4	3.1
Environmental Scoring	475	475	525	700	750

Preferred Option Decision Making

DLO	Leading Option at DLO Stage	Justification for Leading Option
DLO1 - Economic Assessment	Raise (sustain) embankments, walls, flood gates and revetments.	This option has the highest BCR and a significantly lower amount of contributions required. It should be noted that the Upgrade option also shows BCR of greater than one so SoP could be increased at OBC stage depending on third party contributions available.
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

Raise (sustain) embankments, walls, flood gates and revetments.

Preferred Option

This option involves improving the SoP provided by the defences to 0.5% AEP SoP with sea level rise; in year 5 to 5.1m AOD and then in year 50 to 6.3m AOD to continue to provide protection in line with sea level rise.

Justification

This option has the highest NPV and incremental BCR of over 5. It should be noted that the Upgrade option also presents a BCR of greater than one (but not an incremental BCR greater than 1) and therefore the SoP could be increased at OBC stage depending on third party contributions available. 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
£ 16,123,989	£ 63,083,714	3.9	33%